CHAPTER 27

LIST OF EFFECTIVE TEMPORARY REVISIONS

FOLLOWING IS A COMPLETE LISTING OF ALL ACTIVE TEMPORARY REVISIONS (TR'S). TR'S NOT LISTED SHOULD BE REMOVED. THE ATA NUMBER, CONFIG CODE AND PAGE NUMBER IDENTIFIES THE PAGE PRECEDING THE TR.

TR NUMBER	ATA NUMBER	CONFIG CODE	PAGE NUMBER	TR DATE
NONE				

CHAPTER 27

FLIGHT CONTROLS

LIST OF EFFECTIVE PAGES

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
List of Effective Pages	1	Jun 15/96	
	2	Jun 15/96	
	3	Jun 15/96	
	4	Jun 15/96	
	5	Jun 15/96	
	6	Jun 15/96	
	7	Jun 15/96	
	8	Jun 15/96	
	9	Jun 15/96	
	10	Jun 15/96	
	11	Jun 15/96	
	12	Jun 15/96	
	13	Jun 15/96	
	14	Jun 15/96	
	15	Jun 15/96	
	16	Jun 15/96	
	17	Jun 15/96	
	18	Jun 15/96	
	19	Jun 15/96	
	20	Jun 15/96	
	21	Jun 15/96	
	22	Jun 15/96	
	23	Jun 15/96	
	24	Jun 15/96	
	25	Jun 15/96	
	26	Jun 15/96	
Table of Contents	1	Nov 15/89	
	2	Nov 15/89	
	3	Nov 15/89	
	4	May 15/89	
	5	May 15/89	
	6	May 15/89	
	7	Mar 15/91	
	8	May 15/89	
	9	May 15/89	
	10	May 15/89	
	11	Dec 15/93	
	12	May 15/89	
	13	Dec 15/93	
	14	Dec 15/93	
	15	May 15/89	
	16	May 15/89	
	17	May 15/89	
	18	May 15/89	
	19	May 15/89	
	20	Dec 15/93	
	21	May 15/89	
	22	May 15/89	
	23	May 15/89	
	24	Mar 15/91	
	25	May 15/89	
	26	May 15/89	
27-conts	1	Nov 15/89	
27-conts	2	Mar 15/91	
27-conts	3	Jun 15/93	
27-conts	4	Jun 15/94	
27-conts	5	May 15/89	
27-conts	6	Mar 15/91	
27-conts	7	Jul 15/83	
27-conts	8	Nov 15/88	
27-conts	9	Dec 15/91	
27-conts	10	Dec 15/91	
27-conts	11	Dec 15/91	
27-conts	12	Dec 15/91	
27-DIAGM	1	Jul 15/83	
27-DIAGM	2	Jul 15/83	
27-DIAGM	3	Feb 15/82	
27-DIAGM	4	Feb 15/82	
27-DIAGM	5	Nov 15/84	
27-DIAGM	6	Mar 15/91	
27-DIAGM	7	Mar 15/91	
27-DIAGM	8	Mar 15/91	
27-DIAGM	9	May 15/82	
27-DIAGM	10	Jul 15/83	
27-DIAGM	11	Jul 15/83	
27-DIAGM	12	May 15/82	
27-DIAGM	13	May 15/85	
27-DIAGM	14	Mar 15/91	
27-DIAGM	15	Mar 15/91	
27-DIAGM	16	Mar 15/84	
27-DIAGM	17	Jul 15/83	
27-DIAGM	18	May 15/82	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-DIAGM	19/20	May 15/82	
27-INDEX	1	Nov 15/84	
27-INDEX	2	Aug 15/82	
27-INDEX	3	May 15/85	
27-INDEX	4	Dec 15/95	
27-INDEX	5	Jul 15/83	
27-INDEX	6	Jul 15/83	
27-INDEX	7	Nov 15/84	
27-INDEX	8	May 15/85	
27-INDEX	9	Jul 15/83	
27-INDEX	10	Nov 15/84	
27-INDEX	11	Jul 15/83	
27-INDEX	12	Jul 15/83	
27-INDEX	13	Jul 15/83	
27-INDEX	14	Jul 15/83	
27-INDEX	15	Jul 15/83	
27-INDEX	16	Jul 15/83	
27-INDEX	17	Jun 15/93	
27-INDEX	18	Mar 15/91	
27-INDEX	19	Mar 15/91	
27-INDEX	20	Mar 15/91	
27-INDEX	21	Mar 15/91	
27-INDEX	22	Mar 15/91	
27-INDEX	23/24	Mar 15/91	
27-00-00	1	Nov 15/81	
27-00-00	2	Dec 1/71	
27-00-00	3	Aug 15/74	
27-00-00	4	Jul 15/83	
27-00-00	5/6	Mar 15/91	
27-00-00	7	Nov 15/74	
27-00-00	8	Jun 15/80	
27-00-00	9/10	Jun 15/80	
27-00-00	11	Jul 15/83	
27-00-00	12	Jun 15/80	
27-00-00	13/14	Aug 15/82	
27-00-00	15/16	Aug 15/82	
27-00-00	17	May 15/85	
27-00-00	18	Jul 15/83	
27-00-00	19	Aug 15/81	
27-00-00	20	Mar 15/91	
27-00-00	21	Mar 15/91	
27-00-00	22	Mar 15/91	
27-00-00	23	Jul 15/83	
27-00-00	24	Jul 15/83	
27-00-00	25/26	May 15/82	
27-00-00	27	May 15/82	
27-00-00	28	Jul 15/83	
27-00-00	29	May 15/82	
27-00-00	30	May 15/82	
27-00-00	31	Jul 15/83	
27-00-00	32	Jul 15/83	
27-00-00	33/34	Aug 15/81	
27-00-01	201/202	Jun 15/92	
27-00-01	401/402	Oct 1/72	
27-00-01	501	Aug 15/75	
27-00-01	502	Aug 15/75	
27-00-01	503/504	Aug 15/75	
27-00-02	201	Aug 15/82	
27-00-02	202	Aug 15/82	
27-00-03	201/202	Nov 15/83	
R 27-11-00	1	Jun 15/96	
R 27-11-00	2	Jun 15/96	
27-11-00	3/4	Dec 1/71	
27-11-00	5	May 15/85	
R 27-11-00	6	Jun 15/96	
27-11-00	7/8	Mar 15/73	
27-11-00	9	Sep 15/73	
R 27-11-00	10	Jun 15/96	
27-11-00	11/12	Apr 1/72	
27-11-00	13	Jan 15/73	
R 27-11-00	14	Jun 15/96	
27-11-00	15/16	Dec 1/71	
27-11-00	17	Dec 1/71	
R 27-11-00	18	Jun 15/96	
27-11-00	19	Sep 15/73	
R 27-11-00	20	Jun 15/96	
27-11-00	21	Sep 15/73	
R 27-11-00	22	Jun 15/96	
R 27-11-00	23	Jun 15/96	
R 27-11-00	24	Jun 15/96	
27-11-00	25	Nov 15/78	
R 27-11-00	26	Jun 15/96	
27-11-00	27	Nov 15/78	
27-11-00	28	Aug 1/72	
R 27-11-00	29	Jun 15/96	
27-11-00	30	Nov 15/78	
27-11-00	31	Sep 15/73	
R 27-11-00	32	Jun 15/96	
27-11-00	33	Nov 15/78	
R 27-11-00	34	Jun 15/96	
27-11-00	35/36	Nov 15/81	
27-11-00	37/38	Nov 15/75	
R 27-11-00	39	Jun 15/96	
R 27-11-00	40	Jun 15/96	
R 27-11-00	41	Jun 15/96	
R 27-11-00	42	Jun 15/96	

	CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
R	27-11-00	43	Jun 15/96	
R	27-11-00	44	Jun 15/96	
R	27-11-00	45	Jun 15/96	
R	27-11-00	46	Jun 15/96	
	27-11-00	47/48	Nov 15/75	
R	27-11-00	49	Jun 15/96	
R	27-11-00	50	Jun 15/96	
R	27-11-00	51	Jun 15/96	
	27-11-00	52	Nov 15/78	
R	27-11-00	53	Jun 15/96	
	27-11-00	54	Nov 15/78	
R	27-11-00	55	Jun 15/96	
	27-11-00	56	Aug 15/76	
	27-11-00	57	Nov 15/75	
R	27-11-00	58	Jun 15/96	
	27-11-00	59	Nov 15/78	
R	27-11-00	60	Jun 15/96	
	27-11-00	61	Nov 15/78	
R	27-11-00	62	Jun 15/96	
R	27-11-00	63	Jun 15/96	
	27-11-00	64	Nov 15/75	
	27-11-00	101	Jul 15/83	
	27-11-00	102	Nov 15/82	
	27-11-00	103	Mar 15/81	
	27-11-00	104	Jul 15/83	
	27-11-00	105	Mar 15/81	
	27-11-00	106	Mar 15/81	
	27-11-00	107	Jul 15/83	
	27-11-00	108	Jul 15/83	
	27-11-00	109	Nov 15/89	
	27-11-00	110	Jul 15/83	
	27-11-00	111	Jul 15/83	
	27-11-00	112	May 15/89	
	27-11-00	113	Jul 15/83	
	27-11-00	114	Jul 15/83	
	27-11-00	115	May 15/89	
	27-11-00	116	Jul 15/83	
	27-11-00	201	May 15/85	
	27-11-00	202	May 15/85	
	27-11-00	203/204	May 15/85	
	27-11-00	501	Feb 15/82	
	27-11-00	502	May 15/85	
	27-11-00	503	May 15/85	
	27-11-00	504	Jun 15/92	
	27-11-00	505	Nov 15/83	
	27-11-00	506	May 15/82	
	27-11-00	507	Nov 15/83	
	27-11-00	508	May 15/82	
	27-11-00	509	May 15/82	
	27-11-00	510	May 15/82	
	27-11-00	511	May 15/82	
	27-11-00	512	May 15/82	
	27-11-00	513	May 15/82	
	27-11-00	514	Aug 15/82	
	27-11-00	515	Aug 15/82	
	27-11-00	516	Aug 15/82	
	27-11-00	517	May 15/82	
	27-11-00	518	Nov 15/87	
	27-11-00	519	May 15/82	
	27-11-00	520	Nov 15/85	
	27-11-00	521	Aug 15/82	
	27-11-00	522	Jun 15/92	
	27-11-00	523	Jun 15/92	
	27-11-00	524	Feb 15/82	
	27-11-00	525	Feb 15/82	
	27-11-00	526	Feb 15/82	
	27-11-00	527	Aug 15/82	
	27-11-00	528	Aug 15/82	
	27-11-00	529	Aug 15/82	
	27-11-00	530	Aug 15/82	
	27-11-00	531	Aug 15/82	
	27-11-00	532	Aug 15/82	
	27-11-00	533	Aug 15/82	
	27-11-00	534	Aug 15/82	
	27-11-00	535	Jun 15/92	
	27-11-00	536	May 15/85	
	27-11-00	537/538	May 15/77	
	27-11-00	539	May 15/85	
	27-11-00	540	May 15/85	
	27-11-00	541/542	May 15/85	
	27-11-00	543	Nov 15/85	
	27-11-00	544	Nov 15/85	
	27-11-00	545/546	Feb 15/82	
	27-11-00	547/548	Feb 15/82	
	27-11-00	549	Nov 15/85	
	27-11-00	550	Nov 15/87	
	27-11-00	551/552	Feb 15/82	
	27-11-00	553	Nov 15/87	
	27-11-00	554	Nov 15/87	
	27-11-00	555/556	May 15/85	
	27-11-00	557/558	Nov 15/83	
	27-11-00	559/560	Nov 15/83	
	27-11-00	561	Nov 15/85	
	27-11-00	562	Nov 15/88	
	27-11-00	563	Jun 15/92	
	27-11-00	564	Jun 15/92	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-11-00	565/566	Nov 15/83	
27-11-00	567	Nov 15/83	
27-11-00	568	Nov 15/85	
27-11-00	569	Dec 15/92	
27-11-00	570	Dec 15/92	
27-11-00	571	Dec 15/92	
27-11-00	572	Dec 15/92	
27-11-00	573	Dec 15/92	
27-11-00	574	Dec 15/92	
27-11-00	575	Dec 15/92	
27-11-00	576	Dec 15/92	
27-11-00	577/578	May 15/85	
27-11-00	579	Dec 15/92	
27-11-00	580	Dec 15/92	
27-11-00	581/582	Jun 15/92	
27-11-00	583/584	Jun 15/92	
27-11-00	585	Dec 15/92	
27-11-00	586	Dec 15/92	
27-11-00	587	Dec 15/92	
27-11-00	588	Dec 15/92	
27-11-00	589/590	May 15/89	
27-11-00	591	Dec 15/92	
27-11-00	592	Dec 15/92	
27-11-00	593	Dec 15/92	
27-11-00	594	Dec 15/92	
27-11-00	595	Dec 15/92	
27-11-00	596	Dec 15/92	
27-11-00	597	Dec 15/92	
27-11-00	598	Dec 15/92	
27-11-00	599	Dec 15/92	
27-11-00	600	Jun 15/92	
27-11-01	401	Nov 15/83	
27-11-01	402	Jul 15/84	
27-11-01	403	Jul 15/84	
27-11-01	404	Jul 15/84	
27-11-01	405	May 15/85	
27-11-01	406	Jul 15/84	
27-11-01	407	Jul 15/84	
27-11-01	408	Jul 15/84	
27-11-01	409	May 15/86	
27-11-01	410	May 15/86	
27-11-01	411	Nov 15/83	
27-11-01	412	Nov 15/87	
27-11-01	601	Mar 15/83	
27-11-01	602	Mar 15/83	
27-11-01	603	Mar 15/83	
27-11-01	604	Nov 15/76	
27-11-01	605	Nov 15/76	
27-11-01	606	Nov 15/76	
27-11-03	401	May 15/86	
27-11-03	402	Nov 15/88	
27-11-03	403/404	Jun 15/80	
27-11-03	405	Nov 15/88	
27-11-03	406	May 15/85	
27-11-03	407	May 15/85	
27-11-03	408	Nov 15/88	
27-11-03	501	Nov 15/82	
27-11-03	502	Nov 15/82	
27-11-03	503	Jul 15/83	
27-11-03	504	Nov 15/85	
27-11-03	505/506	Aug 15/82	
27-11-03	507	Aug 15/82	
27-11-03	508	Nov 15/85	
27-11-03	509/510	Nov 15/85	
27-11-04	201	Aug 15/81	
27-11-04	202	Aug 15/81	
27-11-04	401	Aug 15/78	
27-11-04	402	Aug 15/78	
27-11-04	403/404	Aug 15/78	
27-11-04	405/406	Aug 15/78	
27-11-05	401	May 15/85	
27-11-05	402	Nov 15/89	
27-11-05	403	Nov 15/88	
27-11-05	404	Nov 15/89	
27-11-05	405	Nov 15/88	
27-11-05	406	Nov 15/88	
27-11-05	407	May 15/85	
27-11-05	408	May 15/85	
27-11-05	409	May 15/85	
27-11-05	410	May 15/85	
27-11-05	411/412	May 15/85	
27-11-05	413/414	Feb 15/82	
27-11-05	415/416	Jul 15/83	
27-11-06	401	Jul 15/83	
27-11-06	402	Aug 15/82	
27-11-06	403	Nov 15/85	
27-11-06	404	Nov 15/85	
27-11-06	405/406	Nov 15/85	
27-11-07	401	Nov 15/75	
27-11-07	402	Nov 15/75	
27-11-07	403	Nov 15/75	
27-11-07	404	Nov 15/75	
27-11-07	405/406	Nov 15/75	
27-11-07	407/408	Nov 15/75	
27-11-11	401	Nov 15/76	
27-11-11	402	Aug 1/72	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-11-11	403	Aug 1/72	
27-11-11	404	Nov 15/76	
27-11-11	405/406	Nov 15/76	
27-11-13	801	Nov 15/81	
27-11-13	802	Nov 15/81	
27-11-13	803/804	Nov 15/81	
27-11-15	401	Aug 15/82	
27-11-15	402	Jul 15/83	
27-11-15	403/404	Aug 15/82	
27-11-15	405/406	Aug 15/82	
27-11-17	401	Jun 15/92	
27-11-17	402	Jun 15/92	
27-11-17	403	Jun 15/92	
27-11-17	404	Jun 15/92	
27-11-17	405	Jun 15/92	
27-11-17	406	Jun 15/92	
27-11-17	407	Jun 15/92	
27-11-17	408	Jun 15/92	
27-11-17	409	Jun 15/92	
27-11-17	410	Nov 15/83	
27-11-17	411	Nov 15/83	
27-11-17	412	Nov 15/83	
27-11-17	413/414	Nov 15/83	
27-11-19	401	Jun 15/92	
27-11-19	402	Jun 15/92	
27-11-19	403	Dec 15/92	
27-11-19	404	Dec 15/92	
27-11-19	405	Dec 15/92	
27-11-19	406	Dec 15/92	
27-11-19	407	Dec 15/92	
27-11-19	408	Dec 15/92	
27-11-19	409	Dec 15/92	
27-11-19	410	Dec 15/92	
27-11-19	411	Jun 15/92	
27-11-19	412	Jun 15/92	
27-11-19	413/414	Jun 15/92	
27-11-20	401	May 15/82	
27-11-20	402	May 15/82	
27-11-20	403	May 15/82	
27-11-20	404	May 15/82	
27-11-20	405	May 15/82	
27-11-20	406	Dec 15/80	
27-11-20	407	Dec 15/80	
27-11-20	408	Dec 15/80	
27-11-21	401	Aug 15/82	
27-11-21	402	Aug 15/82	
27-11-21	403	Dec 15/80	
27-11-21	404	Dec 15/80	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-11-22	401	Aug 15/74	
27-11-22	402	Jul 15/84	
27-11-22	403/404	Jul 15/84	
27-11-23	401	Aug 15/82	
27-11-23	402	Dec 15/80	
27-11-23	403	Aug 15/82	
27-11-23	404	Aug 15/82	
27-11-23	501	Aug 15/74	
27-11-23	502	Nov 15/74	
27-11-24	401	Dec 15/92	
27-11-24	402	May 15/86	
27-11-24	403	May 15/86	
27-11-24	404	Jul 15/84	
27-11-24	405	May 15/82	
27-11-24	406	May 15/82	
27-11-24	407/408	May 15/86	
27-11-24	601	May 15/82	
27-11-24	602	Mar 15/83	
27-11-24	603	Mar 15/83	
27-11-24	604	Mar 15/83	
27-11-24	605	Mar 15/83	
27-11-24	606	Mar 15/83	
27-11-24	607	Mar 15/83	
27-11-24	608	Mar 15/83	
27-11-24	609	Feb 15/82	
27-11-24	610	Feb 15/82	
27-11-24	611/612	Feb 15/82	
27-11-26	301	Mar 15/84	
27-11-26	302	May 15/86	
27-11-26	303	Mar 15/84	
27-11-26	304	May 15/89	
27-11-26	305/306	Mar 15/84	
27-11-26	401	Nov 15/82	
27-11-26	402	May 15/86	
27-11-26	403	Aug 15/82	
27-11-26	404	Aug 15/82	
27-11-26	405	Mar 15/84	
27-11-26	406	Nov 15/82	
27-11-26	501/502	May 15/73	
27-11-27	401	May 15/85	
27-11-27	402	May 15/85	
27-11-27	403	Dec 15/92	
27-11-27	404	Dec 15/92	
27-11-27	405	Dec 15/92	
27-11-27	406	Dec 15/92	
27-11-27	407	Dec 15/92	
27-11-27	408	Dec 15/80	
27-11-27	409	Dec 15/80	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-11-27	410	Dec 15/80	
27-11-27	601	Jun 15/80	
27-11-27	602	Nov 15/85	
27-11-28	401	Feb 15/82	
27-11-28	402	Feb 15/82	
27-11-28	403	May 15/85	
27-11-28	404	May 15/85	
27-11-28	405	May 15/85	
27-11-28	406	May 15/85	
27-11-28	407	Dec 15/80	
27-11-28	408	Dec 15/80	
27-11-28	409/410	Dec 15/80	
27-11-28	601	Dec 15/91	
27-11-28	602	Dec 15/91	
27-11-28	801	Feb 15/77	
27-11-28	802	Feb 15/77	
27-11-28	803	Feb 15/77	
27-11-28	804	Mar 15/80	
27-11-28	805	Feb 15/77	
27-11-28	806	Mar 15/80	
27-11-28	807	May 15/77	
27-11-28	808	Feb 15/77	
27-11-28	809	May 15/77	
27-11-28	810	May 15/77	
27-11-28	811	Feb 15/77	
27-11-28	812	Feb 15/77	
27-11-28	813	Feb 15/77	
27-11-28	814	Feb 15/77	
27-11-28	815	Feb 15/77	
27-11-28	816	Feb 15/77	
27-11-28	817	Feb 15/77	
27-11-28	818	Feb 15/77	
27-11-28	819/820	Feb 15/77	
27-11-29	401	May 15/85	
27-11-29	402	May 15/85	
27-11-29	403	May 15/85	
27-11-29	404	May 15/85	
27-11-29	405/406	May 15/85	
27-11-29	407/408	Aug 15/78	
27-11-29	409/410	Mar 15/83	
27-11-31	401	May 15/86	
27-11-31	402	May 15/86	
27-11-31	403	May 15/86	
27-11-31	404	May 15/85	
27-11-32	401	May 15/85	
27-11-32	402	May 15/85	
27-11-32	403	May 15/85	
27-11-32	404	May 15/85	
27-11-32	405/406	May 15/85	
27-11-33	401	Mar 15/73	
27-11-33	402	Dec 1/71	
27-11-33	403	Dec 1/71	
27-11-33	404	Mar 15/73	
27-11-33	405/406	Mar 15/73	
27-11-34	401	Feb 15/82	
27-11-34	402	Feb 15/82	
27-11-34	403	Jun 15/92	
27-11-34	404	Feb 15/82	
27-11-34	405	Jun 15/92	
27-11-34	406	Jun 15/92	
27-11-37	401	Feb 15/77	
27-11-37	402	Feb 15/78	
27-11-37	403/404	Feb 15/78	
27-11-38	401	Aug 15/82	
27-11-38	402	Aug 15/82	
27-11-38	403	Aug 15/82	
27-11-38	404	Aug 15/82	
27-11-38	405	Aug 15/82	
27-11-38	406	Jun 15/79	
27-11-38	407	Mar 15/80	
27-11-38	408	Mar 15/80	
27-11-38	409/410	Mar 15/80	
27-11-38	501	May 15/85	
27-11-38	502	May 15/85	
27-11-38	503	Jun 15/92	
27-11-38	504	Nov 15/83	
27-11-38	505	Nov 15/83	
27-11-38	506	May 15/85	
27-11-38	507/508	May 15/85	
27-11-38	509/510	Jun 15/92	
27-11-39	401	Feb 15/74	
27-11-39	402	Feb 15/74	
27-11-39	403	Jul 15/83	
27-11-39	404	Jul 15/83	
27-11-41	601	Aug 15/82	
27-11-41	602	Aug 15/82	
27-11-42	401	Nov 15/82	
27-11-42	402	Mar 15/83	
27-11-42	403	Nov 15/82	
27-11-42	404	Nov 15/82	
27-11-42	405	Nov 15/82	
27-11-42	406	Nov 15/84	
27-11-42	407	Mar 15/84	
27-11-42	408	Nov 15/82	
27-11-42	409/410	Nov 15/82	
27-12-00	1	Mar 15/73	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-12-00	2	Jul 15/83	
27-12-00	3	May 15/75	
27-12-00	4	Dec 1/71	
27-12-00	5	Sep 15/73	
27-12-00	6	May 15/75	
27-12-00	501	Feb 15/78	
27-12-00	502	May 15/75	
27-12-00	503	May 15/89	
27-12-00	504	Feb 15/78	
27-12-00	505/506	Sep 15/73	
27-12-00	507/508	Feb 15/78	
27-12-01	401	Dec 15/93	
27-12-01	402	Dec 1/71	
27-12-01	403	Dec 15/93	
27-12-01	404	Dec 15/93	
27-12-05	401	Jun 15/73	
27-12-05	402	Jun 15/73	
27-12-05	403/404	Jun 15/73	
27-12-05	405	Jun 15/79	
27-12-05	406	Jun 15/79	
27-13-00	1	Feb 15/74	
27-13-00	2	Dec 1/71	
27-13-00	3/4	Aug 15/75	
27-13-00	101	Mar 15/81	
27-13-00	102	Feb 15/82	
27-13-00	103	Mar 15/81	
27-13-00	104	Nov 15/89	
27-13-00	105/106	Feb 15/82	
27-13-01	401	May 15/85	
27-13-01	402	May 15/85	
27-13-01	403	May 15/87	
27-13-01	404	May 15/85	
27-13-01	405/406	Feb 15/82	
27-21-00	1	Mar 15/91	
27-21-00	2	Feb 15/82	
27-21-00	3/4	Jul 15/83	
27-21-00	5	Mar 15/91	
27-21-00	6	Mar 15/91	
27-21-00	7	Mar 15/91	
27-21-00	8	Mar 15/91	
27-21-00	9/10	Jul 15/84	
27-21-00	11/12	Jul 15/84	
27-21-00	13	Mar 15/91	
27-21-00	14	May 15/86	
27-21-00	15	Jul 15/83	
27-21-00	16	May 15/85	
27-21-00	17	Jul 15/83	
27-21-00	18	Mar 15/84	
27-21-00	19	Jul 15/83	
27-21-00	20	May 15/87	
27-21-00	21	Jul 15/83	
27-21-00	22	Jul 15/83	
27-21-00	23	Mar 15/84	
27-21-00	24	Mar 15/84	
27-21-00	25/26	Nov 15/78	
27-21-00	27	Jul 15/83	
27-21-00	28	Jul 15/83	
27-21-00	29	Nov 15/87	
27-21-00	30	Jul 15/83	
27-21-00	31	Jul 15/83	
27-21-00	32	Jul 15/83	
27-21-00	33	Mar 15/91	
27-21-00	34	Feb 15/82	
27-21-00	35	Jul 15/83	
27-21-00	36	Jul 15/83	
27-21-00	37	Jul 15/83	
27-21-00	38	Jul 15/83	
27-21-00	39	Jul 15/83	
27-21-00	40	Jul 15/83	
27-21-00	41	Jul 15/83	
27-21-00	42	Jul 15/83	
27-21-00	43	Mar 15/91	
27-21-00	44	Jul 15/83	
27-21-00	45	May 15/86	
27-21-00	46	Jul 15/83	
27-21-00	47/48	Mar 15/91	
27-21-00	49	Jul 15/83	
27-21-00	50	Jul 15/83	
27-21-00	51/52	Jul 15/83	
27-21-00	101	Mar 15/81	
27-21-00	102	Mar 15/84	
27-21-00	103	Mar 15/91	
27-21-00	104	Mar 15/91	
27-21-00	105	Mar 15/91	
27-21-00	106	Mar 15/91	
27-21-00	107	Mar 15/91	
27-21-00	108	Mar 15/91	
27-21-00	109	Mar 15/91	
27-21-00	110	Mar 15/91	
27-21-00	111	May 15/86	
27-21-00	112	May 15/89	
27-21-00	113	May 15/86	
27-21-00	114	May 15/86	
27-21-00	115	Nov 15/88	
27-21-00	116	May 15/88	
27-21-00	117	May 15/86	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-21-00	118	May 15/86	
27-21-00	119	May 15/86	
27-21-00	120	Nov 15/88	
27-21-00	121	Jul 15/83	
27-21-00	122	May 15/85	
27-21-00	123	May 15/85	
27-21-00	124	May 15/85	
27-21-00	125	Jul 15/83	
27-21-00	126	Mar 15/84	
27-21-00	127	Mar 15/91	
27-21-00	128	Mar 15/91	
27-21-00	129	Mar 15/91	
27-21-00	130	Nov 15/87	
27-21-00	131/132	Mar 15/91	
27-21-00	133/134	Mar 15/91	
27-21-00	135/136	Mar 15/91	
27-21-00	137/138	Mar 15/91	
27-21-00	139/140	Dec 15/92	
27-21-00	141/142	Dec 15/92	
27-21-00	143/144	Dec 15/92	
27-21-00	145/146	Dec 15/92	
27-21-00	147/148	Mar 15/91	
27-21-00	149/150	Mar 15/91	
27-21-00	151/152	Mar 15/91	
27-21-00	153/154	Mar 15/91	
27-21-00	155	Mar 15/91	
27-21-00	156	Mar 15/91	
27-21-00	157/158	Mar 15/91	
27-21-00	501	Jun 15/93	
27-21-00	502	Nov 15/84	
27-21-00	503	Jun 15/93	
27-21-00	504	Jun 15/93	
27-21-00	505	Jun 15/93	
27-21-00	506	Jun 15/93	
27-21-00	507	Jun 15/93	
27-21-00	508	Dec 15/93	
27-21-00	509	Dec 15/93	
27-21-00	510	Jun 15/93	
27-21-00	511	Jun 15/93	
27-21-00	512	Jun 15/93	
27-21-00	513	Jun 15/93	
27-21-00	514	Dec 15/93	
27-21-00	515	Dec 15/93	
27-21-00	516	Dec 15/93	
27-21-00	517/518	May 15/86	
27-21-00	519	Dec 15/93	
27-21-00	520	Dec 15/93	
27-21-00	521/522	Jun 15/93	
27-21-00	523/524	Dec 15/93	
27-21-00	525	Dec 15/93	
27-21-00	526	Dec 15/93	
27-21-00	527	Dec 15/93	
27-21-00	528	Dec 15/93	
27-21-00	529	Dec 15/93	
27-21-00	530	Dec 15/93	
27-21-00	531/532	Mar 15/91	
27-21-00	533/534	Jun 15/93	
27-21-01	401	May 15/85	
27-21-01	402	May 15/85	
27-21-01	403/404	May 15/75	
27-21-01	405	May 15/85	
27-21-01	406	May 15/85	
27-21-01	407/408	May 15/85	
27-21-01	601/602	Nov 15/88	
27-21-02	201	Aug 15/82	
27-21-02	202	Aug 15/82	
27-21-02	203/204	Aug 15/82	
27-21-02	401	Aug 15/76	
27-21-02	402	May 15/85	
27-21-02	403/404	Aug 15/76	
27-21-06	401	Nov 15/78	
27-21-06	402	Nov 15/78	
27-21-06	403/404	Nov 15/78	
27-21-06	405/406	Nov 15/78	
27-21-07	401	Dec 15/92	
27-21-07	402	Jun 15/92	
27-21-07	403	Dec 15/92	
27-21-07	404	Dec 15/92	
27-21-07	405/406	Jun 15/92	
27-21-07	407	Jun 15/92	
27-21-07	408	Jun 15/92	
27-21-07	409/410	Jun 15/92	
27-21-07	411	Dec 15/92	
27-21-07	412	Jun 15/93	
27-21-07	413	Jun 15/93	
27-21-07	414	Jun 15/93	
27-21-07	415	Jun 15/93	
27-21-07	416	Jun 15/93	
27-21-07	501	Aug 15/81	
27-21-07	502	Feb 15/73	
27-21-07	503/504	Feb 15/73	
27-21-08	401	Dec 15/93	
27-21-08	402	Mar 15/91	
27-21-08	403	Mar 15/91	
27-21-08	404	Aug 15/81	
27-21-08	405	Mar 15/91	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-21-08	406	Dec 15/93	
27-21-08	407/408	Dec 15/93	
27-21-09	401	Dec 1/72	
27-21-09	402	Sep 15/79	
27-21-09	403/404	Nov 15/75	
27-21-10	401	Aug 15/81	
27-21-10	402	Aug 15/81	
27-21-10	403/404	Aug 15/81	
27-21-12	401	Aug 15/81	
27-21-12	402	Aug 15/81	
27-21-12	403	Feb 15/76	
27-21-12	404	Aug 15/81	
27-21-12	405	Aug 15/81	
27-21-12	406	Aug 15/81	
27-21-12	407/408	Aug 15/81	
27-21-12	501	Aug 15/74	
27-21-12	502	Jun 1/72	
27-21-14	201/202	Mar 15/81	
27-21-14	301	May 15/89	
27-21-14	302	May 15/89	
27-21-14	303	May 15/89	
27-21-14	304	Aug 15/81	
27-21-14	305	Nov 15/81	
27-21-14	306	Mar 15/84	
27-21-14	401	Aug 15/82	
27-21-14	402	Nov 15/82	
27-21-14	403	Aug 15/82	
27-21-14	404	Nov 15/81	
27-21-14	405	Nov 15/81	
27-21-14	406	Aug 15/82	
27-21-14	501/502	May 15/73	
27-21-15	401	Dec 15/79	
27-21-15	402	May 15/75	
27-21-15	403	Mar 15/80	
27-21-15	404	Mar 15/80	
27-21-15	405	May 15/85	
27-21-15	406	Mar 15/80	
27-21-15	407	Mar 15/80	
27-21-15	408	Dec 15/79	
27-21-15	409	Dec 15/79	
27-21-15	410	Dec 15/79	
27-21-15	411/412	May 15/85	
27-21-17	401	May 15/85	
27-21-17	402	May 15/85	
27-21-17	403	May 15/85	
27-21-17	404	May 15/85	
27-21-17	405/406	May 15/85	
27-21-18	201	Mar 15/91	
27-21-18	202	Mar 15/91	
27-21-18	401	Jun 15/93	
27-21-18	402	Jun 15/93	
27-21-18	403	Jun 15/93	
27-21-18	404	Jun 15/93	
27-21-18	405	Jun 15/93	
27-21-18	406	Jun 15/93	
27-21-18	407	Jun 15/93	
27-21-18	408	Jun 15/93	
27-21-18	409	Jun 15/93	
27-21-18	410	Jun 15/93	
27-21-18	411	Jun 15/93	
27-21-18	412	Jun 15/93	
27-21-18	413/414	Jun 15/93	
27-21-18	501	Mar 15/91	
27-21-18	502	Mar 15/91	
27-21-18	503/504	Mar 15/91	
27-21-20	401	Mar 15/81	
27-21-20	402	Jun 15/93	
27-21-20	403	Jun 15/93	
27-21-20	404	Jun 15/93	
27-21-20	405/406	Jun 15/93	
27-21-21	401	Nov 15/85	
27-21-21	402	Nov 15/85	
27-21-21	403	Nov 15/85	
27-21-21	404	Nov 15/85	
27-21-21	405	May 15/86	
27-21-21	406	May 15/86	
27-21-21	407/408	May 15/86	
27-21-22	401	Nov 15/82	
27-21-22	402	Nov 15/82	
27-21-22	403	Nov 15/82	
27-21-22	404	Jun 15/92	
27-21-22	405	Nov 15/82	
27-21-22	406	Feb 15/82	
27-21-22	407/408	Feb 15/82	
27-21-24	401	May 15/78	
27-21-24	402	May 15/78	
27-21-24	403/404	May 15/78	
27-21-25	401	Nov 15/75	
27-21-25	402	Oct 1/72	
27-21-25	403	Nov 15/75	
27-21-25	404	Nov 15/75	
27-21-26	401	Jun 15/80	
27-21-26	402	Nov 15/81	
27-21-26	403	Nov 15/81	
27-21-26	404	Nov 15/81	
27-21-31	401	Nov 15/82	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-21-31	402	Nov 15/82	
27-21-31	403	Nov 15/82	
27-21-31	404	Jul 15/83	
27-21-32	401	Jul 15/83	
27-21-32	402	Jul 15/83	
27-21-32	403	Jul 15/83	
27-21-32	404	Jul 15/83	
27-21-32	405	Jul 15/83	
27-21-32	406	Jul 15/83	
27-21-32	407	Jul 15/83	
27-21-32	408	Jul 15/83	
27-21-32	409	Jul 15/83	
27-21-32	410	Jul 15/83	
27-22-00	1	Aug 15/75	
27-22-00	2	Aug 15/75	
27-22-00	3/4	May 15/74	
27-22-00	5	Aug 15/75	
27-22-00	6	Aug 15/75	
27-22-00	7/8	May 15/74	
27-22-00	501	Nov 15/84	
27-22-00	502	Feb 15/82	
27-22-00	503	Feb 15/82	
27-22-00	504	Jun 15/94	
27-22-00	505	Jun 15/94	
27-22-00	506	May 15/90	
27-22-00	507	May 15/90	
27-22-00	508	May 15/90	
R 27-22-00	509/510	Jun 15/96	
27-22-02	401	Mar 15/80	
27-22-02	402	Aug 15/75	
27-22-02	403	May 15/77	
27-22-02	404	May 15/77	
27-22-02	405/406	Aug 15/75	
27-22-04	401	May 15/82	
27-22-04	402	Aug 15/82	
27-22-04	403	May 15/82	
27-22-04	404	Nov 15/82	
27-22-04	405	Aug 15/82	
27-22-04	406	Nov 15/83	
27-23-00	1	Dec 1/72	
27-23-00	2	Feb 15/74	
27-23-00	3/4	Feb 15/74	
27-23-00	101	Mar 15/81	
27-23-00	102	Mar 15/81	
27-23-00	103	Mar 15/81	
27-23-00	104	Nov 15/89	
27-23-00	105/106	Mar 15/81	
27-23-01	401	Nov 15/76	
27-23-01	402	Aug 15/81	
27-23-01	403	Aug 15/81	
27-23-01	404	Aug 15/81	
27-23-01	405/406	Aug 15/81	
27-31-00	1	Aug 15/81	
27-31-00	2	Aug 15/81	
27-31-00	3	Dec 15/93	
27-31-00	4	Dec 15/93	
27-31-00	5	Dec 15/93	
27-31-00	6	Aug 15/81	
27-31-00	7	Dec 15/93	
27-31-00	8	Jun 15/92	
27-31-00	101	Mar 15/81	
27-31-00	102	Mar 15/81	
27-31-00	103	Mar 15/81	
27-31-00	104	Nov 15/89	
27-31-00	501	Dec 15/80	
27-31-00	502	Sep 15/79	
27-31-00	503	Dec 15/80	
27-31-00	504	Jul 15/83	
27-31-00	505/506	May 15/85	
27-31-00	507/508	Feb 15/78	
27-31-00	601	Jun 15/80	
27-31-00	602	Jun 15/80	
27-31-00	603	Feb 15/78	
27-31-00	604	Feb 15/78	
27-31-03	401	Dec 15/92	
27-31-03	402	Dec 15/92	
27-31-03	403	Dec 15/92	
27-31-03	404	Dec 15/92	
27-31-03	405	Dec 15/92	
27-31-03	406	Dec 15/91	
27-31-03	407	Mar 15/91	
27-31-03	408	Dec 15/91	
27-31-03	409	Mar 15/91	
27-31-03	410	Mar 15/91	
27-31-03	411	Dec 15/92	
27-31-03	412	Dec 15/92	
27-31-03	413	Dec 15/92	
27-31-03	414	May 15/85	
27-31-03	415	May 15/85	
27-31-03	416	Dec 15/92	
27-31-04	401	May 15/89	
27-31-04	402	May 15/89	
27-31-04	403	May 15/89	
27-31-04	404	May 15/89	
27-31-04	405/406	May 15/89	
27-31-06	401	Feb 15/77	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-31-06	402	May 15/78	
27-31-06	403/404	Jun 15/92	
27-31-06	405	Jun 15/92	
27-31-06	406	May 15/78	
27-31-07	301	Aug 15/81	
27-31-07	302	Aug 15/82	
27-31-07	303	May 15/87	
27-31-07	304	Aug 15/82	
27-31-07	305/306	Aug 15/82	
27-31-07	401	May 15/87	
27-31-07	402	May 15/87	
27-31-07	403	Aug 15/82	
27-31-07	404	May 15/87	
27-31-07	405/406	Aug 15/82	
27-31-07	501/502	May 15/78	
27-31-10	401	Nov 15/81	
27-31-10	402	Jul 15/83	
27-31-10	403	May 15/88	
27-31-10	404	May 15/88	
27-31-10	405	May 15/88	
27-31-10	406	May 15/88	
27-31-10	407	Jul 15/83	
27-31-10	408	Jul 15/83	
27-31-10	409	Jul 15/83	
27-31-10	410	Jun 15/92	
27-31-10	411/412	Nov 15/81	
27-31-10	413	Nov 15/81	
27-31-10	414	Jul 15/83	
27-31-10	601	Feb 15/78	
27-31-10	602	Feb 15/78	
27-31-10	603	Feb 15/78	
27-31-10	604	Feb 15/78	
27-31-11	201	Nov 15/83	
27-31-11	202	Nov 15/81	
27-31-11	203/204	Nov 15/81	
27-31-11	401	Nov 15/81	
27-31-11	402	Nov 15/81	
27-31-11	403	Dec 15/92	
27-31-11	404	Dec 15/92	
27-31-11	405/406	Dec 15/92	
27-31-11	501	Jul 15/83	
27-31-11	502	Jul 15/83	
27-31-11	503/504	Jul 15/83	
27-31-11	601	Nov 15/81	
27-31-11	602	Nov 15/81	
27-31-11	603/604	Nov 15/81	
27-31-12	401	Nov 15/81	
27-31-12	402	Nov 15/81	
27-31-12	403/404	Dec 15/79	
27-31-13	201	Dec 15/92	
27-31-13	202	Dec 15/92	
27-41-00	1	Nov 15/81	
27-41-00	2	Mar 15/91	
27-41-00	3/4	Feb 15/74	
27-41-00	5/6	Feb 15/74	
27-41-00	7/8	Feb 15/74	
27-41-00	9	Mar 15/91	
27-41-00	10	Mar 15/91	
27-41-00	11	Feb 15/74	
27-41-00	12	Mar 15/91	
27-41-00	13	Mar 15/91	
27-41-00	14	Feb 15/74	
27-41-00	15	Mar 15/91	
27-41-00	16	Nov 15/81	
27-41-00	17	Mar 15/91	
27-41-00	18	Mar 15/91	
27-41-00	19	Feb 15/74	
27-41-00	20	Mar 15/91	
27-41-00	21	Feb 15/74	
27-41-00	22	Mar 15/91	
27-41-00	23	Feb 15/75	
27-41-00	24	Mar 15/91	
27-41-00	25/26	Feb 15/74	
27-41-00	27	Mar 15/91	
27-41-00	28	Feb 15/74	
27-41-00	29	Mar 15/91	
27-41-00	30	Mar 15/91	
27-41-00	31/32	Feb 15/74	
27-41-00	33	Feb 15/74	
27-41-00	34	Mar 15/91	
27-41-00	35	Mar 15/91	
27-41-00	36	Feb 15/74	
27-41-00	37	Dec 15/92	
27-41-00	38	Nov 15/75	
27-41-00	39/40	May 15/89	
27-41-00	41	Mar 15/91	
27-41-00	42	Mar 15/91	
27-41-00	43	Mar 15/91	
27-41-00	44	Mar 15/91	
27-41-00	45	Mar 15/91	
27-41-00	46	Mar 15/91	
27-41-00	47/48	Mar 15/91	
27-41-00	49	Mar 15/91	
27-41-00	50	Nov 15/75	
27-41-00	51/52	Mar 15/91	
27-41-00	53/54	Mar 15/91	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-41-00	101	Nov 15/83	
27-41-00	102	May 15/88	
27-41-00	103	May 15/88	
27-41-00	104	Nov 15/83	
27-41-00	105	Nov 15/83	
27-41-00	106	Nov 15/83	
27-41-00	107	Nov 15/83	
27-41-00	108	Jun 15/93	
27-41-00	109	Nov 15/83	
27-41-00	110	Mar 15/91	
27-41-00	111	Nov 15/83	
27-41-00	112	Nov 15/83	
27-41-00	113	Nov 15/83	
27-41-00	114	Nov 15/88	
27-41-00	115	Nov 15/83	
27-41-00	116	Nov 15/83	
27-41-00	117/118	Nov 15/88	
27-41-00	119/120	Nov 15/83	
27-41-00	121/122	Nov 15/83	
27-41-00	123/124	May 15/86	
27-41-00	501	Nov 15/83	
27-41-00	502	Nov 15/83	
27-41-00	503	Nov 15/83	
27-41-00	504	Nov 15/83	
27-41-00	505	Nov 15/83	
27-41-00	506	Nov 15/83	
27-41-00	507	Nov 15/83	
27-41-00	508	May 15/89	
27-41-00	509	May 15/89	
27-41-00	510	May 15/89	
27-41-00	511	May 15/89	
27-41-00	512	May 15/89	
27-41-00	513	May 15/89	
27-41-00	514	May 15/89	
27-41-00	515	May 15/89	
27-41-00	516	May 15/89	
27-41-00	517	May 15/89	
27-41-00	518	May 15/89	
27-41-00	519/520	Feb 15/78	
27-41-00	521	May 15/89	
27-41-00	522	May 15/89	
27-41-00	523/524	May 15/85	
27-41-00	525/526	Jul 15/83	
27-41-00	527/528	Jul 15/83	
27-41-00	529	May 15/89	
27-41-00	530	May 15/89	
27-41-00	531	May 15/89	
27-41-00	532	May 15/89	
27-41-00	533/534	Dec 15/80	
27-41-00	535	May 15/89	
27-41-00	536	Nov 15/87	
27-41-00	537	Nov 15/87	
27-41-00	538	May 15/89	
27-41-00	539	Nov 15/87	
27-41-00	540	Nov 15/87	
27-41-00	541	Jul 15/83	
27-41-00	542	Nov 15/87	
27-41-00	543	May 15/89	
27-41-00	544	Nov 15/87	
27-41-00	545	May 15/89	
27-41-00	546	May 15/89	
27-41-00	547	Nov 15/87	
27-41-00	548	Nov 15/87	
27-41-00	549	Nov 15/87	
27-41-00	550	Nov 15/83	
27-41-00	601	Feb 15/79	
27-41-00	602	Nov 15/87	
27-41-00	603	Mar 15/84	
27-41-00	604	Mar 15/84	
27-41-00	605/606	Mar 15/84	
27-41-01	401	Jul 15/73	
27-41-01	402	Jul 15/73	
27-41-01	403	Feb 15/82	
27-41-01	404	Feb 15/82	
27-41-01	405	Aug 15/82	
27-41-01	406	Nov 15/82	
27-41-01	407	Aug 15/82	
27-41-01	408	Aug 15/82	
27-41-01	409/410	Aug 15/82	
27-41-03	401	May 15/85	
27-41-03	402	Nov 15/88	
27-41-03	403	Nov 15/88	
27-41-03	404	Nov 15/88	
27-41-03	405	Dec 15/93	
27-41-03	406	Nov 15/88	
27-41-03	407	Nov 15/88	
27-41-03	408	Nov 15/88	
27-41-03	409	Nov 15/88	
27-41-03	410	Nov 15/88	
27-41-03	411/412	Nov 15/88	
27-41-03	413/414	Aug 15/81	
27-41-03	415/416	Aug 15/81	
27-41-03	501	Nov 15/88	
27-41-03	502	Nov 15/88	
27-41-03	503/504	Nov 15/88	
27-41-03	505/506	Dec 15/80	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-41-06	401	May 15/82	
27-41-06	402	May 15/88	
27-41-06	403	May 15/88	
27-41-06	404	May 15/88	
27-41-06	405/406	May 15/85	
27-41-06	501	May 15/82	
27-41-06	502	May 15/82	
27-41-06	503	May 15/82	
27-41-06	504	Feb 15/75	
27-41-06	505	May 15/82	
27-41-06	506	May 15/82	
27-41-06	507	May 15/82	
27-41-06	508	May 15/82	
27-41-09	401	May 15/76	
27-41-09	402	May 15/76	
27-41-09	403/404	Feb 15/74	
27-41-09	405	Mar 15/91	
27-41-09	406	Mar 15/91	
27-41-09	407/408	Mar 15/91	
27-41-09	601	May 15/74	
27-41-09	602	May 15/74	
27-41-12	401	Nov 15/81	
27-41-12	402	Nov 15/81	
27-41-12	403	Nov 15/81	
27-41-12	404	Nov 15/81	
27-41-12	405/406	Mar 15/73	
27-41-12	501/502	Feb 15/75	
27-41-13	401	Nov 15/74	
27-41-13	402	Nov 15/74	
27-41-13	403	Nov 15/74	
27-41-13	404	Nov 15/74	
27-41-16	401	Aug 15/82	
27-41-16	402	Aug 15/82	
27-41-16	403	Feb 15/76	
27-41-16	404	Feb 15/76	
27-41-16	405	Feb 15/76	
27-41-16	406	Aug 15/82	
27-41-16	407	Aug 15/76	
27-41-16	408	Aug 15/76	
27-41-16	409	Aug 15/82	
27-41-16	410	Feb 15/78	
27-41-17	401	May 15/86	
27-41-17	402	Oct 1/72	
27-41-17	403/404	Nov 15/85	
27-41-17	405	Feb 15/76	
27-41-17	406	May 15/86	
27-41-17	407	May 15/86	
27-41-17	408	Dec 15/92	
27-41-17	409	Dec 15/92	
27-41-17	410	Dec 15/92	
27-41-17	411/412	Dec 15/92	
27-41-20	401	Nov 15/83	
27-41-20	402	Nov 15/83	
27-41-20	403	Nov 15/85	
27-41-20	404	Aug 15/82	
27-41-20	405	Nov 15/85	
27-41-20	406	Nov 15/85	
27-41-20	407/408	Nov 15/85	
27-41-20	409/410	Nov 15/83	
27-41-20	411	Nov 15/83	
27-41-20	412	Nov 15/83	
27-41-20	801	Feb 15/78	
27-41-20	802	Feb 15/78	
27-41-20	803	Nov 15/75	
27-41-20	804	Feb 15/78	
27-41-21	401	Aug 15/82	
27-41-21	402	Dec 1/71	
27-41-21	403/404	Aug 15/82	
27-41-22	401	Aug 15/82	
27-41-22	402	Aug 15/82	
27-41-22	403	May 15/75	
27-41-22	404	Aug 15/82	
27-41-22	405/406	Aug 15/82	
27-41-24	401	Mar 15/84	
27-41-24	402	Mar 15/84	
27-41-24	403	Mar 15/84	
27-41-24	404	Mar 15/84	
27-41-28	401	Aug 15/82	
27-41-28	402	Jun 15/93	
27-41-28	403	Nov 15/88	
27-41-28	404	Nov 15/88	
27-41-28	405	Nov 15/88	
27-41-28	406	Jun 15/93	
27-41-28	407	Jun 15/93	
27-41-28	408	Jun 15/93	
27-41-28	409/410	Jun 15/93	
27-41-31	401	Aug 1/72	
27-41-31	402	Aug 1/72	
27-41-31	403/404	Feb 15/74	
27-41-32	401	Nov 15/74	
27-41-32	402	Nov 15/73	
27-41-32	403/404	Nov 15/74	
27-41-32	501	Aug 15/76	
27-41-32	502	May 15/85	
27-41-32	503	Aug 15/76	
27-41-32	504	Aug 15/76	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-41-33	401	Aug 15/82	
27-41-33	402	Feb 15/82	
27-41-33	403	Mar 15/91	
27-41-33	404	Mar 15/91	
27-41-33	405	Mar 15/91	
27-41-33	406	Feb 15/82	
27-41-33	407/408	Feb 15/82	
27-41-35	201	Aug 15/81	
27-41-35	202	Aug 15/81	
27-41-35	401	Aug 15/78	
27-41-35	402	Aug 15/78	
27-41-35	403	Nov 15/88	
27-41-35	404	Aug 15/78	
27-41-38	401	Feb 15/74	
27-41-38	402	Mar 15/80	
27-41-38	403/404	Feb 15/74	
27-41-38	405	Mar 15/80	
27-41-38	406	Mar 15/80	
27-41-39	401	Nov 15/85	
27-41-39	402	Dec 15/80	
27-41-39	403	Dec 15/80	
27-41-39	404	Dec 15/80	
27-41-39	405	Dec 15/80	
27-41-39	406	Dec 15/80	
27-41-40	401	Feb 15/74	
27-41-40	402	May 15/74	
27-41-40	403/404	Feb 15/74	
27-41-40	405/406	Feb 15/74	
27-41-41	401	Nov 15/74	
27-41-41	402	Nov 15/74	
27-41-41	403/404	Nov 15/74	
27-41-42	401	Feb 15/78	
27-41-42	402	May 15/75	
27-41-42	403/404	Feb 15/78	
27-41-43	401	Nov 15/81	
27-41-43	402	Nov 15/81	
27-41-43	403	Nov 15/81	
27-41-43	404	Nov 15/81	
27-41-44	401	May 15/87	
27-41-44	402	May 15/87	
27-41-44	403	May 15/87	
27-41-44	404	May 15/87	
27-41-44	405	May 15/87	
27-41-44	406	May 15/87	
27-41-44	407	May 15/87	
27-41-44	408	May 15/87	
27-41-44	409/410	May 15/87	
27-41-45	401	Nov 15/88	
27-41-45	402	Mar 15/91	
27-41-45	403/404	Nov 15/88	
27-41-45	405/406	Nov 15/88	
27-42-00	1	Jul 15/83	
27-42-00	2	Dec 1/71	
27-42-00	3	Jul 15/83	
27-42-00	4	Jul 15/83	
27-42-00	201	May 15/85	
27-42-00	202	May 15/85	
27-42-00	501	Mar 15/91	
27-42-00	502	Mar 15/91	
27-42-00	503	Nov 15/87	
27-42-00	504	Jul 15/83	
27-42-00	505	Mar 15/83	
27-42-00	506	May 15/86	
27-42-00	507/508	Jul 15/83	
27-42-01	401	Mar 15/91	
27-42-01	402	Mar 15/91	
27-42-01	403	Mar 15/91	
27-42-01	404	May 15/82	
27-42-03	401	Mar 15/91	
27-42-03	402	Mar 15/91	
27-42-03	403	Mar 15/91	
27-42-03	404	May 15/82	
27-42-05	401	Aug 15/77	
27-42-05	402	Aug 15/77	
27-42-05	403/404	Aug 15/77	
27-42-05	405/406	May 15/75	
27-42-07	401	May 15/85	
27-42-07	402	Aug 15/82	
27-42-07	403	Aug 15/82	
27-42-07	404	Jun 15/80	
27-42-07	405	Aug 15/81	
27-42-07	406	Jun 15/80	
27-42-07	407/408	Jun 15/80	
27-42-12	401	May 15/85	
27-42-12	402	May 15/85	
27-42-12	403/404	May 15/85	
27-42-13	401	Nov 15/88	
27-42-13	402	Nov 15/88	
27-42-13	403	Nov 15/88	
27-42-13	404	Nov 15/88	
27-42-13	405/406	Nov 15/88	
27-43-00	1	Nov 15/83	
27-43-00	2	Dec 1/71	
27-43-00	3/4	Feb 15/74	
27-43-00	101	Mar 15/81	
27-43-00	102	Mar 15/81	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-43-00	103	Mar 15/81	
27-43-00	104	Mar 15/81	
27-43-00	105/106	Mar 15/81	
27-43-01	401	Nov 15/83	
27-43-01	402	Aug 15/82	
27-43-01	403	Aug 15/82	
27-43-01	404	Aug 15/82	
27-51-00	1	Feb 15/82	
27-51-00	2	Dec 1/71	
27-51-00	3	Apr 1/72	
27-51-00	4	Dec 15/92	
27-51-00	5/6	Aug 15/82	
27-51-00	7	Nov 15/88	
27-51-00	8	Mar 15/83	
27-51-00	9	Nov 15/88	
27-51-00	10	Aug 15/82	
27-51-00	11	Aug 15/82	
27-51-00	12	Dec 15/92	
27-51-00	13	Aug 15/82	
27-51-00	14	Nov 15/88	
27-51-00	15	Nov 15/88	
27-51-00	16	Nov 15/88	
27-51-00	17/18	Mar 15/83	
27-51-00	19	Nov 15/88	
27-51-00	20	Aug 15/82	
27-51-00	21	Nov 15/88	
27-51-00	22	Nov 15/88	
27-51-00	23/24	Aug 15/82	
27-51-00	25/26	Aug 15/82	
27-51-00	27	Aug 15/82	
27-51-00	28	Nov 15/88	
27-51-00	29	Aug 15/82	
27-51-00	30	Nov 15/88	
27-51-00	31	Aug 15/82	
27-51-00	32	Nov 15/88	
27-51-00	33	Aug 15/82	
27-51-00	34	Aug 15/82	
27-51-00	35	Nov 15/88	
27-51-00	36	Nov 15/88	
27-51-00	37/38	Aug 15/82	
27-51-00	39	Aug 15/82	
27-51-00	40	Nov 15/88	
27-51-00	41	Aug 15/82	
27-51-00	42	Dec 15/92	
27-51-00	101	May 15/88	
27-51-00	102	Nov 15/82	
27-51-00	103	Jun 15/92	
27-51-00	104	Feb 15/82	
27-51-00	105	Jul 15/84	
27-51-00	106	Nov 15/83	
27-51-00	107	Feb 15/82	
27-51-00	108	Nov 15/82	
27-51-00	109	Dec 15/92	
27-51-00	110	Nov 15/89	
27-51-00	111	Nov 15/83	
27-51-00	112	Jun 15/94	
27-51-00	113	Feb 15/82	
27-51-00	114	Aug 15/81	
27-51-00	115	Feb 15/82	
27-51-00	116	Mar 15/83	
27-51-00	117	May 15/82	
27-51-00	118	May 15/82	
27-51-00	119	Nov 15/83	
27-51-00	120	May 15/82	
27-51-00	121	May 15/82	
27-51-00	122	May 15/82	
27-51-00	123/124	Aug 15/82	
27-51-00	125/126	Aug 15/82	
27-51-00	127/128	May 15/82	
27-51-00	129/130	May 15/82	
27-51-00	131/132	May 15/89	
27-51-00	501	Nov 15/82	
27-51-00	502	Nov 15/83	
27-51-00	503	Nov 15/82	
27-51-00	504	Mar 15/83	
27-51-00	505	Dec 15/93	
27-51-00	506	Dec 15/93	
27-51-00	507	Dec 15/93	
27-51-00	508	Dec 15/93	
27-51-00	509	Dec 15/93	
27-51-00	510	Dec 15/93	
27-51-00	511	Dec 15/93	
27-51-00	512	Dec 15/93	
27-51-00	513	Dec 15/93	
27-51-00	514	Dec 15/93	
27-51-00	515	Dec 15/93	
27-51-00	516	Dec 15/93	
27-51-00	517	Dec 15/93	
27-51-00	518	Dec 15/93	
27-51-00	519	Dec 15/93	
27-51-00	520	Dec 15/93	
27-51-00	521/522	May 15/85	
27-51-00	523	Dec 15/93	
27-51-00	524	Dec 15/93	
27-51-00	525	Dec 15/93	
27-51-00	526	Dec 15/93	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-51-00	527	Dec 15/93	
27-51-00	528	Dec 15/93	
27-51-00	529/530	Nov 15/82	
27-51-00	531	Nov 15/88	
27-51-00	532	Nov 15/88	
27-51-00	533	Nov 15/88	
27-51-00	534	Nov 15/88	
27-51-00	535	Jul 15/84	
27-51-00	536	Mar 15/91	
27-51-00	537/538	Nov 15/82	
27-51-00	539	May 15/88	
27-51-00	540	May 15/88	
27-51-00	541	May 15/88	
27-51-00	542	Nov 15/89	
27-51-00	543	Nov 15/89	
27-51-00	544	Jun 15/92	
27-51-00	545	Jun 15/92	
27-51-00	546	Jun 15/92	
27-51-00	601	Mar 15/84	
27-51-00	602	Mar 15/84	
27-51-00	603	Nov 15/87	
27-51-00	604	Nov 15/87	
27-51-00	605	Mar 15/91	
27-51-00	606	Mar 15/91	
27-51-00	607/608	Mar 15/91	
27-51-04	401	May 15/77	
27-51-04	402	Nov 15/84	
27-51-04	403/404	Mar 15/84	
27-51-04	501	Jul 15/84	
27-51-04	502	Jul 15/84	
27-51-04	503	Jul 15/84	
27-51-04	504	Nov 15/85	
27-51-04	505	Nov 15/85	
27-51-04	506	Nov 15/85	
27-51-04	507	Nov 15/85	
27-51-04	508	Nov 15/85	
27-51-04	509	Jul 15/84	
27-51-04	510	Jul 15/84	
27-51-06	401/402	Jun 15/92	
27-51-06	501	Nov 15/82	1
27-51-06	502	Nov 15/82	1
27-51-06	503	Nov 15/83	1
27-51-06	504	Nov 15/82	1
27-51-06	505	Nov 15/86	1
27-51-06	506	Nov 15/88	1
27-51-06	507	Nov 15/88	1
27-51-06	508	Nov 15/86	1
27-51-06	509	Nov 15/86	1
27-51-06	510	Nov 15/86	1
27-51-06	511	Nov 15/86	1
27-51-06	512	Nov 15/86	1
27-51-06	513	Nov 15/86	1
27-51-06	514	Nov 15/86	1
27-51-06	515	Nov 15/86	1
27-51-06	516	Nov 15/86	1
27-51-06	517	Nov 15/86	1
27-51-06	518	Nov 15/86	1
27-51-06	519	Nov 15/87	1
27-51-06	520	Nov 15/89	1
27-51-06	521	Nov 15/89	1
27-51-06	522	Nov 15/89	1
27-51-06	523	Nov 15/89	1
27-51-06	524	Nov 15/89	1
27-51-06	525	Nov 15/89	1
27-51-06	526	Nov 15/89	1
27-51-06	527	Nov 15/89	1
27-51-06	528	Nov 15/89	1
27-51-06	529/530	Nov 15/89	1
27-51-06	501	Nov 15/82	2
27-51-06	502	May 15/85	2
27-51-06	503	Jul 15/84	2
27-51-06	504	Mar 15/84	2
27-51-06	505	Mar 15/84	2
27-51-06	506	May 15/86	2
27-51-06	507	May 15/86	2
27-51-06	508	Nov 15/86	2
27-51-06	509	May 15/86	2
27-51-06	510	May 15/86	2
27-51-06	511	May 15/87	2
27-51-06	512	Nov 15/87	2
27-51-06	513	May 15/87	2
27-51-06	514	May 15/87	2
27-51-06	515	May 15/87	2
27-51-06	516	May 15/87	2
27-51-06	517	May 15/87	2
27-51-06	518	May 15/87	2
27-51-06	519	May 15/87	2
27-51-06	520	May 15/87	2
27-51-06	521	May 15/87	2
27-51-06	522	Nov 15/87	2
27-51-06	523	May 15/87	2
27-51-06	524	Nov 15/87	2
27-51-06	525	Nov 15/87	2
27-51-06	526	Nov 15/87	2
27-51-06	527/528	Nov 15/87	2
27-51-07	401	May 15/77	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-51-07	402	May 15/89	
27-51-07	403/404	May 15/89	
27-51-07	405/406	May 15/89	
27-51-08	401	Feb 15/78	
27-51-08	402	Mar 15/91	
27-51-08	403	Mar 15/91	
27-51-08	404	Mar 15/91	
27-51-08	405/406	Jul 15/83	
27-51-08	407	Aug 15/81	
27-51-08	408	Mar 15/91	
27-51-08	409	Mar 15/91	
27-51-08	410	Mar 15/91	
27-51-08	411	Mar 15/91	
27-51-08	412	Mar 15/91	
27-51-08	413	Dec 15/92	
27-51-08	414	Mar 15/91	
27-51-08	415	Dec 15/92	
27-51-08	416	Dec 15/92	
27-51-08	417	Dec 15/92	
27-51-08	418	Dec 15/92	
27-51-10	401	Mar 15/81	
27-51-10	402	Mar 15/81	
27-51-10	403	Mar 15/81	
27-51-10	404	Mar 15/81	
27-51-10	405/406	Mar 15/81	
27-51-11	401	Jul 15/83	
27-51-11	402	Jul 15/83	
27-51-11	403/404	Jul 15/83	
27-51-12	401	May 15/87	
27-51-12	402	May 15/87	
27-51-12	403	May 15/87	
27-51-12	404	May 15/87	
27-51-12	405	May 15/87	
27-51-12	406	May 15/87	
27-51-12	407/408	May 15/87	
27-51-12	409	May 15/87	
27-51-12	410	May 15/87	
27-51-12	411	May 15/87	
27-51-12	412	May 15/87	
27-51-12	413/414	May 15/87	
27-51-14	401	May 15/74	
27-51-14	402	May 15/74	
27-51-14	403/404	May 15/74	
27-51-15	401	Dec 1/72	
27-51-15	402	Dec 1/71	
27-51-15	403/404	Dec 1/72	
27-51-17	401	Aug 15/82	
27-51-17	402	May 15/88	
27-51-17	403	May 15/88	
27-51-17	404	May 15/82	
27-51-19	401	May 15/88	
27-51-19	402	Sep 15/80	
27-51-19	403	May 15/88	
27-51-19	404	Aug 15/81	
27-51-22	401	Aug 15/81	
27-51-22	402	Jun 15/92	
27-51-22	403	Jun 15/92	
27-51-22	404	Jun 15/92	
27-51-22	405	Jun 15/92	
27-51-22	406	Jun 15/92	
27-51-22	407/408	May 15/89	
27-51-22	601	Feb 15/79	
27-51-22	602	Feb 15/79	
27-51-22	603/604	Feb 15/79	
27-51-25	401	Feb 15/82	
27-51-25	402	Feb 15/82	
27-51-25	403	May 15/88	
27-51-25	404	May 15/88	
27-51-25	405/406	Aug 15/82	
27-51-25	407	May 15/88	
27-51-25	408	May 15/88	
27-51-25	601	Nov 15/89	
27-51-25	602	Nov 15/89	
27-51-25	603	Nov 15/89	
27-51-25	604	Nov 15/89	
27-51-25	605	Nov 15/89	
27-51-25	606	Nov 15/89	
27-51-25	607/608	Nov 15/89	
27-51-26	401	Feb 15/82	
27-51-26	402	Feb 15/82	
27-51-26	403	May 15/85	
27-51-26	404	Aug 15/82	
27-51-26	405	Aug 15/82	
27-51-26	406	Aug 15/82	
27-51-26	407/408	Feb 15/82	
27-51-26	409	Nov 15/83	
27-51-26	410	May 15/89	
27-51-26	411	May 15/88	
27-51-26	412	May 15/88	
27-51-26	413/414	May 15/88	
27-51-26	601	Jul 15/83	
27-51-26	602	Nov 15/88	
27-51-26	603/604	Jul 15/83	
27-51-26	605/606	Jul 15/83	
27-51-30	401	May 15/90	
27-51-30	402	May 15/90	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-51-30	403/404	Nov 15/83	
27-51-34	401	May 15/78	
27-51-34	402	Dec 15/80	
27-51-34	403	Dec 15/80	
27-51-34	404	Aug 15/82	
27-51-35	401	May 15/82	
27-51-35	402	Nov 15/89	
27-51-35	403	May 15/88	
27-51-35	404	May 15/88	
27-51-35	405	Dec 15/91	
27-51-35	406	May 15/88	
27-51-35	407	May 15/88	
27-51-35	408	May 15/88	
27-51-35	409	May 15/88	
27-51-35	410	May 15/88	
27-51-35	411	May 15/88	
27-51-35	412	May 15/88	
27-51-35	413/414	May 15/82	
27-51-35	415/416	Nov 15/87	
27-51-35	417	May 15/87	
27-51-35	418	May 15/87	
27-51-35	419/420	May 15/87	
27-51-39	401	Nov 15/76	
27-51-39	402	Nov 15/76	
27-51-39	403/404	Nov 15/76	
27-51-40	401	Nov 15/76	
27-51-40	402	Nov 15/76	
27-51-40	403/404	Nov 15/76	
27-51-41	401	May 15/82	
27-51-41	402	May 15/82	
27-51-41	403	Dec 1/72	
27-51-41	404	Jul 15/83	
27-51-41	405/406	Jul 15/83	
27-51-42	401	May 15/87	
27-51-42	402	May 15/87	
27-51-42	403	Nov 15/88	
27-51-42	404	Nov 15/88	
27-51-42	405	May 15/87	
27-51-42	406	May 15/87	
27-51-46	401	May 15/82	
27-51-46	402	May 15/82	
27-51-46	403/404	Nov 15/76	
27-51-47	401	May 15/90	
27-51-47	402	May 15/90	
27-51-47	403	May 15/90	
27-51-47	404	May 15/90	
27-51-47	405	May 15/90	
27-51-47	406	May 15/90	
27-51-47	407	May 15/90	
27-51-47	408	May 15/90	
27-51-47	409	May 15/90	
27-51-47	410	May 15/90	
27-51-47	411/412	Nov 15/86	
27-51-47	413/414	Nov 15/86	
27-51-47	415/416	Jul 15/83	
27-51-47	417/418	Mar 15/91	
27-51-47	419/420	May 15/90	
27-51-48	401	Nov 15/83	
27-51-48	402	Jun 15/93	
27-51-48	403/404	Nov 15/83	
27-51-48	405/406	Nov 15/83	
27-51-48	801	Nov 15/85	
27-51-48	802	Nov 15/85	
27-51-48	803	Nov 15/85	
27-51-48	804	Nov 15/85	
27-51-49	401	Nov 15/73	
27-51-49	402	Mar 15/84	
27-51-49	403	Mar 15/84	
27-51-49	404	Aug 15/81	
27-51-50	401	Jun 15/93	
27-51-50	402	Jun 15/93	
27-51-50	403	Jun 15/93	
27-51-50	404	Jun 15/93	
27-51-50	405/406	Jun 15/93	
27-51-50	501	Nov 15/88	
27-51-50	502	Nov 15/88	
27-51-50	503	Nov 15/88	
27-51-50	504	Nov 15/88	
27-51-50	505/506	Feb 15/76	
27-51-51	401	Nov 15/88	
27-51-51	402	Nov 15/88	
27-51-51	403	Nov 15/85	
27-51-51	404	May 15/89	
27-51-51	405/406	May 15/89	
27-51-55	501	May 15/78	
27-51-55	502	Jul 15/83	
27-51-55	503/504	Jul 15/83	
27-51-58	401	May 15/78	
27-51-58	402	May 15/78	
27-51-58	403	Aug 15/74	
27-51-58	404	May 15/78	
27-51-58	405	May 15/78	
27-51-58	406	May 15/78	
27-51-58	407/408	May 15/78	
27-51-59	401	Nov 15/83	
27-51-59	402	Nov 15/83	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-51-59	403	Nov 15/83	
27-51-59	404	Nov 15/83	
27-51-59	405/406	Nov 15/83	
27-51-60	401	Nov 15/76	
27-51-60	402	Nov 15/76	
27-51-60	403/404	Nov 15/76	
27-51-63	401	Nov 15/75	
27-51-63	402	Nov 15/75	
27-51-63	403/404	Nov 15/75	
27-51-64	401	May 15/82	
27-51-64	402	May 15/82	
27-51-64	403	May 15/82	
27-51-64	404	May 15/82	
27-51-64	405	May 15/82	
27-51-64	406	Aug 15/76	
27-51-66	401	Aug 15/82	
27-51-66	402	Aug 15/81	
27-51-66	403	Aug 15/82	
27-51-66	404	Aug 15/81	
27-51-66	405	Aug 15/82	
27-51-66	406	Aug 15/82	
27-51-70	201	May 15/87	
27-51-70	202	May 15/87	
27-51-70	203	May 15/87	
27-51-70	204	May 15/87	
27-51-70	205/206	May 15/87	
27-52-00	1	May 15/85	
27-52-00	2	May 15/85	
27-52-00	3/4	Mar 15/80	
27-52-00	101	Mar 15/81	
27-52-00	102	May 15/85	
27-52-00	103	May 15/85	
27-52-00	104	May 15/85	
27-52-00	105/106	Sep 15/80	
27-52-00	201	May 15/86	
27-52-00	202	May 15/86	
27-52-00	203	May 15/86	
27-52-00	204	May 15/86	
27-52-00	205/206	May 15/86	
27-52-01	401	Mar 15/84	
27-52-01	402	Mar 15/84	
27-52-01	403	Mar 15/84	
27-52-01	404	Mar 15/84	
27-52-01	405/406	May 15/82	
27-52-02	401	Aug 15/82	
27-52-02	402	Aug 15/82	
27-52-02	403/404	Aug 15/82	
27-61-00	1	Nov 15/76	
27-61-00	2	Aug 15/82	
27-61-00	3/4	Aug 15/82	
27-61-00	5/6	Nov 15/74	
27-61-00	7/8	Nov 15/78	
27-61-00	9	Mar 15/84	
27-61-00	10	Aug 15/82	
27-61-00	11	May 15/82	
27-61-00	12	Nov 15/87	
27-61-00	13	May 15/82	
27-61-00	14	May 15/85	
27-61-00	15	Nov 15/78	
27-61-00	16	May 15/82	
27-61-00	17	Feb 15/78	
27-61-00	18	May 15/82	
27-61-00	19/20	Feb 15/74	
27-61-00	21	Aug 15/82	
27-61-00	22	May 15/82	
27-61-00	23	May 15/82	
27-61-00	24	May 15/82	
27-61-00	25	Dec 1/71	
27-61-00	26	May 15/82	
27-61-00	27	Feb 15/82	
27-61-00	28	May 15/82	
27-61-00	29	Feb 15/78	
27-61-00	30	May 15/82	
27-61-00	31/32	Feb 15/74	
27-61-00	33	Mar 15/84	
27-61-00	34	Jun 15/92	
27-61-00	35/36	Oct 1/72	
27-61-00	37/38	May 15/75	
27-61-00	39	Jun 15/92	
27-61-00	40	Feb 15/78	
27-61-00	41	Jun 15/92	
27-61-00	42	Feb 15/82	
27-61-00	43	Jun 15/92	
27-61-00	44	Aug 15/78	
27-61-00	45	Jun 15/92	
27-61-00	46	Jun 15/92	
27-61-00	47	Jun 15/92	
27-61-00	48	Jun 15/92	
27-61-00	49/50	May 15/77	
27-61-00	51	Sep 15/80	
27-61-00	52	Feb 15/82	
27-61-00	53	Jun 15/92	
27-61-00	54	Feb 15/82	
27-61-00	101	May 15/90	
27-61-00	102	May 15/90	
27-61-00	103	Mar 15/81	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-61-00	104	Aug 15/82	
27-61-00	105	Mar 15/81	
27-61-00	106	Nov 15/82	
27-61-00	107	May 15/89	
27-61-00	108	Aug 15/81	
27-61-00	109	May 15/86	
27-61-00	110	May 15/86	
27-61-00	111	Mar 15/81	
27-61-00	112	Mar 15/81	
27-61-00	113	Mar 15/81	
27-61-00	114	May 15/86	
27-61-00	115	Mar 15/81	
27-61-00	116	Jul 15/84	
27-61-00	117	May 15/86	
27-61-00	118	Mar 15/81	
27-61-00	119	Mar 15/81	
27-61-00	120	May 15/87	
27-61-00	121	Mar 15/84	
27-61-00	122	Jun 15/94	
27-61-00	123	May 15/86	
27-61-00	124	Nov 15/81	
27-61-00	125/126	Nov 15/81	
27-61-00	127/128	Nov 15/81	
27-61-00	129/130	May 15/85	
27-61-00	131/132	Nov 15/81	
27-61-00	133	May 15/86	
27-61-00	134	May 15/86	
27-61-00	135/136	May 15/86	
27-61-00	201	May 15/86	
27-61-00	202	Nov 15/81	
27-61-00	203	Nov 15/81	
27-61-00	204	May 15/86	
27-61-00	205	Aug 15/82	
27-61-00	206	May 15/86	
27-61-00	207/208	Nov 15/81	
27-61-00	501	May 15/82	
27-61-00	502	May 15/85	
27-61-00	503	May 15/85	
27-61-00	504	Mar 15/91	
27-61-00	505	May 15/85	
27-61-00	506	May 15/85	
27-61-00	507	May 15/85	
27-61-00	508	Nov 15/82	
27-61-00	509	Jul 15/83	
27-61-00	510	Jul 15/83	
27-61-00	511	Jul 15/83	
27-61-00	512	Nov 15/82	
27-61-00	513	Dec 15/92	
27-61-00	514	Mar 15/91	
27-61-00	515	Mar 15/91	
27-61-00	516	Mar 15/91	
27-61-00	517	Mar 15/91	
27-61-00	518	Dec 15/92	
27-61-00	519	Dec 15/92	
27-61-00	520	Dec 15/92	
27-61-00	521	Dec 15/92	
27-61-00	522	Dec 15/92	
27-61-00	523	Dec 15/92	
27-61-00	524	Dec 15/92	
27-61-00	525/526	May 15/88	
27-61-00	527	Dec 15/92	
27-61-00	528	Dec 15/92	
27-61-00	529/530	Nov 15/85	
27-61-00	531	Nov 15/85	
27-61-00	532	Nov 15/85	
27-61-00	533	Dec 15/92	
27-61-00	534	Dec 15/95	
27-61-00	535	Nov 15/88	
27-61-00	536	Nov 15/88	
27-61-00	537/538	May 15/86	
27-61-00	539	Nov 15/88	
27-61-00	540	Nov 15/88	
27-61-00	541/542	May 15/86	
27-61-00	543/544	May 15/86	
27-61-00	545/546	May 15/86	
27-61-00	547/548	May 15/86	
27-61-00	549	Nov 15/88	
27-61-00	550	Nov 15/88	
27-61-00	551	Nov 15/88	
27-61-00	552	Nov 15/88	
27-61-00	553	Dec 15/94	
27-61-00	554	Nov 15/88	
27-61-00	555/556	May 15/88	
27-61-00	557/558	May 15/88	
27-61-00	559	Nov 15/88	
27-61-00	560	Dec 15/92	
27-61-00	561	Dec 15/95	
27-61-00	562	Mar 15/91	
27-61-00	563	Dec 15/94	
27-61-00	564	Nov 15/88	
27-61-00	565/566	May 15/87	
27-61-00	567	Nov 15/88	
27-61-00	568	Nov 15/88	
27-61-00	569	Nov 15/88	
27-61-00	570	Dec 15/95	
27-61-00	571	Nov 15/88	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-61-00	572	Dec 15/95	
27-61-00	573	Dec 15/95	
27-61-00	574	Dec 15/95	
27-61-00	575/576	Dec 15/95	
27-61-01	401	May 15/77	
27-61-01	402	May 15/77	
27-61-01	403/404	Mar 15/80	
27-61-01	405	May 15/75	
27-61-01	406	May 15/75	
27-61-01	407	May 15/89	
27-61-01	408	May 15/89	
27-61-01	409	May 15/89	
27-61-01	410	May 15/89	
27-61-01	411/412	May 15/89	
27-61-06	401	Aug 15/82	
27-61-06	402	Aug 15/82	
27-61-06	403	May 15/73	
27-61-06	404	May 15/77	
27-61-06	405	Aug 15/81	
27-61-06	406	Aug 15/81	
27-61-07	401	Dec 1/72	
27-61-07	402	Jan 15/73	
27-61-07	403/404	Dec 1/72	
27-61-08	401	Nov 15/89	
27-61-08	402	Nov 15/89	
27-61-08	403	Nov 15/89	
27-61-08	404	Nov 15/89	
27-61-08	405	Nov 15/89	
27-61-08	406	Nov 15/89	
27-61-09	401	Dec 1/71	
27-61-09	402	Jan 15/73	
27-61-09	403/404	Jan 15/73	
27-61-12	401	May 15/85	
27-61-12	402	May 15/85	
27-61-12	403/404	May 15/75	
27-61-12	405/406	Nov 15/89	
27-61-12	407	May 15/85	
27-61-12	408	Nov 15/89	
27-61-12	409	Nov 15/89	
27-61-12	410	Nov 15/89	
27-61-12	601	Jul 15/83	
27-61-12	602	Jul 15/83	
27-61-12	603	Aug 15/81	
27-61-12	604	Aug 15/81	
27-61-14	401	Aug 15/82	
27-61-14	402	Aug 15/82	
27-61-14	403	Feb 15/82	
27-61-14	404	Aug 15/82	
27-61-14	405/406	Aug 15/81	
27-61-16	401	Mar 15/84	
27-61-16	402	Mar 15/84	
27-61-16	403	Mar 15/84	
27-61-16	404	May 15/88	
27-61-16	405/406	May 15/88	
27-61-16	407/408	Mar 15/84	
27-61-17	401	Jun 15/92	
27-61-17	402	Jun 15/92	
27-61-17	403	Jun 15/92	
27-61-17	404	Jun 15/92	
27-61-17	405	Dec 15/92	
27-61-17	406	Jun 15/92	
27-61-17	407	Dec 15/92	
27-61-17	408	Jun 15/92	
27-61-17	409	Dec 15/92	
27-61-17	410	Dec 15/92	
27-61-17	411	Dec 15/92	
27-61-17	412	Dec 15/92	
27-61-17	413	Dec 15/92	
27-61-17	414	Dec 15/92	
27-61-17	415/416	Dec 15/92	
27-61-17	417/418	Dec 15/92	
27-61-17	419/420	Dec 15/92	
27-61-17	421/422	Dec 15/92	
27-61-17	423/424	Dec 15/92	
27-61-17	425/426	Dec 15/92	
27-61-17	427/428	Dec 15/92	
27-61-24	401	May 15/85	
27-61-24	402	Feb 15/82	
27-61-24	403	May 15/85	
27-61-24	404	May 15/85	
27-61-24	405	May 15/85	
27-61-24	406	May 15/85	
27-61-24	407	May 15/88	
27-61-24	408	Nov 15/83	
27-61-24	409	Dec 15/91	
27-61-24	410	Nov 15/83	
27-61-24	411/412	Nov 15/83	
27-61-24	413/414	Nov 15/83	
27-61-25	401	Nov 15/89	
27-61-25	402	Jun 15/92	
27-61-25	403	Jun 15/92	
27-61-25	404	Jun 15/92	
27-61-25	405	Jun 15/92	
27-61-25	406	Jun 15/92	
27-61-25	407	Jun 15/92	
27-61-25	408	Jun 15/92	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-61-25	409	Jun 15/92	
27-61-25	410	Jun 15/92	
27-61-26	401	Nov 15/81	
27-61-26	402	Nov 15/81	
27-61-26	403	Nov 15/82	
27-61-26	404	Nov 15/82	
27-61-26	405	May 15/75	
27-61-26	406	May 15/75	
27-61-26	407	Nov 15/81	
27-61-26	408	Nov 15/81	
27-61-26	409/410	May 15/88	
27-61-26	601	Sep 15/79	
27-61-26	602	Sep 15/79	
27-61-28	401	Feb 15/82	
27-61-28	402	Feb 15/82	
27-61-28	403	Feb 15/75	
27-61-28	404	Nov 15/85	
27-61-28	405/406	Nov 15/85	
27-61-28	407	Nov 15/85	
27-61-28	408	Nov 15/85	
27-61-28	601	Sep 15/79	
27-61-28	602	Sep 15/79	
27-61-34	401	Feb 15/82	
27-61-34	402	Feb 15/82	
27-61-34	403	Feb 15/82	
27-61-34	404	Feb 15/82	
27-61-34	405	Feb 15/82	
27-61-34	406	Feb 15/82	
27-61-34	407/408	Feb 15/82	
27-61-34	409/410	Feb 15/79	
27-61-34	411/412	Feb 15/79	
27-61-34	413/414	Feb 15/79	
27-61-36	401	Dec 1/72	
27-61-36	402	Mar 15/80	
27-61-36	403/404	Jan 15/72	
27-61-38	401	Feb 15/82	
27-61-38	402	Jul 15/83	
27-61-38	403	Jun 15/80	
27-61-38	404	Jul 15/83	
27-61-42	401	Jul 15/84	
27-61-42	402	Jul 15/84	
27-61-42	403	Jul 15/84	
27-61-42	404	Jul 15/84	
27-61-42	405/406	Jul 15/84	
27-61-43	401	Jun 15/93	
27-61-43	402	Aug 15/82	
27-61-43	403	May 15/90	
27-61-43	404	Nov 15/89	
27-61-43	405/406	Nov 15/81	
27-61-44	401	May 15/88	
27-61-44	402	May 15/88	
27-61-44	403/404	May 15/88	
27-62-00	1	Sep 15/73	
27-62-00	2	Dec 1/72	
27-62-00	3/4	Nov 15/75	
27-62-00	101	Mar 15/81	
27-62-00	102	Mar 15/81	
27-62-00	103	Mar 15/81	
27-62-00	104	Mar 15/81	
27-62-00	105/106	Aug 15/81	
27-62-01	401	Mar 15/81	
27-62-01	402	Jul 15/83	
27-62-01	403	May 15/73	
27-62-01	404	May 15/86	
27-62-01	405/406	Jul 15/83	
27-81-00	1	Mar 15/91	
27-81-00	2	Dec 1/71	
27-81-00	3	Dec 1/71	
27-81-00	4	Mar 15/91	
27-81-00	5/6	May 15/85	
27-81-00	7	Mar 15/91	
27-81-00	8	Mar 15/83	
27-81-00	9	Nov 15/82	
27-81-00	10	Mar 15/91	
27-81-00	11	Nov 15/82	
27-81-00	12	Mar 15/91	
27-81-00	13/14	Nov 15/82	
27-81-00	15	Nov 15/82	
27-81-00	16	Nov 15/82	
27-81-00	17	Mar 15/91	
27-81-00	18	Mar 15/91	
27-81-00	19	Mar 15/91	
27-81-00	20	Nov 15/82	
27-81-00	21	Nov 15/82	
27-81-00	22	Mar 15/91	
27-81-00	23	Mar 15/91	
27-81-00	24	Nov 15/82	
27-81-00	25	Jul 15/84	
27-81-00	26	Mar 15/91	
27-81-00	27	Nov 15/82	
27-81-00	28	Nov 15/82	
27-81-00	29	Mar 15/91	
27-81-00	30	Mar 15/91	
27-81-00	31	Nov 15/82	
27-81-00	32	Nov 15/82	
27-81-00	33	Mar 15/91	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-81-00	34	Mar 15/91	
27-81-00	35	Mar 15/91	
27-81-00	36	Nov 15/82	
27-81-00	37	Mar 15/91	
27-81-00	38	Mar 15/91	
27-81-00	39/40	Nov 15/82	
27-81-00	101	May 15/86	
27-81-00	102	Nov 15/82	
27-81-00	103	Mar 15/81	
27-81-00	104	Nov 15/82	
27-81-00	105	Mar 15/83	
27-81-00	106	Mar 15/83	
27-81-00	107	Mar 15/83	
27-81-00	108	Mar 15/91	
27-81-00	109	Mar 15/91	
27-81-00	110	Mar 15/91	
27-81-00	111	Mar 15/91	
27-81-00	112	Jul 15/84	
27-81-00	113	Jul 15/84	
27-81-00	114	Jul 15/84	
27-81-00	115	Jul 15/84	
27-81-00	116	Jul 15/84	
27-81-00	117	Jul 15/84	
27-81-00	118	Jul 15/84	
27-81-00	119	Jul 15/84	
27-81-00	120	Jul 15/84	
27-81-00	121/122	Jul 15/83	
27-81-00	123/124	Jul 15/83	
27-81-00	125/126	Jul 15/83	
27-81-00	127/128	Jul 15/83	
27-81-00	129/130	May 15/85	
27-81-00	501	Jun 15/95	
27-81-00	502	Jun 15/95	
27-81-00	503	Jun 15/95	
27-81-00	504	Jul 15/83	
27-81-00	505	May 15/82	
27-81-00	506	May 15/82	
27-81-00	507	Jun 15/95	
27-81-00	508	Jun 15/95	
27-81-00	509	May 15/87	
27-81-00	510	May 15/87	
27-81-00	511	Jun 15/95	
27-81-00	512	Jun 15/95	
27-81-00	513	Jun 15/95	
27-81-00	514	Jun 15/95	
27-81-00	515	Nov 15/88	
27-81-00	516	May 15/87	
27-81-00	517	Jun 15/95	
27-81-00	518	Jun 15/95	
27-81-00	519/520	May 15/82	
27-81-00	521	Jun 15/95	
27-81-00	522	Nov 15/89	
27-81-00	523	Jun 15/95	
27-81-00	524	Nov 15/89	
27-81-00	525	May 15/87	
27-81-00	526	May 15/87	
27-81-00	527/528	Jul 15/84	
27-81-00	529/530	Jul 15/84	
27-81-00	531	Jul 15/83	
27-81-00	532	Jul 15/83	
27-81-00	533	Jun 15/95	
27-81-00	534	Jun 15/95	
27-81-00	535	Jun 15/95	
27-81-00	536	Jun 15/95	
27-81-00	537	Jun 15/95	
27-81-00	538	Jun 15/95	
27-81-00	539	Jun 15/95	
27-81-00	540	Nov 15/89	
27-81-00	541	Jun 15/95	
27-81-00	542	Jun 15/95	
27-81-00	543/544	Jun 15/95	
27-81-00	601	Nov 15/88	
27-81-00	602	Mar 15/83	
27-81-00	603	Mar 15/83	
27-81-00	604	Nov 15/88	
27-81-03	401	May 15/85	
27-81-03	402	Nov 15/89	
27-81-03	403	Nov 15/86	
27-81-03	404	Dec 15/91	
27-81-03	405	Dec 15/91	
27-81-03	406	Nov 15/86	
27-81-03	407	May 15/90	
27-81-03	408	Dec 15/92	
27-81-03	409	Dec 15/92	
27-81-03	410	Dec 15/92	
27-81-03	411	Dec 15/92	
27-81-03	412	Dec 15/92	
27-81-03	413/414	Dec 15/92	
27-81-03	415/416	Dec 15/92	
27-81-03	417/418	Dec 15/92	
27-81-03	601	Nov 15/89	
27-81-03	602	Nov 15/89	
27-81-03	801	Aug 15/75	
27-81-03	802	Aug 15/75	
27-81-03	803	Aug 15/75	
27-81-03	804	May 15/74	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-81-03	805	Aug 15/82	
27-81-03	806	Aug 15/82	
27-81-03	807/808	Aug 15/82	
27-81-04	401	Mar 15/91	
27-81-04	402	Mar 15/91	
27-81-04	403/404	Mar 15/83	
27-81-05	401	May 15/75	
27-81-05	402	Nov 15/73	
27-81-05	403	Nov 15/89	
27-81-05	404	Nov 15/89	
27-81-05	405/406	Nov 15/89	
27-81-06	401	Mar 15/83	
27-81-06	402	Nov 15/89	
27-81-06	403/404	Mar 15/83	
27-81-07	401	Mar 15/83	
27-81-07	402	Mar 15/83	
27-81-07	403/404	Mar 15/83	
27-81-08	401	Mar 15/91	
27-81-08	402	Mar 15/91	
27-81-08	403	Mar 15/91	
27-81-08	404	Jun 15/93	
27-81-08	405/406	Jun 15/93	
27-81-10	401	Mar 15/83	
27-81-10	402	Mar 15/83	
27-81-10	403	Mar 15/83	
27-81-10	404	Mar 15/83	
27-81-11	401	Nov 15/85	
27-81-11	402	Nov 15/85	
27-81-11	403	Nov 15/85	
27-81-11	404	Nov 15/85	
27-81-12	401	Nov 15/85	
27-81-12	402	May 15/85	
27-81-12	403/404	Mar 15/83	
27-81-12	405	Nov 15/85	
27-81-12	406	May 15/87	
27-81-12	407	May 15/87	
27-81-12	408	May 15/87	
27-81-12	409	May 15/87	
27-81-12	410	May 15/87	
27-81-13	401	May 15/87	
27-81-13	402	May 15/85	
27-81-13	403/404	Mar 15/83	
27-81-13	405	May 15/85	
27-81-13	406	May 15/85	
27-81-13	407	May 15/87	
27-81-13	408	May 15/85	
27-81-13	409/410	May 15/87	
27-81-13	601/602	Mar 15/83	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-81-15	401	Nov 15/85	
27-81-15	402	Nov 15/85	
27-81-15	403	Mar 15/83	
27-81-15	404	May 15/87	
27-81-15	405/406	May 15/87	
27-81-16	401	Nov 15/85	
27-81-16	402	May 15/87	
27-81-16	403	May 15/87	
27-81-16	404	Mar 15/83	
27-81-17	401	Nov 15/85	
27-81-17	402	Mar 15/83	
27-81-17	403	Mar 15/83	
27-81-17	404	Mar 15/83	
27-81-17	405	May 15/87	
27-81-17	406	May 15/87	
27-81-17	501	May 15/85	
27-81-17	502	Jul 15/83	
27-81-17	503	Dec 15/93	
27-81-17	504	Dec 15/93	
27-81-17	505	Dec 15/93	
27-81-17	506	Dec 15/93	
27-81-17	507/508	Jul 15/85	
27-81-18	401	May 15/78	
27-81-18	402	May 15/78	
27-81-18	403/404	Apr 1/72	
27-81-18	405	Apr 1/72	
27-81-18	406	May 15/78	
27-81-18	407	May 15/78	
27-81-18	408	May 15/87	
27-81-18	409/410	May 15/87	
27-81-18	601	Mar 15/83	
27-81-18	602	May 15/75	
27-81-21	401	Jun 15/80	
27-81-21	402	Nov 15/81	
27-81-21	403	Nov 15/88	
27-81-21	404	Nov 15/88	
27-81-21	405	Nov 15/88	
27-81-21	406	Nov 15/88	
27-81-21	407/408	Nov 15/83	
27-81-21	601	May 15/87	
27-81-21	602	May 15/89	
27-81-21	603/604	Aug 15/82	
27-81-23	401	May 15/82	
27-81-23	402	Jul 15/84	
27-81-23	403	May 15/82	
27-81-23	404	Jul 15/84	
27-81-23	405	Jul 15/84	
27-81-23	406	Jul 15/84	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-81-23	407	May 15/89	
27-81-23	408	May 15/89	
27-81-23	409	Jul 15/84	
27-81-23	410	Nov 15/86	
27-81-23	411	Jul 15/84	
27-81-23	412	Jul 15/84	
27-81-23	413	Jul 15/84	
27-81-23	414	Nov 15/86	
27-81-23	415	Jul 15/84	
27-81-23	416	Jul 15/84	
27-81-23	417	Jul 15/84	
27-81-23	418	Jul 15/84	
27-81-23	419/420	Mar 15/91	
27-81-23	421/422	Jul 15/84	
27-81-23	423/424	Jul 15/84	
27-81-23	425/426	Jul 15/84	
27-81-23	601	Jul 15/84	
27-81-23	602	Jul 15/84	
27-81-26	401	May 15/82	
27-81-26	402	May 15/82	
27-81-26	403	Jul 15/84	
27-81-26	404	Jul 15/84	
27-81-26	405	Jul 15/84	
27-81-26	406	Jul 15/84	
27-81-26	407	May 15/89	
27-81-26	408	Mar 15/84	
27-81-26	409	Mar 15/84	
27-81-26	410	Jun 15/93	
27-81-26	411	Jun 15/93	
27-81-26	412	Jun 15/93	
27-81-26	413	Jul 15/84	
27-81-26	414	Jul 15/84	
27-81-26	415/416	Mar 15/84	
27-81-26	417/418	Mar 15/84	
27-81-26	419	Mar 15/84	
27-81-26	420	Mar 15/84	
27-81-26	421/422	Jul 15/84	
27-81-26	423/424	Jul 15/84	
27-81-26	601	Jul 15/84	
27-81-26	602	Jul 15/84	
27-81-30	401	Jul 15/84	
27-81-30	402	Jul 15/84	
27-81-30	403	Jul 15/84	
27-81-30	404	Jul 15/84	
27-81-31	401	Jul 15/84	
27-81-31	402	Jul 15/84	
27-81-31	403	Jul 15/84	
27-81-31	404	Jul 15/84	
27-81-32	401	Mar 15/83	
27-81-32	402	Mar 15/83	
27-81-32	403/404	Aug 15/74	
27-81-32	405	Jun 15/93	
27-81-32	406	Nov 15/88	
27-81-33	401	Jul 15/84	
27-81-33	402	Jul 15/84	
27-81-33	403	Jul 15/84	
27-81-33	404	Jul 15/84	
27-81-33	405/406	Aug 15/76	
27-81-36	401	May 15/82	
27-81-36	402	May 15/85	
27-81-36	403	May 15/85	
27-81-36	404	May 15/82	
27-81-37	401	May 15/87	
27-81-37	402	May 15/87	
27-81-37	403	Nov 15/86	
27-81-37	404	Nov 15/86	
27-81-37	405	Nov 15/86	
27-81-37	406	Nov 15/86	
27-81-37	501	Jun 15/93	
27-81-37	502	Nov 15/89	
27-81-37	503	Nov 15/89	
27-81-37	504	Nov 15/89	
27-81-37	505	Nov 15/89	
27-81-37	506	Nov 15/89	
27-81-38	401	Mar 15/83	
27-81-38	402	Dec 15/92	
27-81-38	403	Mar 15/83	
27-81-38	404	Dec 15/92	
27-81-41	401	Mar 15/81	
27-81-41	402	Mar 15/81	
27-81-41	403	Mar 15/81	
27-81-41	404	Mar 15/81	
27-81-42	401	Mar 15/83	
27-81-42	402	Mar 15/83	
27-81-42	403	Nov 15/84	
27-81-42	404	Nov 15/84	
27-81-42	405/406	Nov 15/84	
27-81-44	401	Mar 15/83	
27-81-44	402	Mar 15/83	
27-81-44	403/404	Mar 15/83	
27-81-45	401	Aug 15/76	
27-81-45	402	Aug 15/76	
27-81-45	403/404	Aug 15/76	
27-81-70	201	May 15/87	
27-81-70	202	May 15/87	
27-81-70	203	May 15/87	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE	CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
27-81-70	204	May 15/87					
27-81-70	205/206	May 15/87					
27-82-00	1	Jan 15/73					
27-82-00	2	Aug 15/81					
27-82-00	3/4	Aug 15/81					
27-82-00	101	Mar 15/83					
27-82-00	102	Mar 15/81					
27-82-00	103	Mar 15/81					
27-82-00	104	Mar 15/81					
27-82-00	105	Mar 15/83					
27-82-00	106	Mar 15/81					
27-82-00	107/108	Aug 15/81					
27-82-01	401	Dec 15/92					
27-82-01	402	Feb 15/82					
27-82-01	403	Aug 15/82					
27-82-01	404	Dec 15/92					
27-82-01	405/406	Dec 15/92					
27-82-02	401	Mar 15/83					
27-82-02	402	Aug 15/76					
27-82-02	403/404	Aug 15/76					
27-82-03	401	Mar 15/83					
27-82-03	402	May 15/85					
27-82-03	403	May 15/87					
27-82-03	404	May 15/85					
27-82-03	405/406	Mar 15/83					

CHAPTER 27

FLIGHT CONTROLS

TABLE OF CONTENTS

	Subject	Chapter Section Subject	Page	Effectivity
	INDEX	27-INDEX		
	FIRM Fault Code Cross Reference		1	ALL
	FLIGHT CONTROLS	27-00-00		
	Description and Operation		1	ALL
	NOTE: REF. 22-17-00 FLIGHT CONTROL ELECTRONICS SYSTEM			
	INDICATOR - SURFACE POSITION	27-00-01		
	Maintenance Practices		201	ALL
	Removal/Installation		401	ALL
	Adjustment/Test		501	ALL
C	CONTROL CABLE	27-00-02		
C	Maintenance Practices		201	ALL
CR	CONTROL SURFACES	27-00-03		
CR	Maintenance Practices		201	ALL

Subject	Chapter Section Subject	Page	Effectivity
AILERON AND TRIM	27-10-00		
NOTE: REF. 27-00-00 FOR SURFACE POSITION INDICATOR. REF. 27-17-00 FLIGHT CONTROL ELECTRONICS SYSTEM FOR AILERON SHUTDOWN, ROLL PFCS MONITOR.			
AILERON CONTROL SYSTEM	27-11-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
Maintenance Practices		201	ALL
Adjustment/Test		501	ALL
WHEEL - CAPTAINS/FIRST OFFICERS AILERON CONTROL	27-11-01		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
DEVICE - ROLL DISCONNECT MECHANISM AND LOST MOTION	27-11-03		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
HANDLE - ROLL DISCONNECT	27-11-04		
Maintenance Practices		201	ALL
Removal/Installation		401	ALL
ASSEMBLY - AILERON CONTROL TORQUE LIMITER	27-11-05		
Removal/Installation		401	ALL
SWITCH - TORQUE LIMITER JAM WARNING	27-11-06		
Removal/Installation		401	ALL
LOST MOTION DEVICE	27-11-07		
Removal/Installation		401	ALL
BUNGEE - AILERON TRIM AND FEEL	27-11-11		
Removal/Installation		401	ALL
BELLCRANKS - STACKED	27-11-13		
Approved Repairs		801	ALL
BUNGEE - AILERON INTERCONNECT OVERRIDE	27-11-15		
Removal/Installation		401	ALL
R SERVO CONTROL MODULE - INBOARD AILERON	27-11-17		
Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effectivity
AILERON AND TRIM (CONT)	27-10-00		
SERVO CONTROL MODULE - OUTBOARD AILERON	27-11-19		
Removal/Installation		401	ALL
VALVE - AILERON SERVO SOLENOID SHUTOFF	27-11-20		
Removal/Installation		401	ALL
VALVE - (EHV), LEFT INBOARD AILERON SERVO ELECTROHYDRAULIC SERVO	27-11-21		
Removal/Installation		401	ALL
FILTER ELEMENT - INBOARD AND OUTBOARD AILERON SERVO CONTROL MODULE	27-11-22		
Removal/Installation		401	ALL
ACTUATOR HYDRAULIC - INBOARD AILERON	27-11-23		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL

Subject	Chapter Section Subject	Page	Effectivity
AILERON AND TRIM (CONT)	27-10-00		
ACTUATOR - HYDRAULIC, OUTBOARD AILERON	27-11-24		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
DAMPER - OUTBOARD AILERON CONTROL SURFACE	27-11-26		
Servicing		301	ALL
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
AILERON - INBOARD	27-11-27		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
AILERON - OUTBOARD	27-11-28		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
Approved Repairs		801	ALL
SCISSOR LINKAGE ASSEMBLY - AILERON/SPOILER CABLE	27-11-29		
Removal/Installation		401	ALL
BUNGEE CARTRIDGE - INBOARD AILERON, INBOARD	27-11-31		
Removal/Installation		401	ALL
BUNGEE CARTRIDGE - INBOARD AILERON, OUTBOARD	27-11-32		
Removal/Installation		401	ALL
BEARING - AILERON HINGE	27-11-33		
Removal/Installation		401	ALL
POTENTIOMETER - TORQUE LIMITER POSITION, DFDR	27-11-34		
Removal/Installation		401	ALL
SWITCH - LEFT INBOARD AILERON SERVO PRESSURE	27-11-37		
Removal/Installation		401	ALL
LIMITER SWITCH MECHANISM - AILERON AUTOPILOT	27-11-38		
Removal/Installation		401	ALL
R Adjustment/Test		501	ALL
SWITCH - LIGHT, ROLL DISCONNECT HANDLE	27-11-39		
Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	AILERON AND TRIM (CONT)	27-10-00		
C	AFT AILERON BELLCRANKS -			
C	BEARING HOUSING INSTALLATION	27-11-41		
C	Inspection/Check		601	ALL
	RELIEF VALVE - AILERON SERVO STATIC CAVITY	27-11-42		
	Removal/Installation		401	ALL
	AILERON TRIM CONTROL SYSTEM	27-12-00		
	Description and Operation		1	ALL
R	Adjustment/Test		501	ALL
	TRIM CONTROL - AILERON AND RUDDER	27-12-01		
	Removal/Installation		401	ALL
	ACTUATOR - AILERON TRIM	27-12-05		
	Removal/Installation		401	ALL
	AILERON POSITION INDICATING SYSTEM	27-13-00		
R	Description and Operation		1	ALL
	Fault Isolation		101	ALL
	TRANSMITTER - AILERON SURFACE POSITION (SINGLE)	27-13-01		
	Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	RUDDER AND TRIM	27-20-00		
	NOTE: REF. 27-00-00 FOR SURFACE POSITION INDICATOR.			
	REF. 29-11-00 HYDRAULIC POWER SYSTEM FOR SYSTEM A RUDDER HYDRAULIC FUSING CONTROL AND INDICATION.			
	RUDDER CONTROL SYSTEM	27-21-00		
R	Description and Operation		1	ALL
	Fault Isolation		101	ALL
R	Adjustment/Test		501	ALL
R	PEDAL - RUDDER	27-21-01		
	Removal/Installation		401	ALL
	Inspection/Check		601	ALL
	CRANK - RUDDER PEDAL ADJUSTMENT	27-21-02		
	Maintenance Practices		201	ALL
	Removal/Installation		401	ALL
	SPRING CARTRIDGE ASSEMBLY - RUDDER FEEL	27-21-06		
	Removal/Installation		401	ALL
R	SERVO CONTROL MODULE - RUDDER	27-21-07		
	Removal/Installation		401	ALL
	Adjustment/Test		501	ALL
	VALVE - RUDDER SERVO AND RUDDER DEFLECTION LIMITER SOLENOID SHUTOFF	27-21-08		
	Removal/Installation		401	ALL
	VALVE - RUDDER SERVO ELECTROHYDRAULIC SERVO	27-21-09		
	Removal/Installation		401	ALL
	FILTER ELEMENT - RUDDER SERVO CONTROL MODULE	27-21-10		
	Removal/Installation		401	ALL
	ACTUATOR - RUDDER DUAL TANDEM	27-21-12		
	Removal/Installation		401	ALL
	Adjustment/Test		501	ALL
	DAMPER - RUDDER	27-21-14		
	Maintenance Practices		201	ALL
	Servicing		301	ALL
	Removal/Installation		401	ALL
	Adjustment/Test		501	ALL
	RUDDER	27-21-15		
	Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	RUDDER AND TRIM (CONT)	27-20-00		
	PRESSURE, REGULATOR AND CONTROL MODULE PRESSURE SWITCH - HYDRAULIC	27-21-17		
	Removal/Installation		401	ALL
	LIMITER - RUDDER MECHANICAL	27-21-18		
	Maintenance Practices		201	001-018, 021, 022
	LIMITER - RUDDER MECHANICAL	27-21-18		
CR	Removal/Installation		401	001-017
CR	Adjustment/Test		501	001-017
	SHAFT ASSEMBLY - RUDDER PEDAL ADJUSTMENT	27-21-20		
	Removal/Installation		401	ALL
	BEARING - RUDDER HINGE	27-21-21		
	Removal/Installation		401	ALL
	POTENTIOMETER - RUDDER PEDAL POSITION, DFDR	27-21-22		
	Removal/Installation		401	ALL
	SWITCH - RUDDER AUTOPILOT SERVO PRESSURE	27-21-24		
	Removal/Installation		401	ALL
	SWITCH - RUDDER SERVO PRESSURE (SYSTEMS A AND B)	27-21-25		
	Removal/Installation		401	ALL
	SWITCH - RUDDER SERVO PRESSURE (SYSTEM C)	27-21-26		
	Maintenance Practices		201	ALL
	Removal/Installation		401	ALL
	RELIEF VALVE - RUDDER SERVO STATIC CAVITY	27-21-31		
	Removal/Installation		401	ALL
	RUDDER COUNTERBALANCE WEIGHT	27-21-32		
	Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	RUDDER AND TRIM (CONT)	27-20-00		
R	RUDDER TRIM CONTROL SYSTEM	27-22-00		
R	Description and Operation		1	ALL
	Adjustment/Test		501	ALL
R	CABLE DRUM ASSEMBLY - RUDDER TRIM	27-22-02		
	Removal/Installation		401	ALL
	ACTUATOR - RUDDER TRIM	27-22-04		
	Removal/Installation		401	ALL
	NOTE: TRIM CONTROL - AILERON AND RUDDER (REF. 27-12-01)			
	RUDDER POSITION INDICATING SYSTEM	27-23-00		
R	Description and Operation		1	ALL
	Fault Isolation		101	ALL
	TRANSMITTER - RUDDER SURFACE POSITION (SINGLE)	27-23-01		
	Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	ELEVATOR AND TRIM	27-30-00		
	NOTE: REF. 22-17-00 FLIGHT CONTROL ELECTRONICS SYSTEM FOR STALL WARNING SYSTEMS 1 AND 2.			
	REF. 22-18-00 TRIM AUGMENTATION SYSTEM FOR PITCH TRIM SYSTEMS 1 AND 2 - CONTROL AND ANNUNCIATION, SIGNAL FLOW, OUTPUT POWER.			
	ELEVATOR CONTROL SYSTEM	27-31-00		
	Description and Operation		1	ALL
	Fault Isolation		101	001-031 WITH SB27-174 AND 032-999
R				
R	Adjustment/Test		501	ALL
	Inspection/Check		601	ALL
	ELEVATOR	27-31-03		
	Removal/Installation		401	ALL
	WEIGHTS, COUNTERBALANCE - DEPLETED URANIUM ELEVATOR	27-31-04		
	Removal/Installation		401	ALL
	BEARING - ELEVATOR HINGE	27-31-06		
	Removal/Installation		401	ALL
	DAMPER - ELEVATOR SURFACE	27-31-07		
	Servicing		301	026-999
R	Removal/Installation	27-31-07	401	026-999
R	Adjustment/Test	27-31-07	501	ALL
	QUADRANT - ELEVATOR AFT CABLE	27-31-10		
	Removal/Installation		401	ALL
	Inspection/Check		601	ALL
R	CABLE TIE-ROD ASSEMBLY - ELEVATOR			
R	DRIVE SYSTEM	27-31-11		
	Maintenance Practices		201	ALL
	CABLE TIE-ROD ASSEMBLY - ELEVATOR CONTROL SYSTEM	27-31-11		
	Removal/Installation		401	001-031 WITH SB27-174 AND 032-999

Subject	Chapter Section Subject	Page	Effectivity
Adjustment/Test		501	001-031 WITH SB27-174 AND 032-999
Inspection/Check		601	001-031 WITH SB27-174 AND 032-999
CABLE BREAK DETECTOR - ELEVATOR DRIVE	27-31-12		
Removal/Installation		401	001-031 WITH SB27-174 AND 032-999
WARNING SYSTEM DEACTIVATION - ELEVATOR JAM	27-31-13		
Maintenance Practices		201	ALL

Subject	Chapter Section Subject	Page	Effectivity
HORIZONTAL STABILIZER	27-40-00		
HORIZONTAL STABILIZER CONTROL SYSTEM	27-41-00		
Description and Operation		1	ALL

NOTE: REF. 22-00-00 FOR SURFACE POSITION INDICATOR.

REF. 22-17-00 FLIGHT CONTROL ELECTRONICS SYSTEM FOR PITCH AFT COUPLER SHUTDOWN, STABILIZER PFCS MONITOR, AND STABILIZER SHUTDOWN.

REF. 22-18-00 TRIM AUGMENTATION SYSTEM FOR PITCH TRIM.

NOTE: SERVO VALVE - ELECTRO-HYDRAULIC,

AUTOPILOT SERVO (REF. 22-11-08)

Fault Isolation	27-41-00	101	ALL
Adjustment/Test	27-41-00	501	ALL
Inspection/Check	27-41-00	601	ALL
COLUMN - CONTROL	27-41-01		
Removal/Installation		401	ALL
DISCONNECT MECHANISM - PITCH	27-41-03		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
BUNGEE - PITCH CONTROL OVERRIDE	27-41-06		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
REGULATOR - CABLE TENSION	27-41-09		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
COUPLER - AFT PITCH	27-41-12		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
ACTUATOR - AFT PITCH COUPLER	27-41-13		
Removal/Installation		401	ALL
R SERVO CONTROL - AUTOPILOT, STABILIZER (Ref. 22-11-05)			

	Subject	Chapter Section Subject	Page	Effectivity
	HORIZONTAL STABILIZER (CONT)	27-40-00		
	FEEL/TRIM ASSEMBLY - ELECTRICAL PITCH	27-41-16		
R	Removal/Installation		401	ALL
	NOTE: (REF. 22-11-00)			
	FEEL/TRIM ASSEMBLY - MECHANICAL PITCH	27-41-17		
R	Removal/Installation		401	ALL
	POWER SERVO - HORIZONTAL STABILIZER	27-41-20		
	Removal/Installation		401	ALL
	Approved Repairs		801	ALL
	FILTER ELEMENT - STABILIZER POWER SERVO	27-41-21		
	Removal/Installation		401	ALL
	VALVE - STABILIZER SERVO SOLENOID SHUTOFF	27-41-22		
	Removal/Installation		401	ALL
	SERVO VALVE - ELECTRO-HYDRAULIC, AUTOPILOT SERVO	27-41-23		
	NOTE: (REF. 22-11-08)			
	CROSS-TIE INTERLOCK BUNGEE, STABILIZER SERVO	27-41-24		
	Removal/Installation		401	ALL
	ACTUATOR - HORIZONTAL HYDRAULIC STABILIZER	27-41-28		
	Removal/Installation		401	ALL
	DAMPER - CONTROL COLUMN ROTARY	27-41-31		
	Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	HORIZONTAL STABILIZER (CONT)	27-40-00		
	DETECTOR - BREAKAGE, PITCH CONTROL CABLE	27-41-32		
	Removal/Installation		401	ALL
	Adjustment/Test		501	ALL
	POTENTIOMETER - CONTROL COLUMN POSITION DFDR	27-41-33		
	Removal/Installation		401	ALL
	HANDLE - PITCH DISCONNECT	27-41-35		
	Maintenance Practices		201	ALL
	Removal/Installation		401	ALL
	SWITCH - LIGHT, PITCH DISCONNECT HANDLE	27-41-38		
	Removal/Installation		401	ALL
	VALVE - STABILIZER POWER SERVO BYPASS AND SHUTOFF	27-41-39		
	Removal/Installation		401	ALL
	SWITCH - PITCH AFT COUPLER JAM SENSING	27-41-40		
	Removal/Installation		401	ALL
	SWITCH - DETECTOR, CABLE BREAKAGE, PITCH CONTROL	27-41-41		
	Removal/Installation		401	ALL
	VALVE - RELIEF, STABILIZER SERVO STATIC CAVITY	27-41-42		
	Removal/Installation		401	ALL
	SWITCH ASSEMBLY - PITCH AFT COUPLER OPEN	27-41-43		
R	Removal/Installation		401	ALL
R	PITCH CONTROL SERIES TRIM TORQUE			
R	TUBE ASSEMBLY	27-41-44		
R	Removal/Installation		401	ALL
R	CONTROL COLUMN SUPPORT BEARING	27-41-45		
R	Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effectivity
HORIZONTAL STABILIZER (CONT)	27-40-00		
HORIZONTAL STABILIZER TRIM CONTROL	27-42-00		
Description and Operation		1	ALL
Maintenance Practices		201	ALL
Adjustment/Test		501	ALL
CONTROL - PITCH TRIM (CAPTAINS)	27-42-01		
Removal/Installation		401	ALL
CONTROL - PITCH TRIM (FIRST OFFICERS)	27-42-03		
Removal/Installation		401	ALL
CABLE DRUM - FORWARD, PITCH TRIM	27-42-05		
Removal/Installation		401	ALL
CABLE DRUM ASSEMBLY - AFT, PITCH TRIM	27-42-07		
Removal/Installation		401	ALL
PITCH TRIM CONTROL WHEEL EDGE LIGHTED PANEL	27-42-12		
Removal/Installation		401	ALL
RIGHT FEEL UNIT BELLCRANK	27-42-13		
Removal/Installation		401	ALL
HORIZONTAL STABILIZER POSITION INDICATING SYSTEM	27-43-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
TRANSMITTER - STABILIZER SURFACE POSITION (SINGLE)	27-43-01		
Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	FLAPS	27-50-00		
	FLAP CONTROL SYSTEM	27-51-00		
R	Description and Operation		1	ALL
	Fault Isolation		101	ALL
R	Adjustment/Test		501	ALL
	Inspection/Check		601	ALL

Subject	Chapter Section Subject	Page	Effectivity
FLAPS (CONT)	27-50-00		
BREAK DETECTOR - FLAP AND SLAT CONTROL SYSTEM CABLE	27-51-04		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
COMPUTER - LOAD RELIEVING SYSTEM	27-51-06		
Adjustment/Test		501	CONFIG 1 AIRCRAFT WITH TWO ANALOG OR ONE ANALOG AND ONE DIGITAL AIR DATA COMPUTER
Adjustment/Test		501	CONFIG 2 AIRCRAFT WITH TWO DIGITAL AIR DATA COM-PUTERS
ACTUATOR - FLAP LOAD RELIEVING SYSTEM	27-51-07		
Removal/Installation		401	ALL
DRIVE UNIT - FLAP POWER	27-51-08		
Removal/Installation		401	ALL
VALVE - SOLENOID SHUTOFF, FLAP PDU	27-51-10		
Removal/Installation		401	ALL
BRAKE - FLAP PDU	27-51-11		
Removal/Installation		401	ALL
SWITCHBOX - LIMIT SWITCH, FLAP PDU	27-51-12		
Removal/Installation		401	ALL
MOTOR - HYDRAULIC, FLAP PDU	27-51-14		
Removal and Installation		401	ALL
FILTER ELEMENT - POWER DRIVE UNIT (PDU)	27-51-15		
Removal/Installation		401	ALL
GEARBOX - 90-DEGREE ANGLE	27-51-17		
Removal/Installation		401	ALL
GEARBOX - FLAP FORWARD FUSELAGE	27-51-19		
Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effectivity
FLAPS (CONT)	27-50-00		
TORQUE SHAFT - FLAP	27-51-22		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
GEARBOX - FLAP DRIVE	27-51-25		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
ACTUATOR - FLAP CARRIAGE BALLSCREW	27-51-26		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
YOKE ASSEMBLY - FLAP	27-51-30		
Removal/Installation		401	ALL
REAR MOUNT - FLAP BALLSCREW	27-51-34		
Removal/Installation		401	ALL
FLAP - WING	27-51-35		
Removal/Installation		401	ALL
TRACKS - FLAP, TORQUE BOX MOUNTED	27-51-39		
Removal/Installation		401	ALL
TRACKS - FLAP, FLAP MOUNTED	27-51-40		
Removal/Installation		401	ALL
CARRIAGE - FLAP SWING LINK	27-51-41		
Removal/Installation		401	ALL
VANE - FLAP	27-51-42		
Removal/Installation		401	ALL
TRACKS - FLAP VANE	27-51-46		
Removal/Installation		401	ALL
CARRIAGE - ASSEMBLY - FLAP VANE	27-51-47		
Removal/Installation		401	ALL
ACTUATOR - FLAP VANE	27-51-48		
Removal/Installation		401	ALL
Approved Repairs		801	ALL
COMPARATOR - FLAP ASYMMETRY	27-51-49		
Removal/Installation		401	ALL
BRAKE - FLAP ASYMMETRY	27-51-50		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
TRANSDUCER - ROTARY, FLAP ASYMMETRY	27-51-51		
Removal/Installation		401	ALL
SWITCHES - FLAP LEVER ACTUATED	27-51-55		
Adjustment Test		501	ALL

Subject	Chapter Section Subject	Page	Effectivity
FLAPS (CONT)	27-50-00		
COMPARATOR - DIVERGENCE, FLAP PDU	27-51-58		
Removal/Installation		401	ALL
QUADRANT-ASSEMBLY, FLAP/SLAT PROGRAMMER	27-51-59		
Removal/Installation		401	ALL
SWITCH - CABLE BREAKAGE FLAP AND SLAT CONTROL	27-51-60		
Removal/Installation		401	ALL
VALVE - RELIEF, POWER DRIVE UNIT	27-51-63		
Removal/Installation		401	ALL
START-UP SWITCH ASSEMBLY - FLAP PDU	27-51-64		
Removal/Installation		401	ALL
ACTUATOR - BALLSCREW, FLAP CARRIAGE FRONT MOUNT	27-51-66		
Removal/Installation		401	ALL
FE/SO ANNUNCIATOR PANEL FLAP/SLAT LOCK LIGHT	27-51-70		
Maintenance Practices		201	ALL
TRAILING EDGE FLAP POSITION INDICATING SYSTEM	27-52-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
TRAILING EDGE FLAP POSITION INDICATING SYSTEM	27-52-00		
Maintenance Practices		201	ALL
TRANSMITTER - FLAP POSITION	27-52-01		
Removal/Installation		401	ALL
INDICATOR - FLAP POSITION	27-52-02		
Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effec-tivity
SPOILER, DRAG DEVICES AND VARIABLE AERODYNAMIC FAIRINGS	27-60-00		
NOTE: REF. 27-00-00 FOR SURFACE POSITION INDICATOR. REF. 22-17-00 FLIGHT CONTROL ELECTRONICS SYSTEM FOR AUTOMATIC GROUND SPEED BRAKE SYSTEMS 1 AND 2; DIRECT LIFT SYSTEMS 1 AND 2 - ENGAGE AND CONTROL AND SIGNAL FLOW; AND SPOILER SHUTDOWN CONTROL AND ANNUNCIATION.			
SPOILER AND SPEEDBRAKE CONTROL SYSTEM	27-61-00		
Description and Operation		1	ALL

Subject	Chapter Section Subject	Page	Effectivity
SPOILER, DRAG DEVICES AND VARIABLE AERODYNAMIC FAIRINGS (CONT)	27-60-00		
SPOILER AND SPEEDBRAKE CONTROL SYSTEM (CONT)	27-61-00		
Fault Isolation		101	ALL
Maintenance Practices		201	ALL
Adjustment/Test		501	ALL
CONTROL LEVER - SPEEDBRAKE	27-61-01		
Removal/Installation		401	ALL
SERVO - DIRECT LIFT CONTROL (DLC)	27-61-06		
Removal/Installation		401	ALL
VALVE - DIRECT LIFT CONTROL SERVO ELECTROHYDRAULIC SERVO	27-61-07		
Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effectivity
SPOILER DRAG DEVICES AND VARIABLE AERODYNAMIC FAIRINGS (CONT)	27-60-00		
VALVE - DIRECT LIFT CONTROL SERVO AND SPOILER CONTROL SERVO SOLENOID SHUTOFF	27-61-08		
Removal/Installation		401	ALL
FILTER ELEMENT - DIRECT LIFT CONTROL SERVO	27-61-09		
Removal/Installation		401	ALL
MIXER - SPOILER	27-61-12		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
BUNGEE - OVERRIDE, NO. 1 SPOILER	27-61-14		
Removal/Installation		401	ALL
SPOILER SCISSOR LINKAGE	27-61-16		
Removal/Installation		401	ALL
CONTROL - SPOILER SERVO	27-61-17		
Removal/Installation		401	ALL
SELECTOR - OUTBOARD SPOILERS CONTROL	27-61-24		
Removal/Installation		401	ALL
ACTUATOR - ELECTRICAL, SELECTOR AND MIXER DWELL	27-61-25		
Removal/Installation		401	ALL
SPOILERS - INBOARD, PANELS 1 AND 2	27-61-26		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
SPOILERS - OUTBOARD, PANELS 3, 4, 5, AND 6	27-61-28		
Removal/Installation		401	ALL
Inspection/Check		601	ALL
CABLE - CONTROLEX, NO. 1 SPOILER	27-61-34		
Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effectivity
SPOILER, DRAG DEVICES AND VARIABLE AERODYNAMIC FAIRINGS (CONT)	27-60-00		
SWITCH - DIRECT LIFT CONTROL (DLC) SERVO PRESSURE	27-61-36		
Removal/Installation		401	ALL
SWITCH - SERVO PRESSURE NO. 1 SPOILER	27-61-38		
Removal/Installation		401	ALL
SPOILER SERVO FILTER	27-61-42		
Removal/Installation		401	ALL
SPOILER MIXER BUNGEE CARTRIDGE	27-61-43		
Removal/Installation		401	ALL
DLC SERVO OVERRIDE BUNGEE ASSEMBLY	27-61-44		
Removal/Installation		401	ALL
SPOILER POSITION INDICATING SYSTEM	27-62-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
TRANSMITTER - SPOILER SURFACE POSITION (SINGLE)	27-62-01		
Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	LIFT AUGMENTATION	27-80-00		
	WING LEADING EDGE SLAT CONTROL SYSTEM	27-81-00		
	Description and Operation		1	ALL
	Fault/Isolation		101	ALL
	Adjustment/Test		501	ALL
	Inspection and Check		601	ALL
R	DRIVE UNIT - SLAT POWER	27-81-03		
	Removal/Installation		401	ALL
	Inspection/Check		601	ALL
	Approved Repairs		801	ALL
	VALVE - FLOW LIMITER, SLAT PDU	27-81-04		
	Removal/Installation		401	ALL
	VALVE - SHUTOFF, SLAT PDU SOLENOID	27-81-05		
	Removal/Installation		401	ALL
	VALVE - FREE WHEEL, SLAT PDU	27-81-06		
	Removal/Installation		401	ALL
	VALVE - BRAKE, SLAT PDU	27-81-07		
	Removal/Installation		401	ALL

	Subject	Chapter Section Subject	Page	Effectivity
	LIFT AUGMENTATION (CONT)	27-80-00		
	PACK - SWITCH, SLAT PDU POSITION INDICATOR	27-81-08		
R	Removal/Installation		401	ALL
	HYDRAULIC MOTOR - SLAT PDU	27-81-10		
	Removal/Installation		401	ALL
	FILTER ELEMENT - SLAT PDU	27-81-11		
	Removal/Installation		401	ALL
	GEARBOX - ANGLE - SLAT	27-81-12		
	Removal/Installation		401	ALL
	TUBE - TORQUE, SLAT DRIVE FUSELAGE	27-81-13		
	Removal/Installation		401	ALL
	Inspection/Check		601	ALL
	BEARING AND HANGER ASSEMBLY - SLAT DRIVE TORQUE TUBE	27-81-15		
	Removal/Installation		401	ALL
	SHOCK ABSORBER - SLAT DRIVE TORSIONAL	27-81-16		
	Removal/Installation		401	ALL
	BRAKE - SLAT TORQUE-LIMITING	27-81-17		
	Removal/Installation		401	ALL
	Adjustment/Test		501	ALL
	TORQUE TUBE - SLAT DRIVE WING	27-81-18		
	Removal/Installation		401	ALL
	Inspection/Check		601	ALL
	ACTUATOR - SLAT BALLSCREW	27-81-21		
	Removal/Installation		401	ALL
	Inspection/Check		601	ALL
	SLATS - INBOARD	27-81-23		
	Removal/Installation		401	ALL
	Inspection/Check		601	001-031 WITHOUT SB57-112

Subject	Chapter Section Subject	Page	Effectivity
LIFT AUGMENTATION (CONT)	27-80-00		
SLATS - OUTBOARD	27-81-26		
Removal/Installation		401	ALL
Inspection/Check		601	001-031 WITHOUT SB57-112
TRACK - INBOARD SLAT	27-81-30		
Removal/Installation		401	ALL
TRACK - OUTBOARD SLAT	27-81-31		
Removal/Installation		401	ALL
ROLLERS - MAIN, SLAT TRACK UPPER AND LOWER	27-81-32		
Removal/Installation		401	ALL
ROLLERS - SIDE, SLAT TRACK	27-81-33		
Removal/Installation		401	ALL
COMPARATOR - SLAT ASYMMETRY	27-81-36		
Removal/Installation		401	ALL
BRAKE - SLAT ASYMMETRY	27-81-37		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
TRANSDUCER - ROTARY, SLAT ASYMMETRY	27-81-38		
Removal/Installation		401	ALL
VALVE - ISOLATION, HYDRAULIC SYSTEM C, SLAT PDU	27-81-41		
Removal/Installation		401	ALL
START-UP SWITCH - SLAT CONTROL	27-81-42		
Removal/Installation		401	ALL
VALVE - SHUTOFF AND RESTRICTING, SLAT PDU	27-81-44		
Removal/Installation		401	ALL
RELAY - ISOLATION VALVE, SLAT PDU HYDRAULIC SYSTEM	27-81-45		
Removal/Installation		401	ALL
FE/SO ANNUNCIATOR PANEL FLAP/SLAT LOCK LIGHT	27-81-70		
Maintenance Practices		201	ALL

	Subject	Chapter Section Subject	Page	Effec-tivity
	LIFT AUGMENTATION (CONT)	27-80-00		
	LEADING EDGE SLAT POSITION INDICATING SYSTEM	27-82-00		
	Description and Operation		1	ALL
	Fault Isolation		101	ALL
R	TRANSMITTER - SLAT POSITION	27-82-01		
	Removal/Installation		401	ALL
	POSITION INDICATOR	27-82-02		
	Removal/Installation		401	ALL
	SENSOR - SLAT PROXIMITY SWITCH	27-82-03		
	Removal/Installation		401	ALL

CHAPTER 27-FLIGHT CONTROLS

TABLE OF CONTENTS

	Subject	Chapter/ Section Subject	Page
	FAULT CODE DIAGRAMS		1
	FAULT CODE INDEX		1
	AILERON CONTROL SYSTEM	27-11-00	
	General		101
	Fault Isolation/Identification		101
	Component Locator Index		103
	Component Locator Diagram		104
	PFCS ROLL MONITOR Switchlight Indicates FAIL		107
	Aileron Switchlight Crosshatch Legend on; Spoiler Switchlight PUSH Legends May Be On		108
R	Aileron Control Wheels Stiff or Notchy		109
	Outboard Ailerons Inoperative, Inboard Ok		111
	Aileron Controls Do Not Center		112
	Aileron Trim Stiff or Notchy		114
	FLT CONT PANELS Light On, Everything Else Normal		115
	Aileron Trim Excessive		116
	AILERON POSITION INDICATING SYSTEM	27-13-00	
	General		101
	Fault Isolation/Identification		101
	Component Locator Index		102
	Component Locator Diagram		103
R	Aileron Position Indicating System Malfunction		104
	Aileron Position Indicating System Schematic		105/106

Subject	Chapter/ Section Subject	Page
RUDDER CONTROL SYSTEM	27-21-00	
General		101
Fault Isolation/Identification		101
Rudder Control System Component Location Index		103
Rudder Control System Component Locators		105
RUDDER HYDR LMTR Annunciator Light On		111
Rudder Trim Excessive		121
Rudder Pedal Operation Stiff or Notchy		122
Rudder Pedals Do Not Center		123
Yaw Trim Wheel Operation Stiff or Notchy		124
Rudder Pedal Adjustment Crank Operation is Stiff or Chatters		125
RUDDER LIMITER HYDRAULIC PUSH Light On Dimly		126
RUDDER MECH LMTR and RUDDER HYDR LMTR Annunciator Lights On		127
RUDDER MECH LMTR Annunciator Light On		128
RUDDER HYDR LMTR Annunciator Light On, RUDDER LIMITER Panel HYDRAULIC PUSH Light Out		130
Rudder Limiting Electrical Schematic		131/132
Rudder Hydraulic Limiter Fault Monitoring Simplified Schematic		155
Rudder Servo Simplified Schematic		157/158
RUDDER POSITION INDICATING SYSTEM	27-23-00	
General		101
Fault Isolation/Identification		101
Rudder Position Indicating System Component Location Index		102
Rudder Position Indicating System Component Locators		103
Rudder Position Indicator Inoperative		104
Rudder Position Indicating System Electrical Schematic		105/106
ELEVATOR CONTROL SYSTEM	27-31-00	
General		101
Fault Isolation/Identification		101
Component Locator Index		102
Component Locator Diagram		103
Elevator Light and Unsafe Takeoff Horn On		104

Subject	Chapter/ Section Subject	Page
HORIZONTAL STABILIZER CONTROL SYSTEM	27-41-00	
General		101
Supplemental Data - Excessive On The Ground Airframe Oscillations or Thumping		101
Fault Isolation/Identification		103
Component Locator Index		104
Component Locator Diagram		105
Stabilizer Switchlight (A, B, C, D) On PFCS Panel Indicates INOP		107
R Pitch Monitor Switchlight on PFCS Panel		
R Indicates FAIL		108
Pitch Manual Trim Wheel Operation Stiff or Notchy		110
Stabilizer Does Not Respond to Manual Pitch Trim Inputs		112
Stabilizer Switchlight on PFCS Panel Indicate PUSH		113
Control Column Operation Stiff or Notchy		114
Stabilizer Switchlight INOP Light (A, B, C, D) On PFCS Panel Is Out With Associated Hydraulic System Off		116
PULL PITCH DISC or AFT CPLR OPEN Legend Fault		117/118
Stabilizer Shutdown Control and Annunciation Electrical Schematic		119/120
Stabilizer PFCS Monitor Control Electrical Schematic		121/122
Stabilizer Aft Coupler Control Electrical Schematic		123/124
HORIZONTAL STABILIZER POSITION INDICATING SYSTEM	27-43-00	
General		101
Fault Isolation/Identification		101
Component Locator Index		102
Component Locators Diagram		103
Stabilizer Position Indication Inoperative		104
Stabilizer Position Indicating System Electrical Schematic		105/106

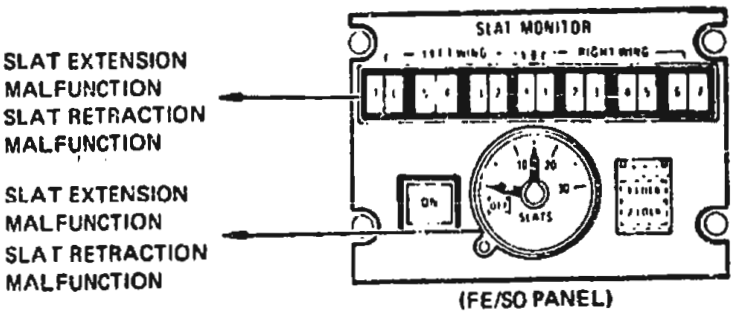
Subject	Chapter/ Section Subject	Page
TRAILING EDGE FLAP SYSTEM	27-51-00	
General		101
Fault Isolation/Identification		101
Flap Control System Component Locator Index		103
Flap Control System Component Locator		104
FLAP/SLAT Lock Light (FE/SO Annunciator Panel) On		108
FLAP ASYM DET FAULT Light (FE/SO Annunciator Panel) On		109
Flaps Inoperative, FLAP/SLAT LOCK Light (FE/SO Annunciator Panel) Off		111
R Jam or Binding in Flap Drive System		112
Flap PDU Inoperative on One Hydraulic System OK on Other		114
Flap Handle Force Excessive		115
Asymmetry Brake Tripped		116
LRS INOP Light (Center Console FLAP LRS OVRD Switchlight) On		117
FLAP LRS INOP Light (Pilots Annunciator) and LRS INOP Light (Center Console FLAP LRS OVRD Switchlight) On		118
Flaps Will Not Fully Retract		120
Flap Lever and Throttle Switches Electrical Schematic		121
Flap PDU Control Schematic		123/124
Flap Asymmetry System Electrical Schematic		125/126
Flap Load Relieving System (LRS) Electrical Schematic (Normal System Operation)		127/128
Flap Load Relieving System (LRS) Electrical Schematic (Fault Monitoring)		129/130
TRAILING EDGE FLAP POSITION INDICATING SYSTEM	27-52-00	
General		101
Fault Isolation/Identification		101
Flap Position Indicating System Location Index		102
Flap Position Indicating System Locator Diagram		103
Flap Position Indicating System Malfunction		104
Trailing Edge Flap Position Indicating System Electrical Schematic		105/106

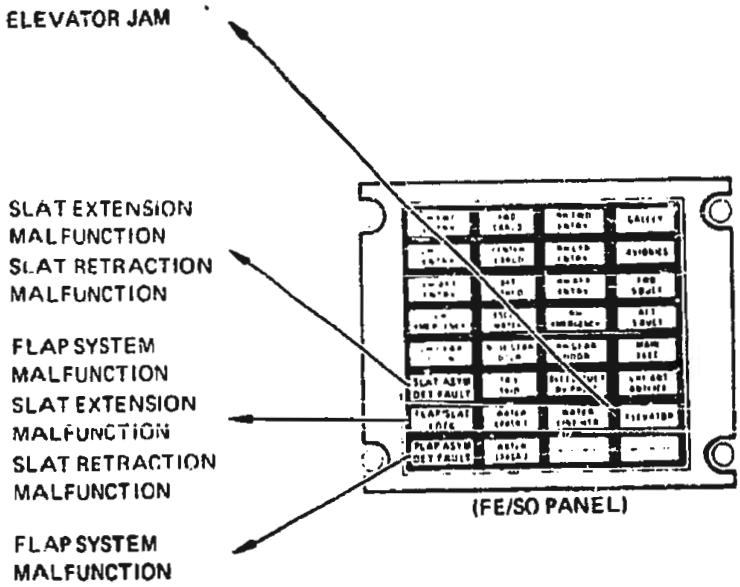
Subject	Chapter/ Section Subject	Page
SPOILER AND SPEEDBRAKE CONTROL SYSTEM	27-61-00	
General		101
Fault Isolation/Identification		101
Component Locator Index		103
Component Locator Diagram		104
R SPOILER 1 FAULT Light on FCAU On		107
MIXER FAULT Light on FCAU On		109
ROLL SPEED BRAKE Light (Pilots Annunciator Panel) and SPOILER L5 and 6 and R5 and 6 PUSH Light (PFCS Panel) On		110
Speedbrake Control Lever Operation Stiff or Notchy		111
One or More Spoilers Do Not Operate		112
DLC Servo Malfunction		113
ROLL SPEED BRAKE Legend On Pilots Annunciator Panel On		114
Spoiler Float in Flight		115
Spoiler Switchlight PUSH Legends On		116
Spoiler Does Not Fully Retract on Ground With Speedbrake Lever Full Forward		117
Spoiler Vibrates in Flight With Flaps at 10 Degrees		118
Speedbrake Lever Does Not Fully Stow After a DLC/AGS Landing		119
One or More Spoilers Do Not Fully Deploy		120
Spoiler Fault Monitoring Trouble Shooting Guide		124
Spoiler Servo Control Electrical Schematic		125/126
Spoiler Fault Monitoring Electrical Schematic		129/130
Spoiler Mixer and Selector Control Electrical Schematic		131/132
SPOILER SURFACE POSITION INDICATING SYSTEM	27-62-00	
General		101
Fault Isolation/Identification		101
Component Locator Index		102
Component Locator Diagram		103
Spoiler Position Indicating System Malfunction		104
Spoiler Position Indicating System Electrical Schematic		105/106

	Subject	Chapter/ Section Subject	Page
	SLAT CONTROL SYSTEM	27-81-00	
	General		101
	Fault Isolation/Identification		101
	Slat Control System Component Location Index		103
	Slat System Component Locator		104
	Slats Inoperative, FLAP/SLAT LOCK Light On (FE/SO Annunciator Panel)		107
R	SLAT ASYM DET FAULT Light On (FE/SO		
R	Annunciator Panel)		108
R	Slats Inoperative, FLAP/SLAT LOCK Light Off		110
R	PDU Inoperative On One Hydraulic System, OK		
R	On Other		111
	Jam or Binding In Slat Drive System		112
	Jam or Binding in Slat Drive System		113
	Asymmetry Brake Tripped		114
	FLAP/SLAT LOCK Light On - Slats Operative		115
	SLAT MONITOR Panel Slat Extend (Segment) Light(s) Does Not Come ON		116
	Slat Extend (Segment) Light on Slat Monitor Panel Stays On		118
	Slats Operate Slowly or Will Not Extend in Flight, OK on Ground		119
	Slats Operate Slowly or Will Not Extend in Flight, or on Ground		120
	LE Slat Control System Electrical Schematic		121/122
	LE Slat Asymmetry System Electrical Schematic		125/126
	Position Monitoring (Proximity) System Electrical Schematic		127/128
	LEADING EDGE SLAT POSITION INDICATING SYSTEM	27-82-00	
	General		101
	Fault Isolation/Identification		101
	Slat Position Indicating System Location Index		102
	Slat Position Indicating System Locator Diagram		103
	LE TRANS Light On Flap Position Indicator Does Not Come On		104
	LE EXT Light on Flap Position Indicator Does Not Come On		105
	Slat Position Indicating System Malfunction		106

Subject	Chapter/ Section Subject	Page
LEADING EDGE SLAT POSITION INDICATING SYSTEM (CONT)	27-82-00	
LE Slat Position Indicating System Electrical Schematic		107/108

FLIGHT CONTROL CONTENTS

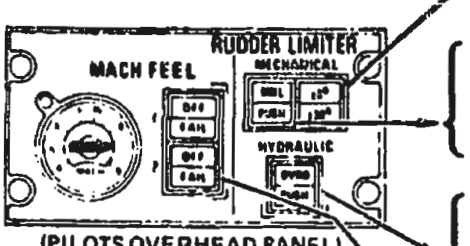




TITLE	CHAP/SEC
ELEVATOR JAM	2731
FLAP SYSTEM MALFUNCTION	2751
SLAT EXTENSION MALFUNCTION	2781
SLAT RETRACTION MALFUNCTION	2781

M1-0000-27-6026

FLIGHT CONTROLS CONTENTS



RUDDER MECHANICAL LIMITER

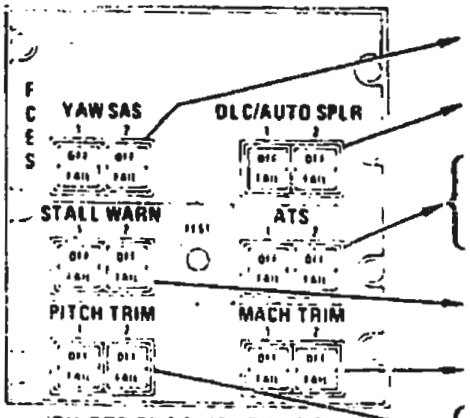
RUDDER MECHANICAL LIMITER

ABNORMAL RUDDER OPERATION

RUDDER HYDRAULIC LIMITER

ABNORMAL RUDDER OPERATION

MACH TRIM/FEEL AUTOFLIGHT



YAW SAS FAIL AUTOFLIGHT

DLC AUTOFLIGHT

ATS FAIL AUTOFLIGHT

AUTOFLIGHT

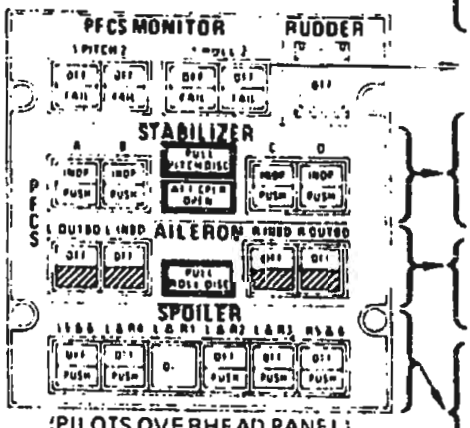
STALL WARN FAIL AUTOFLIGHT

MACH TRIM FAIL AUTOFLIGHT

PITCH TRIM FAIL AUTOFLIGHT

AUTOFLIGHT

AUTOFLIGHT



PITCH/ROLL MONITOR FAIL LEGEND

PITCH AXIS JAM OR OPEN

STABILIZER INOP LIGHT(S)

ROLL AXIS JAM

ABNORMAL ROLL CONTROL

ROLL AXIS JAM

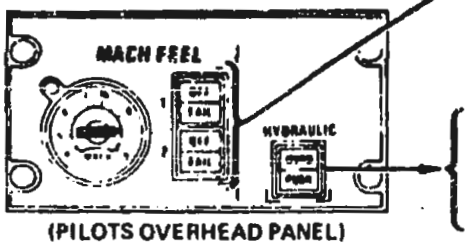
ROLL SPEED BRAKE ANN/ SPOILERS L5 & 6, R5 & 6 SWITCHLIGHT PUSH LEGENDS

TITLE	CHAP/SEC
ABNORMAL ROLL CONTROL	2711
ABNORMAL RUDDER OPERATION	2721
ATS FAIL	AUTOFLIGHT 2231
	AUTOFLIGHT 2231
DLC	AUTOFLIGHT 2217
MACH TRIM FAIL	AUTOFLIGHT 2221
PITCH AXIS JAM OR OPEN	2731, 2741
PITCH/ROLL MONITOR FAIL LEGEND	2731, 2741, 2711
PITCH TRIM FAIL	AUTOFLIGHT 2216
	AUTOFLIGHT 2218
	AUTOFLIGHT 2218
ROLL AXIS JAM	2711
ROLL SPEED BRAKE ANN/ SPOILERS L5 & 6, R5 & 6 SWITCHLIGHT PUSH LEGENDS	2761
RUDDER HYDRAULIC LIMITER	2721
RUDDER MECHANICAL LIMITER	2721
STABILIZER INOP LIGHT(S)	2741
STALL WARN FAIL	AUTOFLIGHT 2217
YAW SAS FAIL	AUTOFLIGHT 2215

M1-0001-27-5006

FLIGHT CONTROLS

FLIGHT CONTROLS CONTENTS

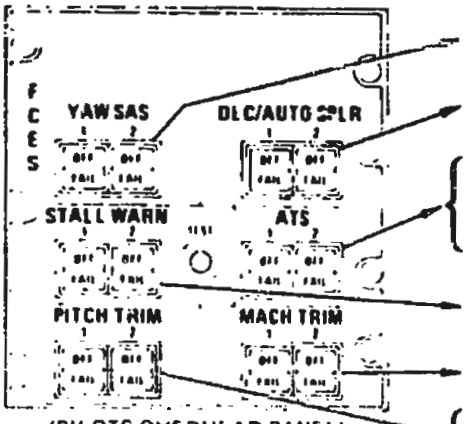


(PILOTS OVERHEAD PANEL)

MACH TRIM/FEEL

RUDDER HYDRAULIC LIMITER

ABNORMAL RUDDER OPERATION



(PILOTS OVERHEAD PANEL)

YAW SAS FAIL AUTOFLIGHT

DLC AUTOFLIGHT

ATS FAIL AUTOFLIGHT

AUTOFLIGHT

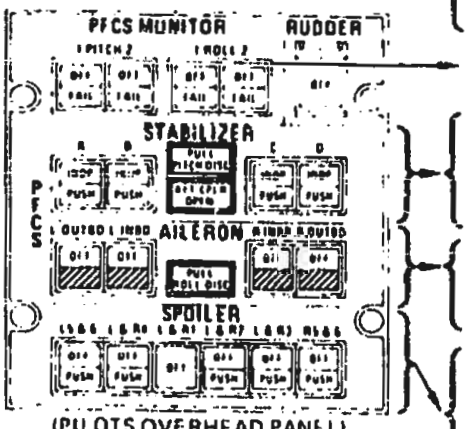
STALL WARN FAIL AUTOFLIGHT

MACH TRIM FAIL AUTOFLIGHT

PITCH TRIM FAIL AUTOFLIGHT

AUTOFLIGHT

AUTOFLIGHT



(PILOTS OVERHEAD PANEL)

PITCH/ROLL MONITOR FAIL LEGEND

PITCH AXIS JAM OR OPEN

STABILIZER INOP LIGHT(S)

ROLL AXIS JAM

ABNORMAL ROLL CONTROL

ROLL AXIS JAM

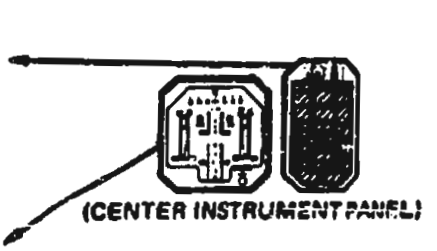
ROLL SPEED BRAKE ANN/SPOILERS L5 & 6, R5 & 6 SWITCHLIGHT PUSH LEGENDS

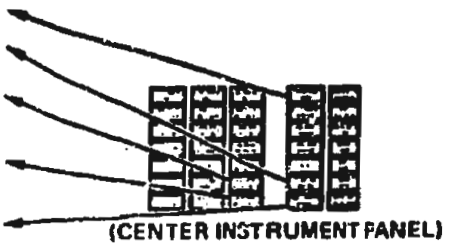
TITLE	CHAP/SEC
ABNORMAL ROLL CONTROL	2711
ABNORMAL RUDDER OPERATION	2721
ATS FAIL	AUTOFLIGHT 2231
	AUTOFLIGHT 2231
DLC	AUTOFLIGHT 2217
MACH TRIM FAIL	AUTOFLIGHT 2221
PITCH AXIS JAM OR OPEN	2731, 2741
PITCH/ROLL MONITOR FAIL LEGEND	2731, 2741, 2711
PITCH TRIM FAIL	AUTOFLIGHT 2218
	AUTOFLIGHT 2218
	AUTOFLIGHT 2218
ROLL AXIS JAM	2711
ROLL SPEED BRAKE ANN/SPOILERS L5 & 6, R5 & 6, SWITCHLIGHT PUSH LEGENDS	2761
RUDDER HYDRAULIC LIMITER	2721
STABILIZER INOP LIGHT(S)	2741
STALL WARN FAIL	AUTOFLIGHT 2217
YAW SAS FAIL	AUTOFLIGHT 2215

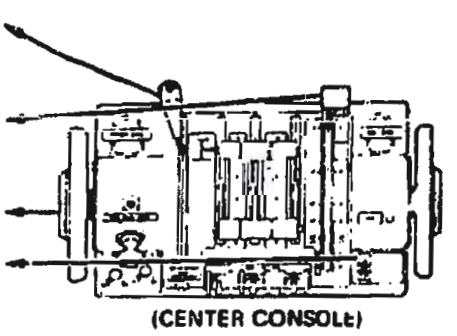
M1-0001-27-4007

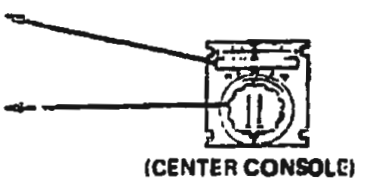
FLIGHT CONTROLS

FLIGHT CONTROLS CONTENTS





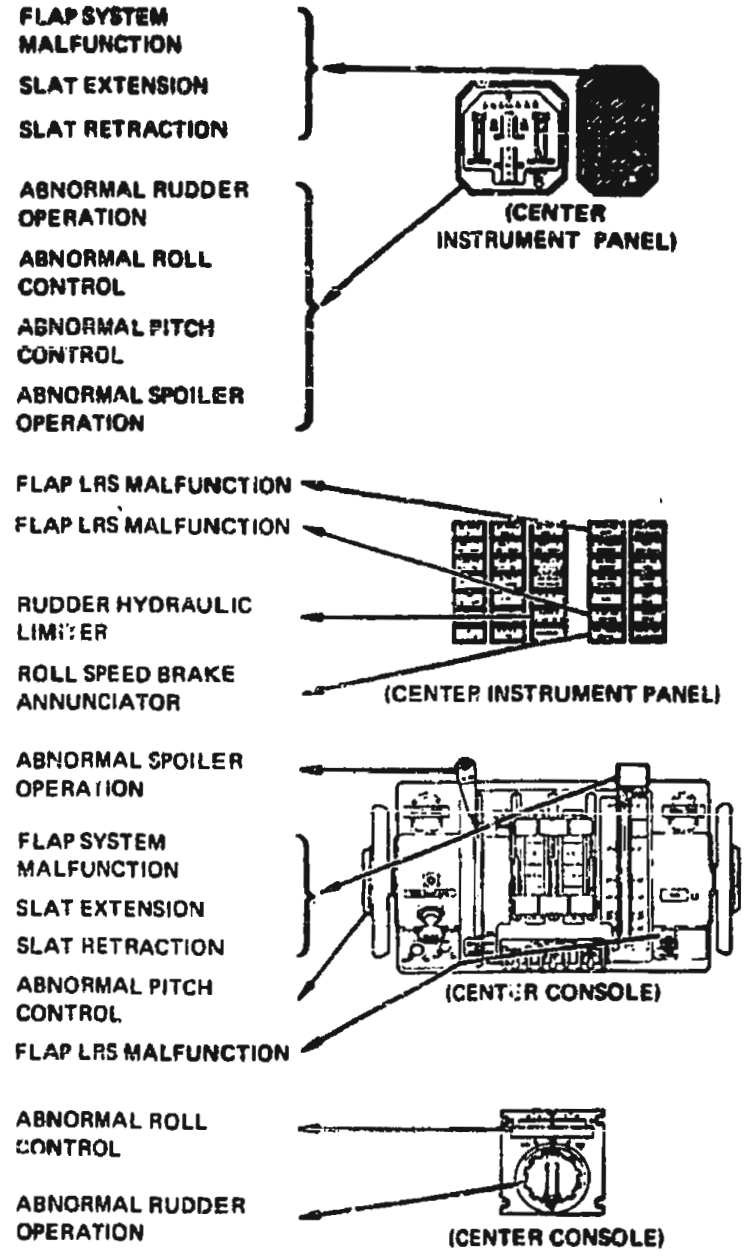




TITLE	CHAP/SEC
ABNORMAL ROLL CONTROL	2711
ABNORMAL RUDDER OPERATION	2721
ABNORMAL PITCH CONTROL	2731, 2741
ABNORMAL SPOILER OPERATION	2761
FLAP LRS MALFUNCTION	2751
FLAP SYSTEM MALFUNCTION	2751
ROLL SPEED BRAKE ANNUNCIATOR	2761
RUDDER HYDRAULIC LIMITER	2721
RUDDER MECHANICAL LIMITER	2721
SLAT EXTENSION	2781
SLAT RETRACTION	2781

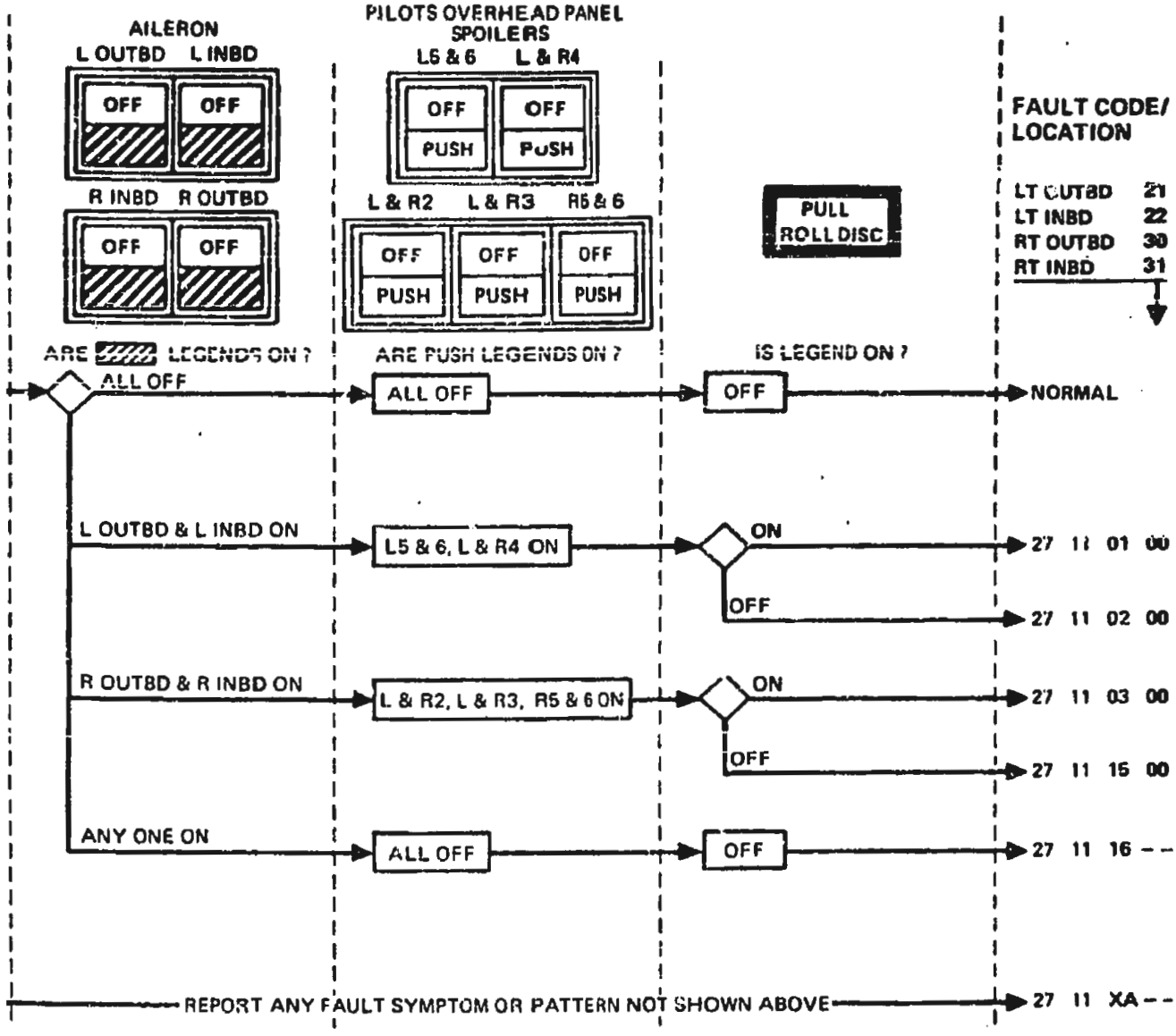
M1-0000-27-6005

FLIGHT CONTROLS CONTENTS



TITLE	CHAP/SEC
ABNORMAL PITCH CONTROL	2731, 2741
ABNORMAL ROLL CONTROL	2711
ABNORMAL RUDDER OPERATION	2721
ABNORMAL SPOILER OPERATION	2761
FLAP LRS MALFUNCTION	2751
RUDDER HYDRAULIC LIMITER	2721
SLAT EXTENSION	2781
SLAT RETRACTION	2781

M1-0000-27-6020



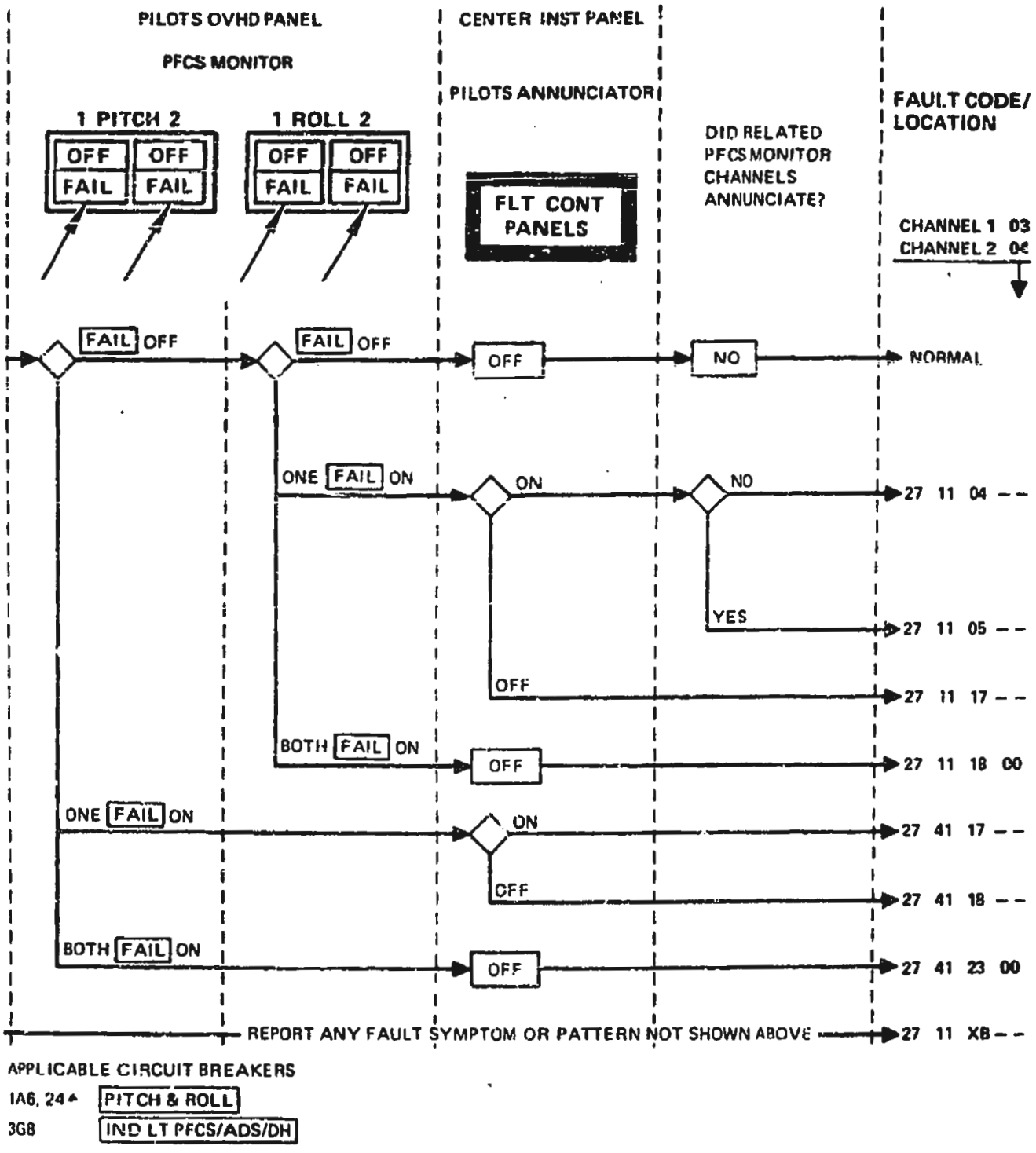
APPLICABLE CIRCUIT BREAKERS

1B4, 5	FCES COMPUTER AC, DC
1B7, 8	SPOILER DWELL AC, DC
2H14, 15	DLC SERVO A, B
2J15, 16, 17, 18	SPOILER HYD A, B, C, D
2J19, 20, 21, 22	AILERON HYD C, A, B, D

EO1-0003-27-010

R Roll Axis Jam - Fault Codes
Figure 1

EFFECTIVITY: ALL

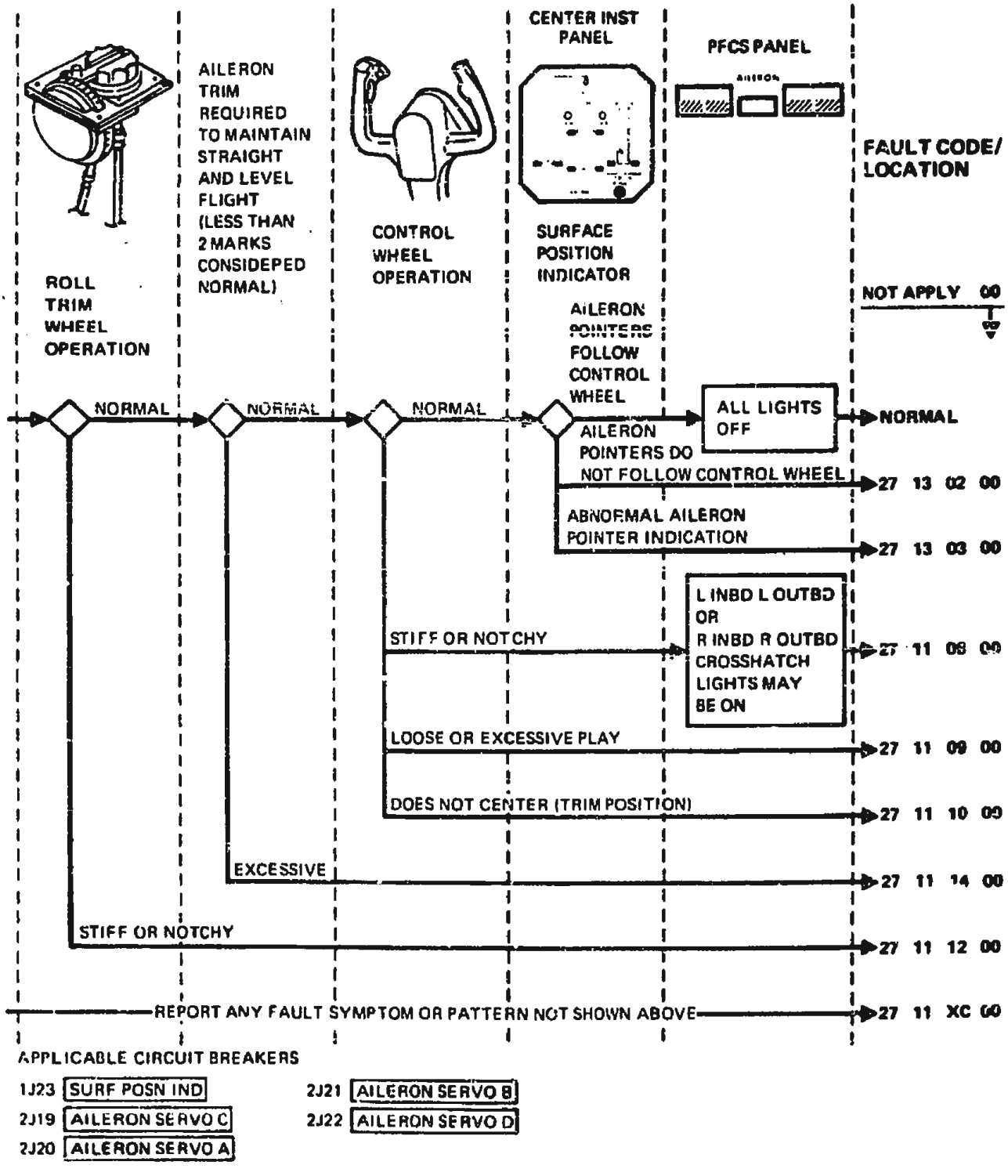


ED1-0006-27-017

R Pitch/Roll Monitor FAIL Legend - Fault Codes
Figure 2

EFFECTIVITY: ALL

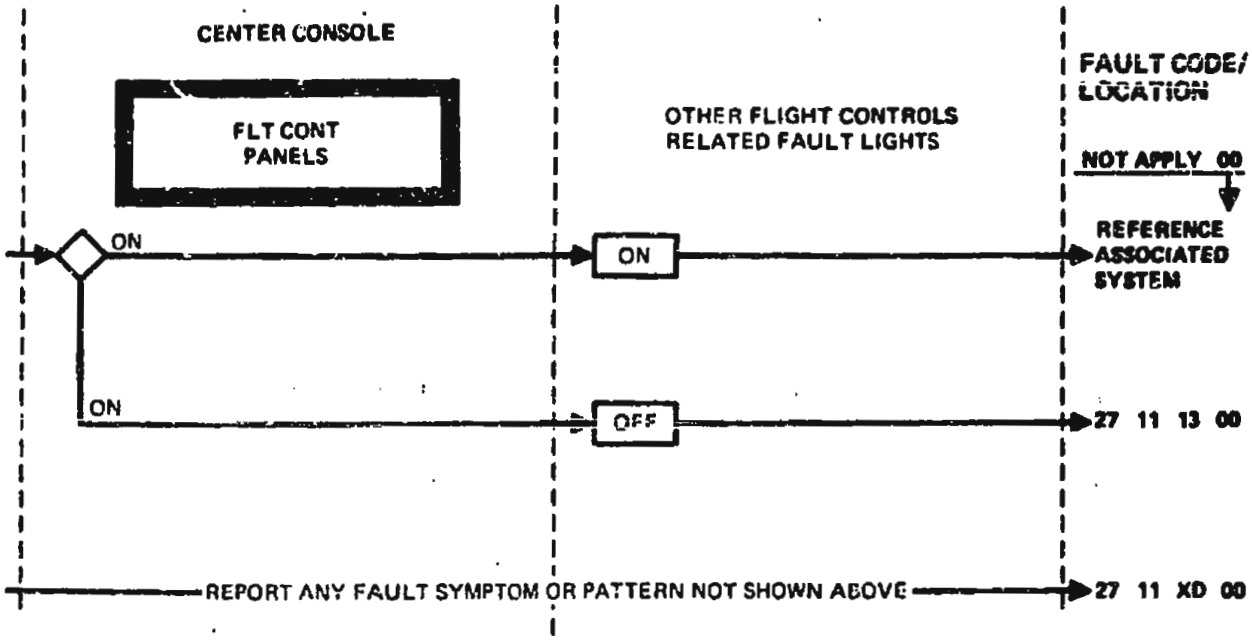
27-FAULT CODE DIAGRAM


ROLL TRIM WHEEL OPERATION
AILERON TRIM REQUIRED TO MAINTAIN STRAIGHT AND LEVEL FLIGHT (LESS THAN 2 MARKS CONSIDEPED NORMAL)
CONTROL WHEEL OPERATION
CENTER INST PANEL
SURFACE POSITION INDICATOR
PFCS PANEL
FAULT CODE/ LOCATION
NOT APPLY 00
AILERON POINTERS FOLLOW CONTROL WHEEL
NORMAL
NORMAL
NORMAL
ALL LIGHTS OFF
NORMAL
AILERON POINTERS DO NOT FOLLOW CONTROL WHEEL
27 13 02 00
ABNORMAL AILERON POINTER INDICATION
27 13 03 00
L INBD L OUTBD OR R INBD R OUTBD CROSSHATCH LIGHTS MAY BE ON
STIFF OR NOTCHY
27 11 08 00
LOOSE OR EXCESSIVE PLAY
27 11 09 00
DOES NOT CENTER (TRIM POSITION)
27 11 10 00
EXCESSIVE
27 11 14 00
STIFF OR NOTCHY
27 11 12 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
27 11 XC 00
APPLICABLE CIRCUIT BREAKERS
1J23 SURF POSN IND
2J19 AILERON SERVO C
2J20 AILERON SERVO A
2J21 AILERON SERVO B
2J22 AILERON SERVO D
ED1-0004-27-052

R Abnormal Roll Control - Fault Codes
Figure 3

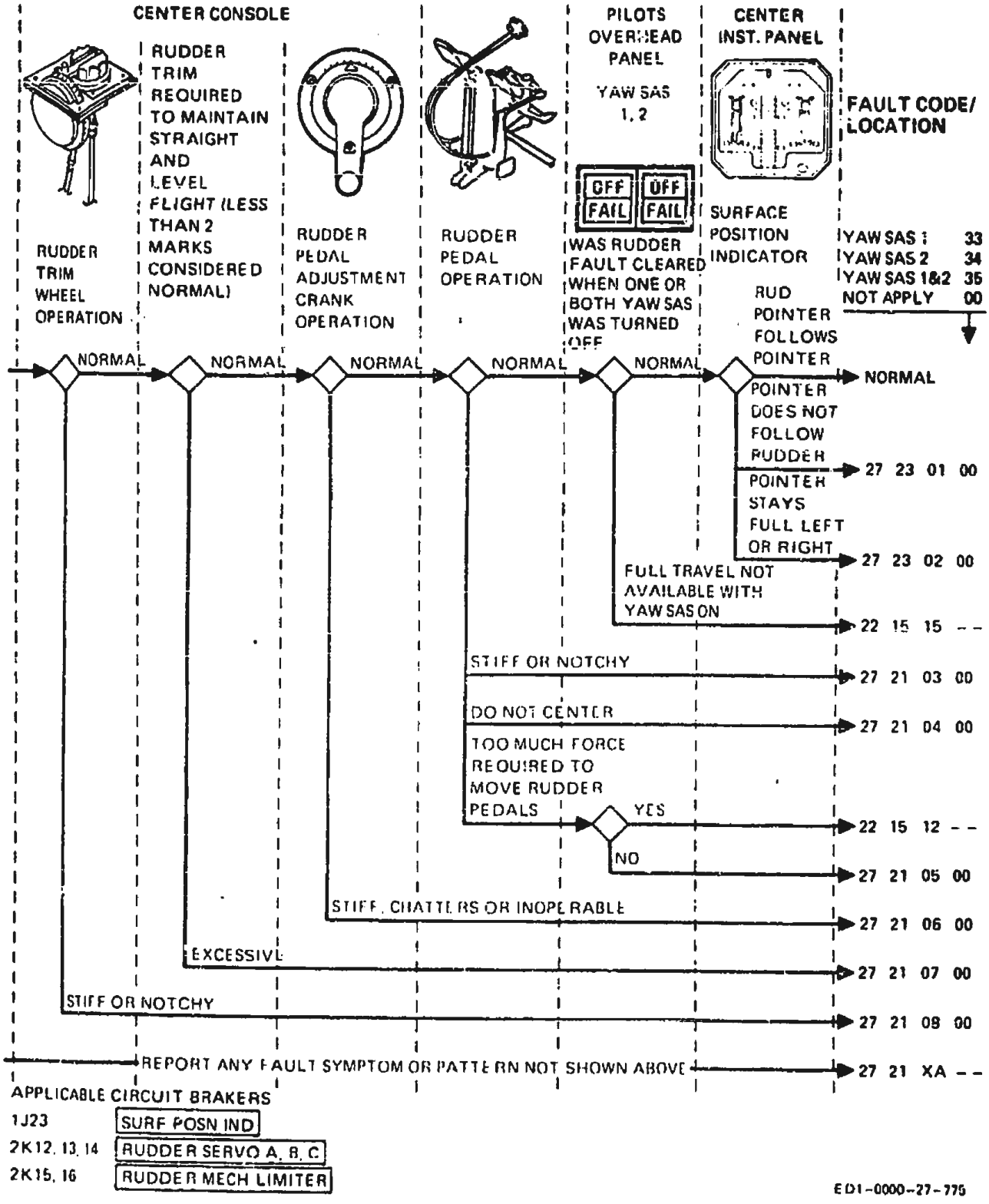
R EFFECTIVITY: ALL

0508



EO1-0001-27-761

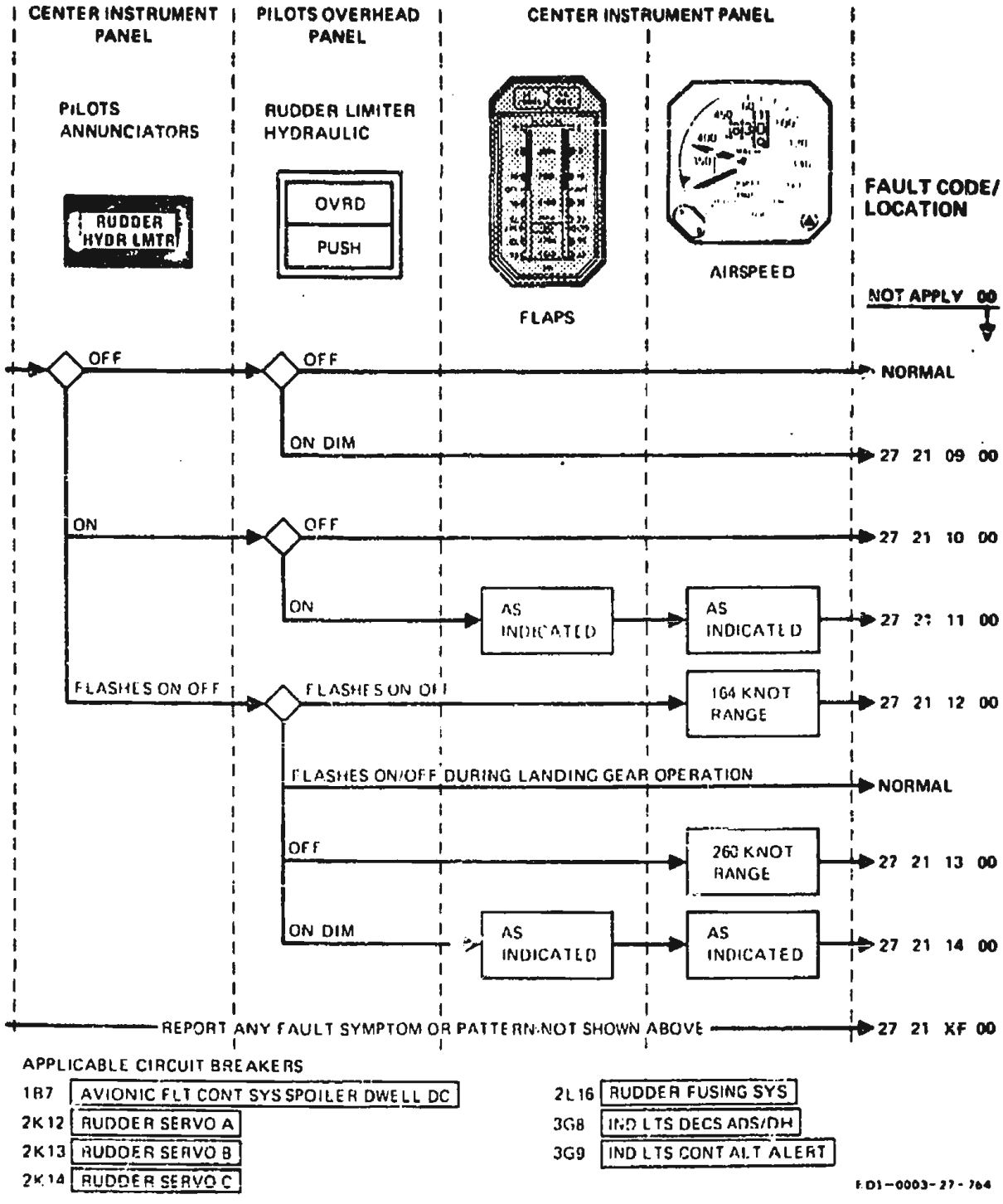
R Flight Control Panel Light On - Fault Codes
Figure 4


CENTER CONSOLE
RUDDER TRIM WHEEL OPERATION
RUDDER TRIM REQUIRED TO MAINTAIN STRAIGHT AND LEVEL FLIGHT (LESS THAN 2 MARKS CONSIDERED NORMAL)
RUDDER PEDAL ADJUSTMENT CRANK OPERATION
RUDDER PEDAL OPERATION
PILOTS OVERHEAD PANEL
YAW SAS 1, 2
OFF FAIL
OFF FAIL
WAS RUDDER FAULT CLEARED WHEN ONE OR BOTH YAW SAS WAS TURNED OFF
CENTER INST. PANEL
SURFACE POSITION INDICATOR
RUD POINTER FOLLOWS POINTER
FAULT CODE/ LOCATION
YAW SAS 1 33
YAW SAS 2 34
YAW SAS 1&2 35
NOT APPLY 00
NORMAL
NORMAL
NORMAL
NORMAL
NORMAL
NORMAL
POINTER DOES NOT FOLLOW RUDDER
27 23 01 00
POINTER STAYS FULL LEFT OR RIGHT
27 23 02 00
FULL TRAVEL NOT AVAILABLE WITH YAW SAS ON
22 15 15 - -
STIFF OR NOTCHY
27 21 03 00
DO NOT CENTER
27 21 04 00
TOO MUCH FORCE REQUIRED TO MOVE RUDDER PEDALS
YES
22 15 12 - -
NO
27 21 05 00
STIFF, CHATTERS OR INOPERABLE
27 21 06 00
EXCESSIVE
27 21 07 00
STIFF OR NOTCHY
27 21 08 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
27 21 XA - -
APPLICABLE CIRCUIT BRAKERS
1J23 SURF POSN IND
2K12, 13, 14 RUDDER SERVO A, B, C
2K15, 16 RUDDER MECH LIMITER
ED1-0000-27-775

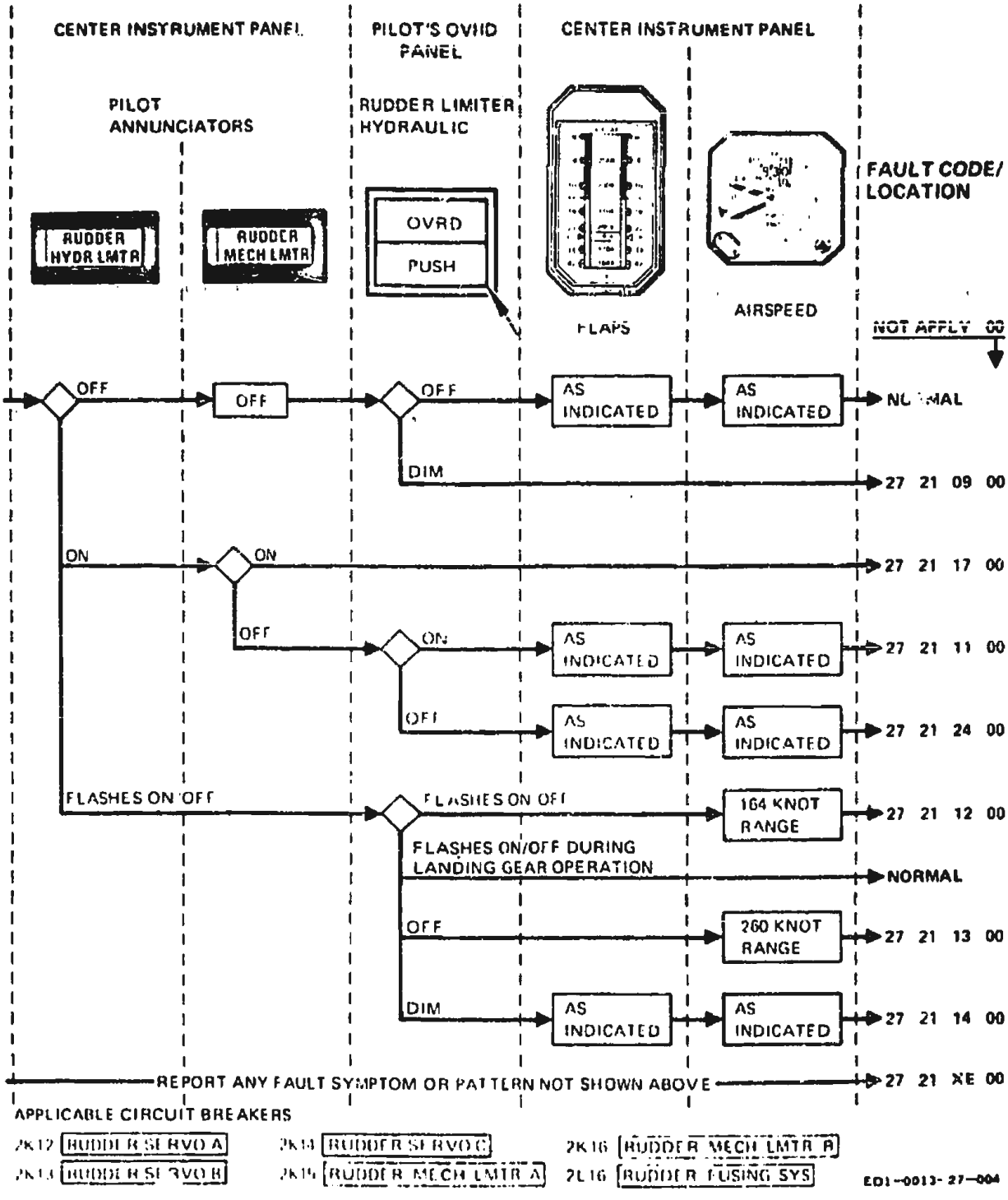
R Abnormal Rudder Operation - Fault Codes
Figure 5

R EFFECTIVITY: ALL

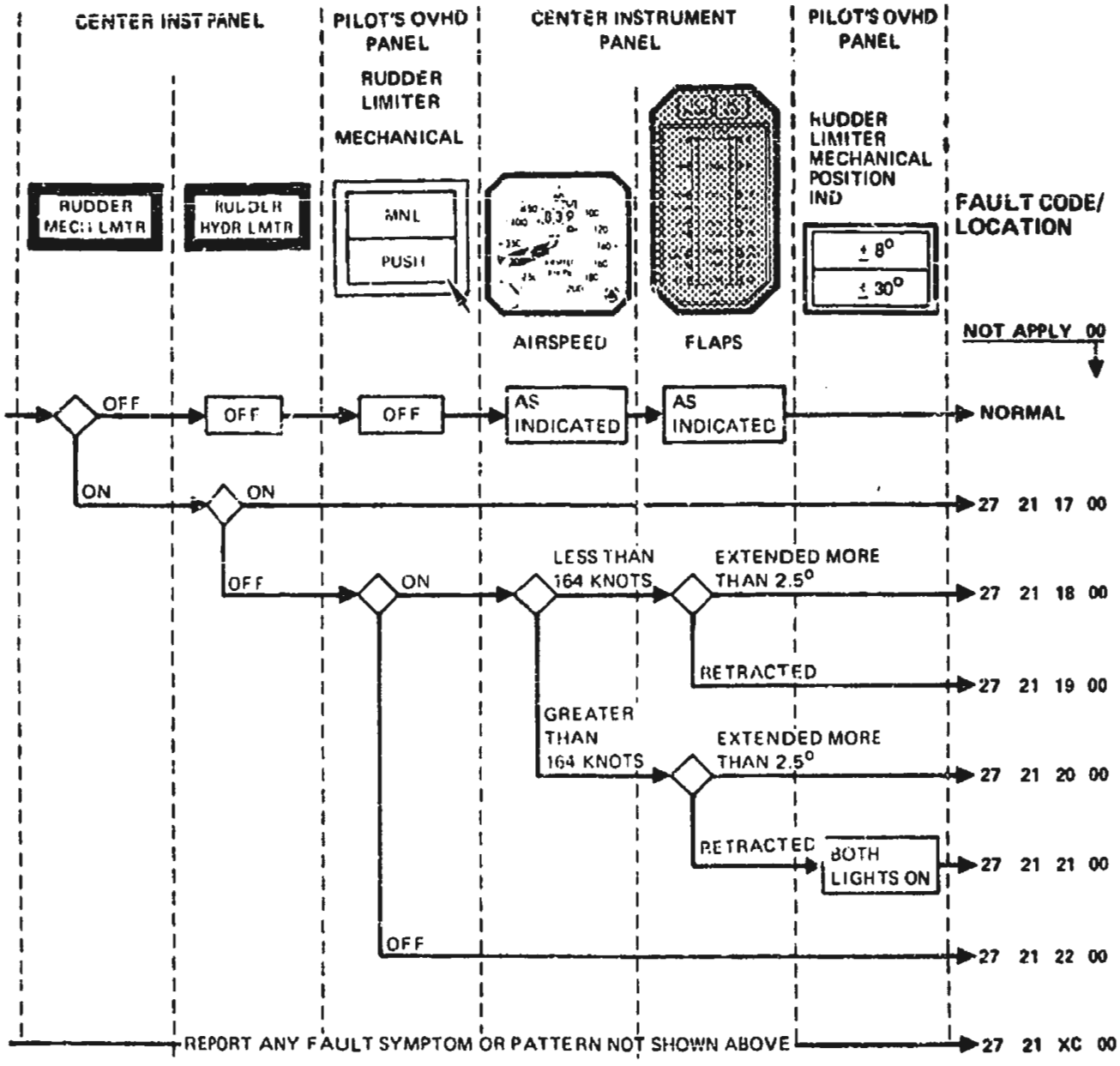
27-FAULT CODE DIAGRAM



Rudder Hydraulic Limiter - Fault Codes
Figure 6



Rudder Hydraulic Limiter - Fault Codes
Figure 7

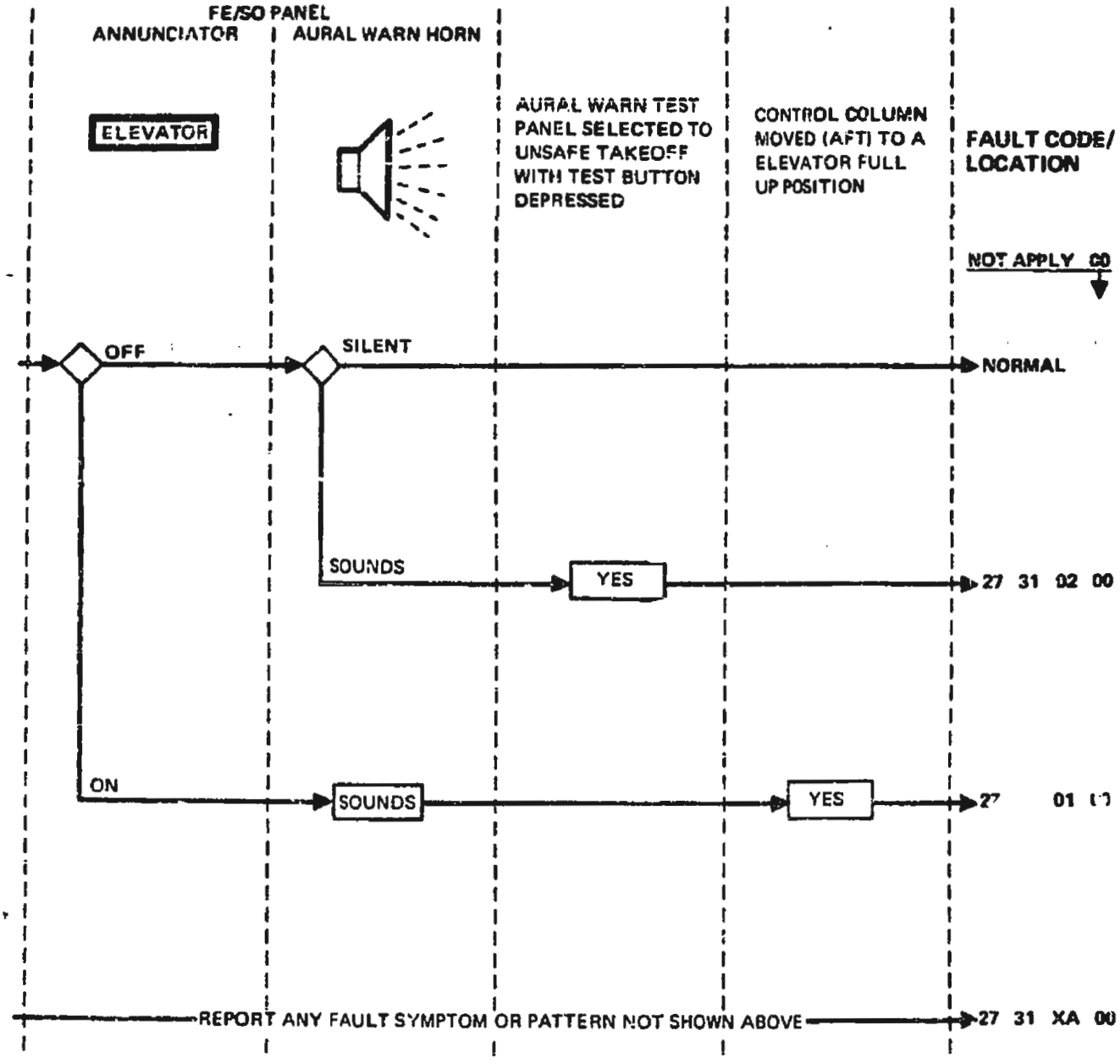


APPLICABLE CIRCUIT BREAKERS

2K12	RUDDER SERVO A
2K13	RUDDER SERVO B
2K14	RUDDER SERVO C
2K15	RUDDER MECH LMTR A
2K16	RUDDER MECH LMTR B

EDI-0008-27-005

R Rudder Mechanical Limiter - Fault Codes
Figure 8

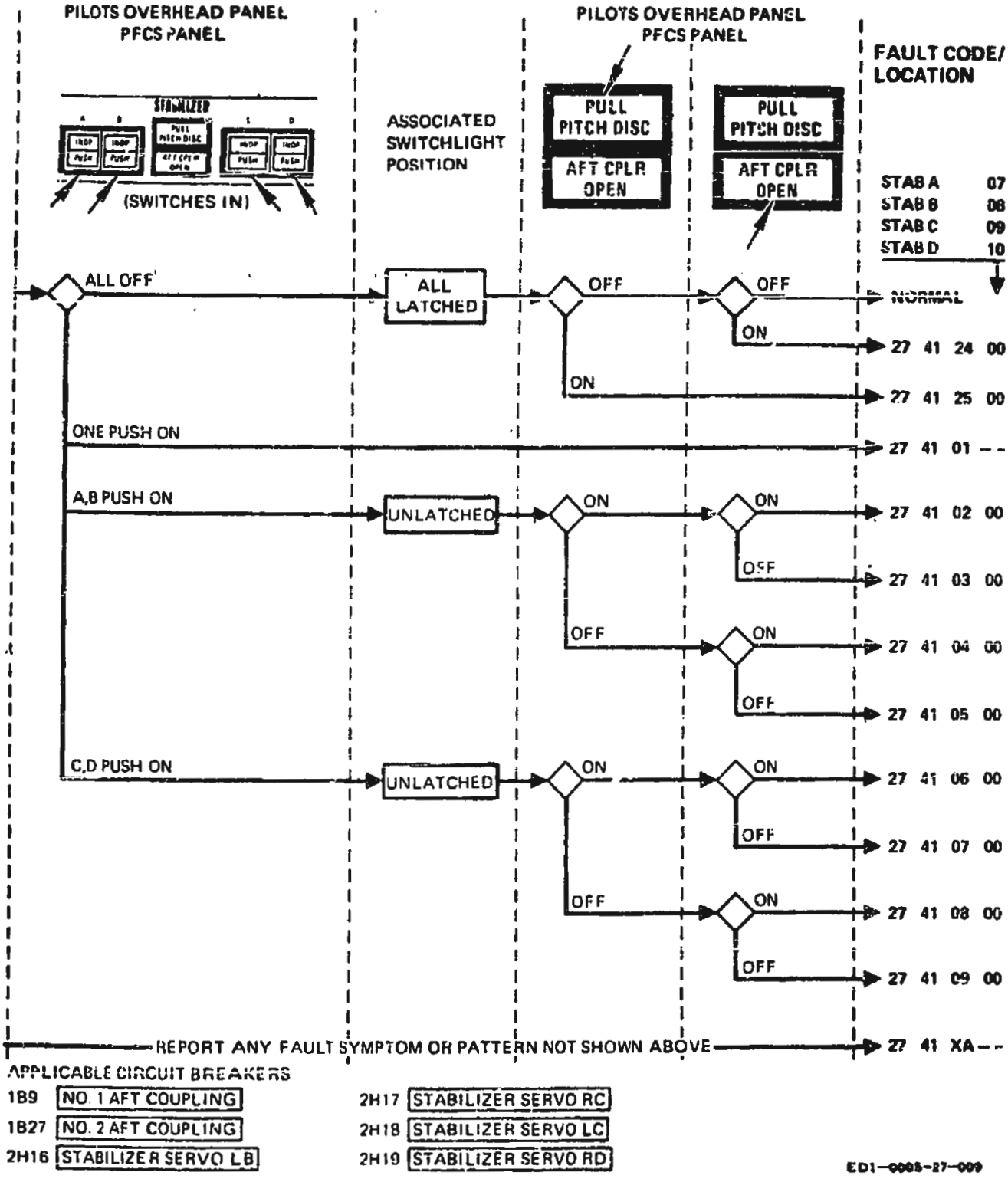


APPLICABLE CIRCUIT BREAKERS

B9	AFT COUPLER NO. 1
H7	T/O AURAL WARN IND

ED1-0007-27-751

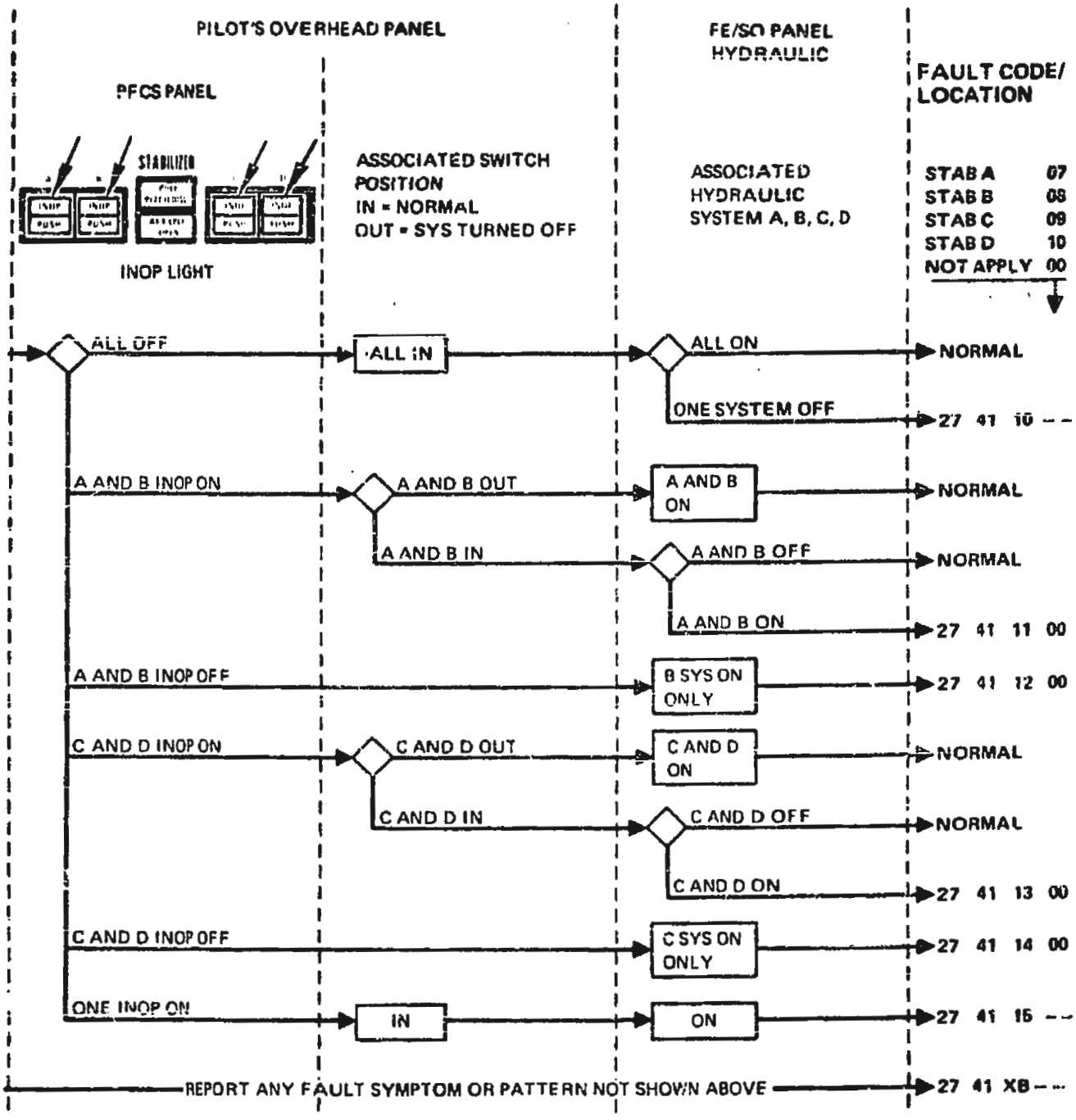
R Elevator Warning System - Fault Codes
Figure 9



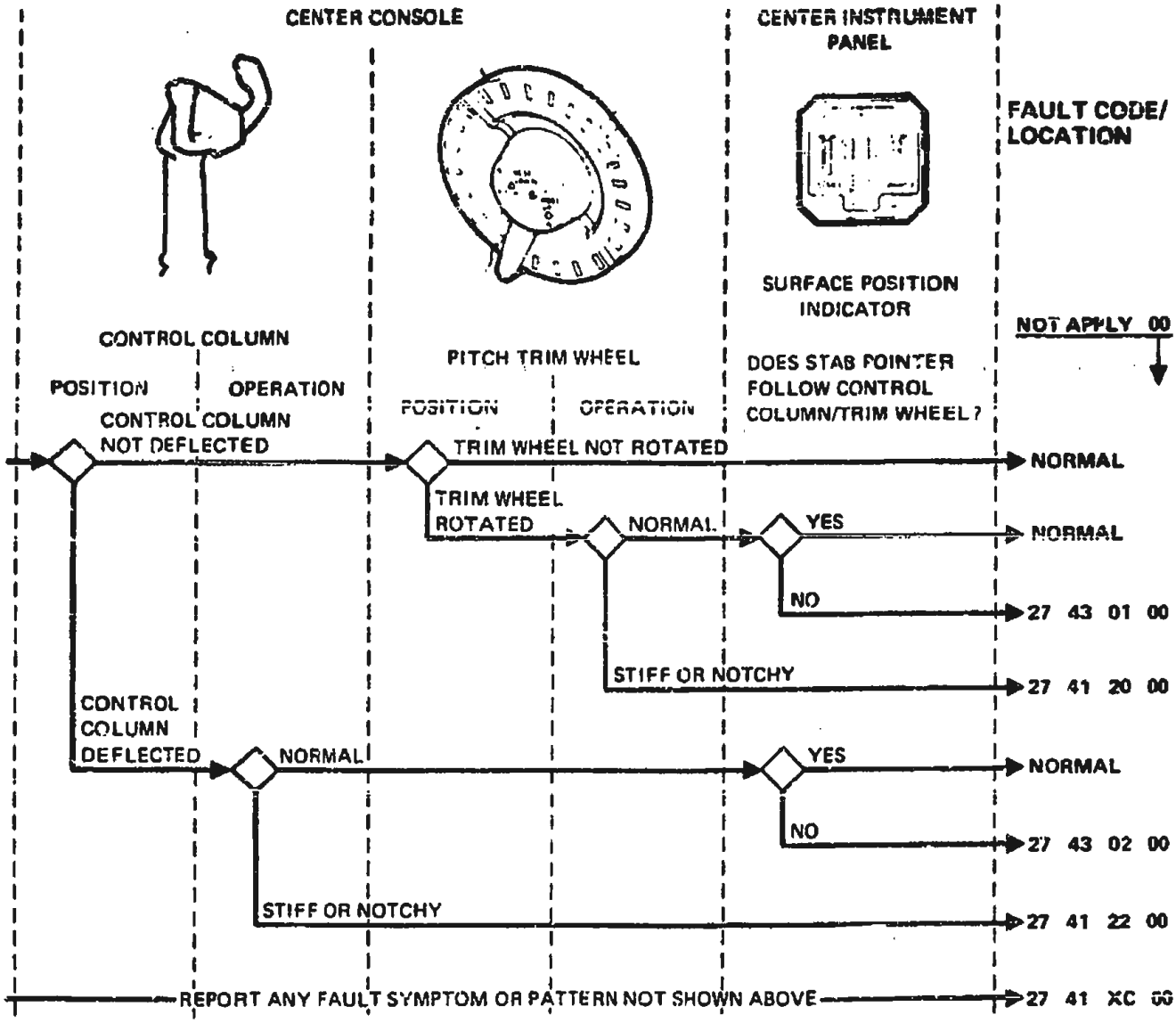
R Pitch Axis Jam or Open - Fault Codes
Figure 10

EFFECTIVITY: ALL

050B



R Stabilizer INOP Legend(s) - Fault Codes
Figure 11

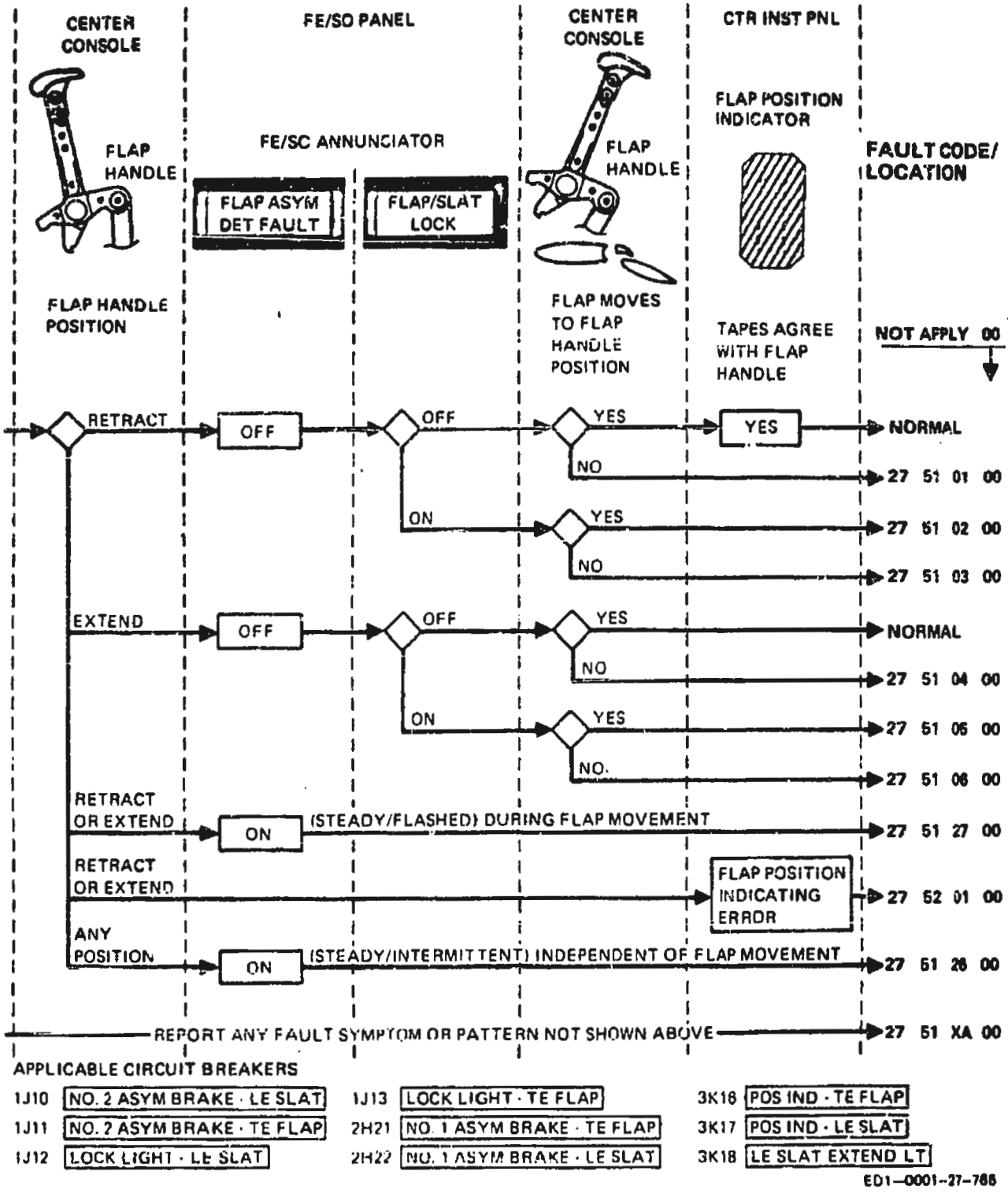


APPLICABLE CIRCUIT BREAKERS

2H16	STABILIZER SERVO LB
2H17	STABILIZER SERVO RC
2H18	STABILIZER SERVO LC
2H19	STABILIZER SERVO RD

ED1-0003-27-053

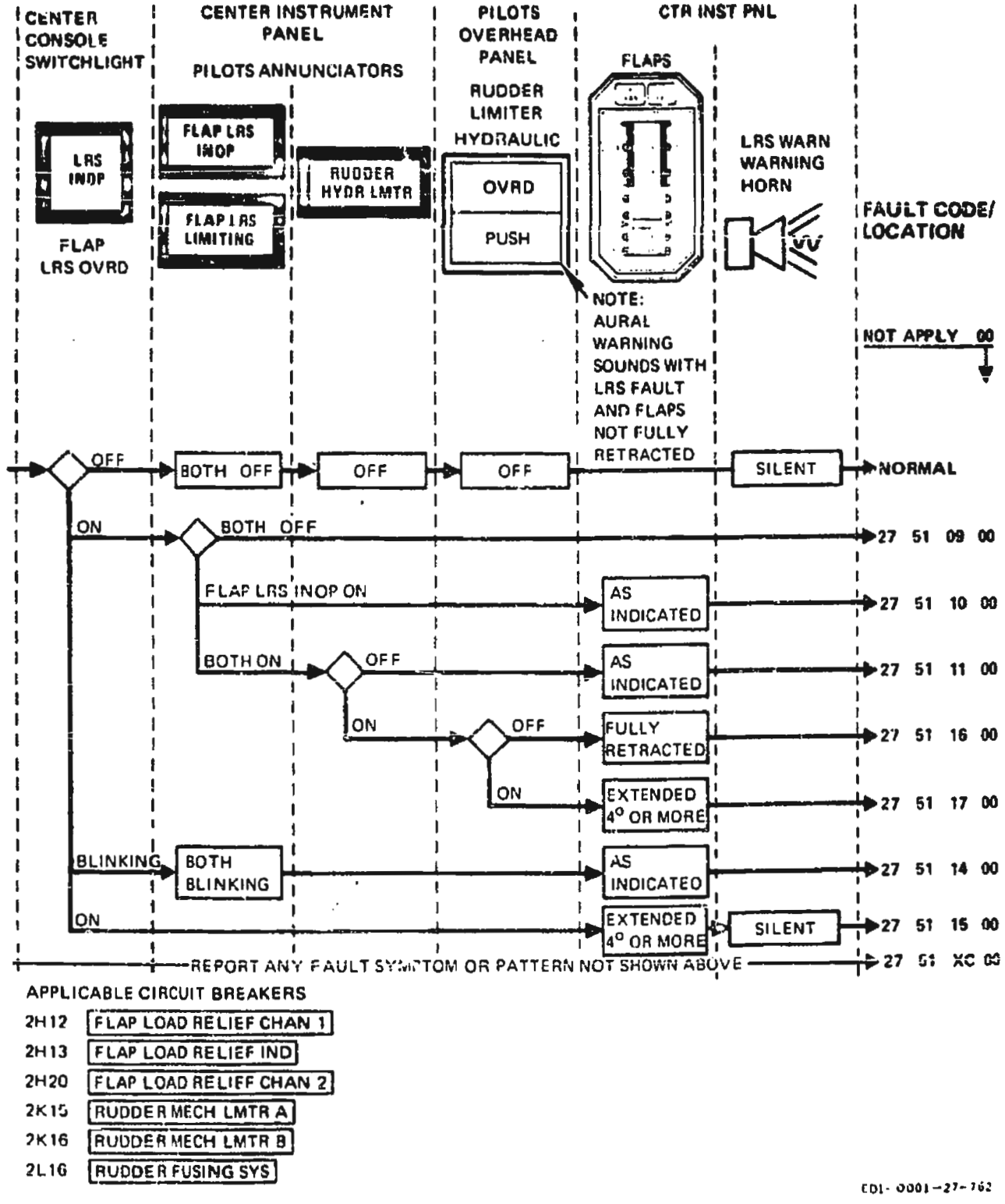
Abnormal Pitch Control - Fault Codes
Figure 12



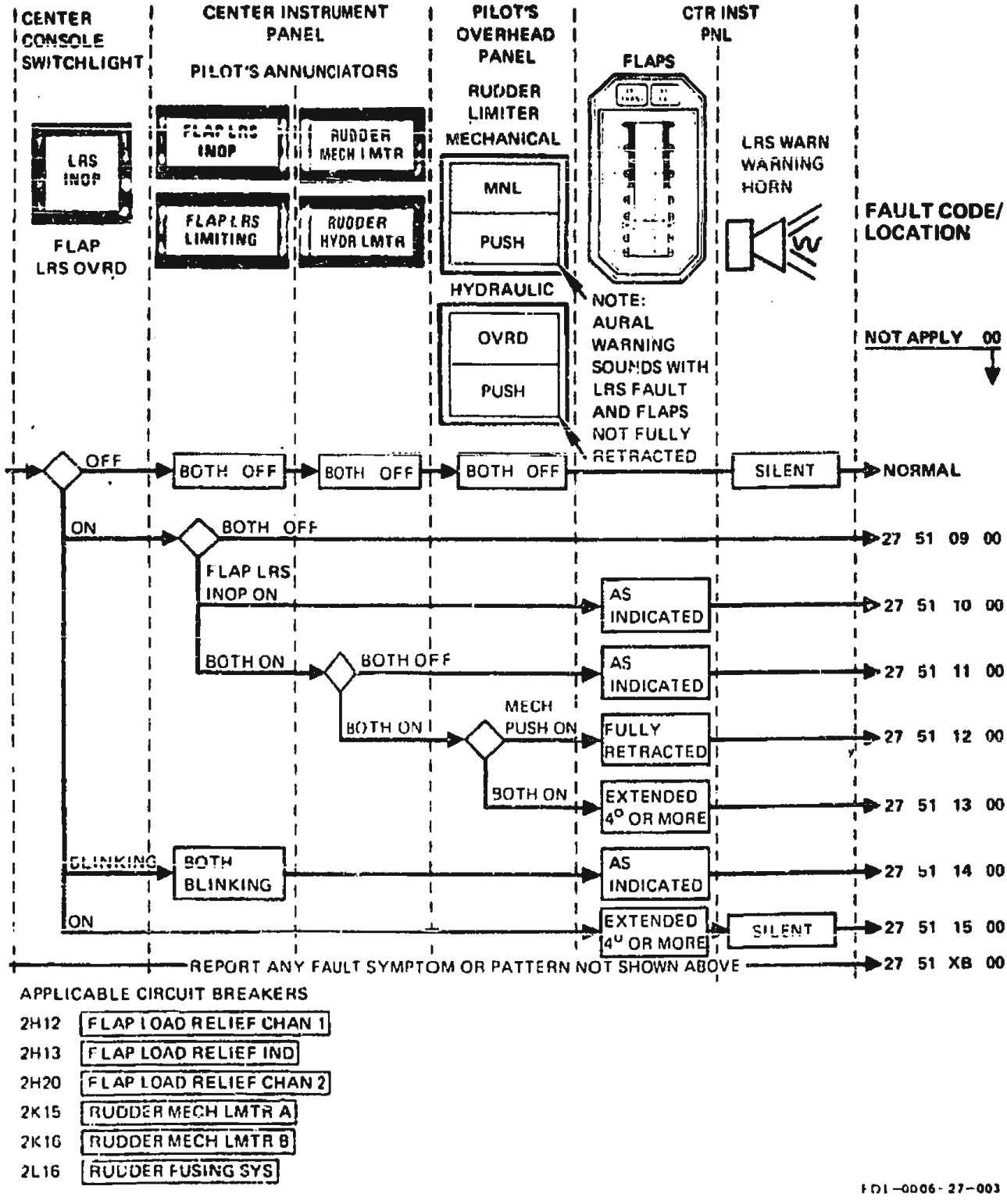
R Flap System Malfunction - Fault Codes
Figure 13

EFFECTIVITY: ALL

27-FAULT CODE DIAGRAM



Flap LRS Malfunction - Fault Codes
Figure 14

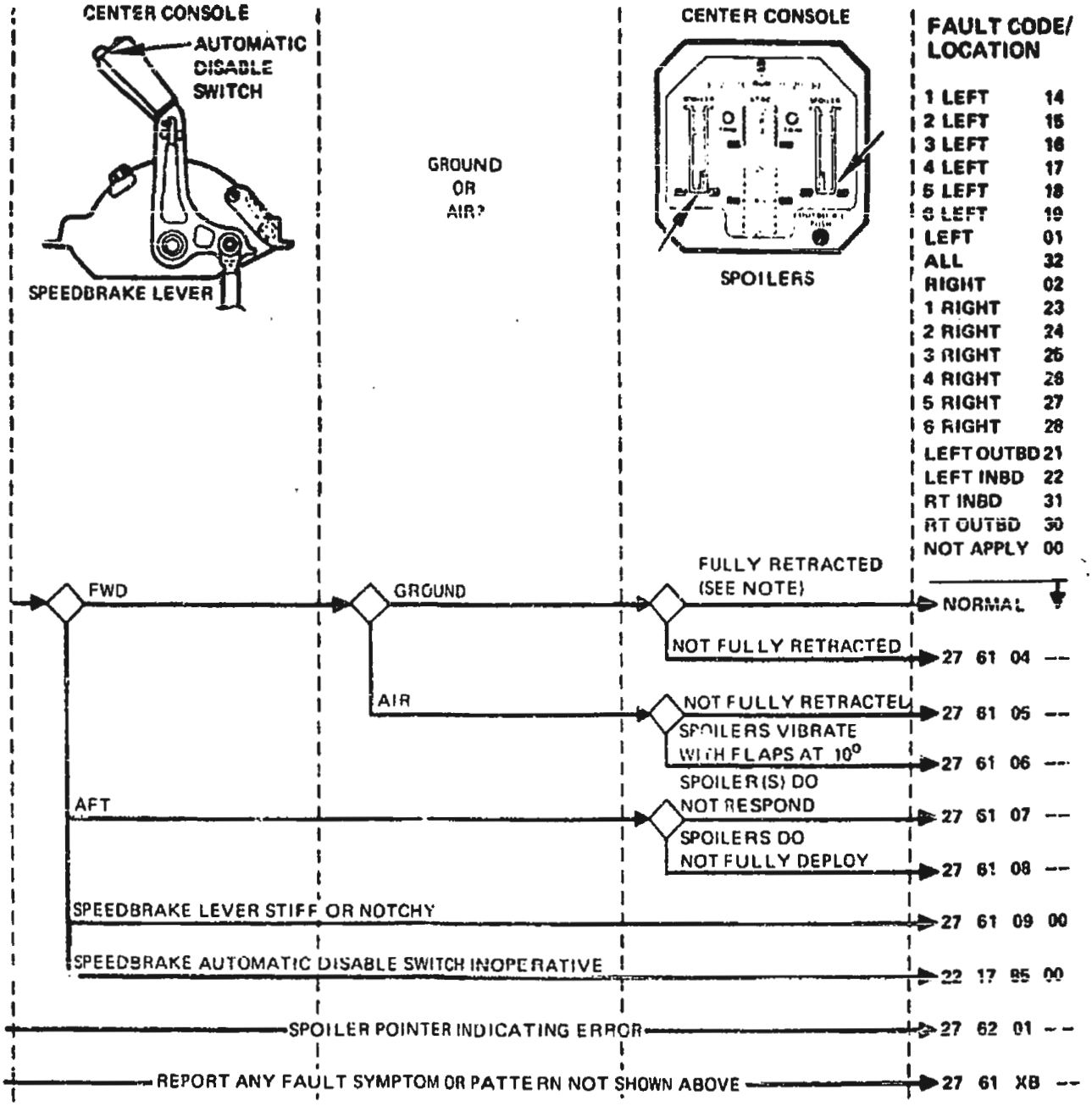


APPLICABLE CIRCUIT BREAKERS

2H12	FLAP LOAD RELIEF CHAN 1
2H13	FLAP LOAD RELIEF IND
2H20	FLAP LOAD RELIEF CHAN 2
2K15	RUDDER MECH LMTR A
2K16	RUDDER MECH LMTR B
2L16	RUDDER FUSING SYS

FDI-0006-27-003

Flap LRS Malfunction - Fault Codes
Figure 15

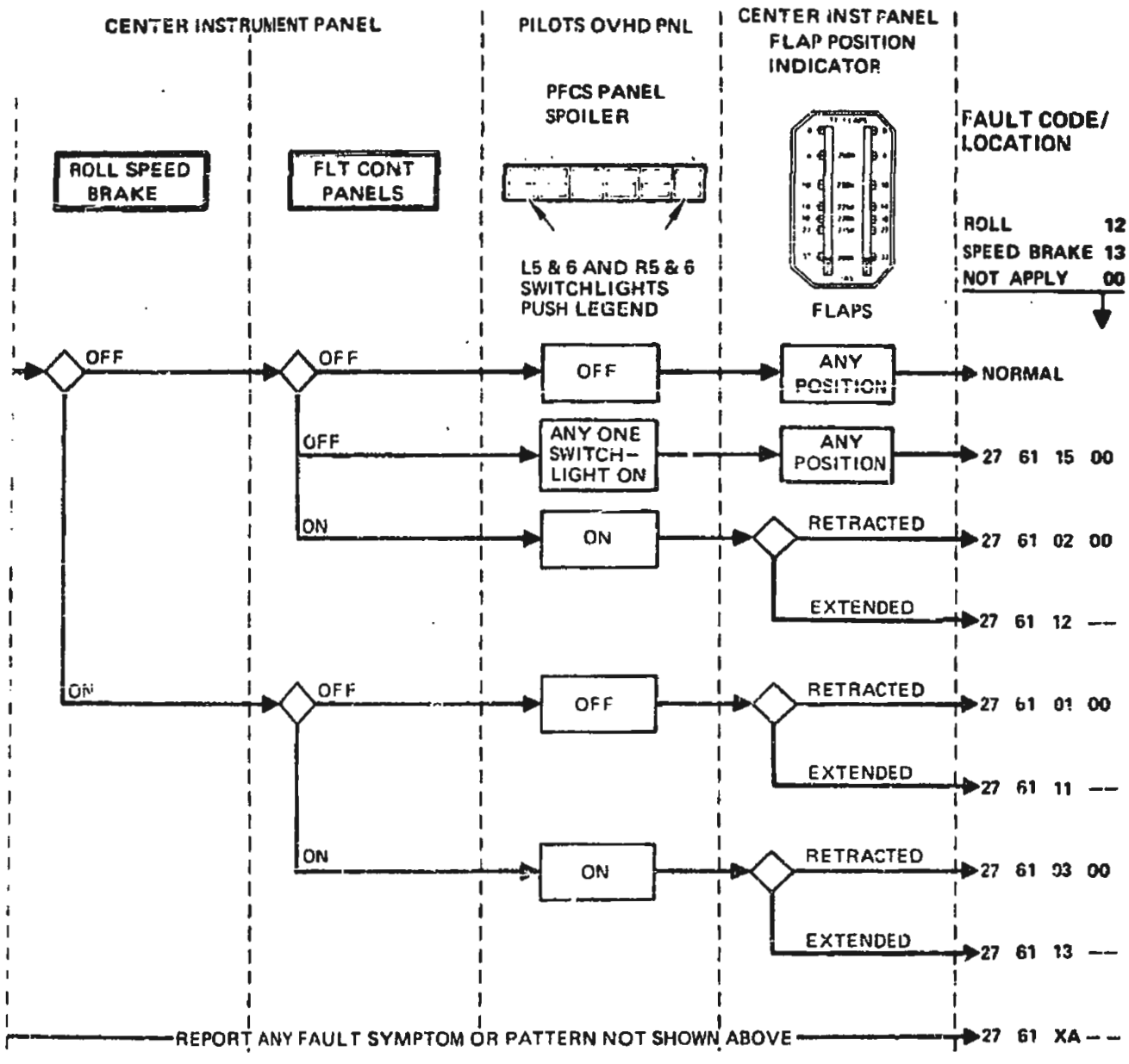


R Abnormal Spoiler Operation - Fault Codes
Figure 16

EFFECTIVITY: ALL

050B

27-FAULT CODE DIAGRAM



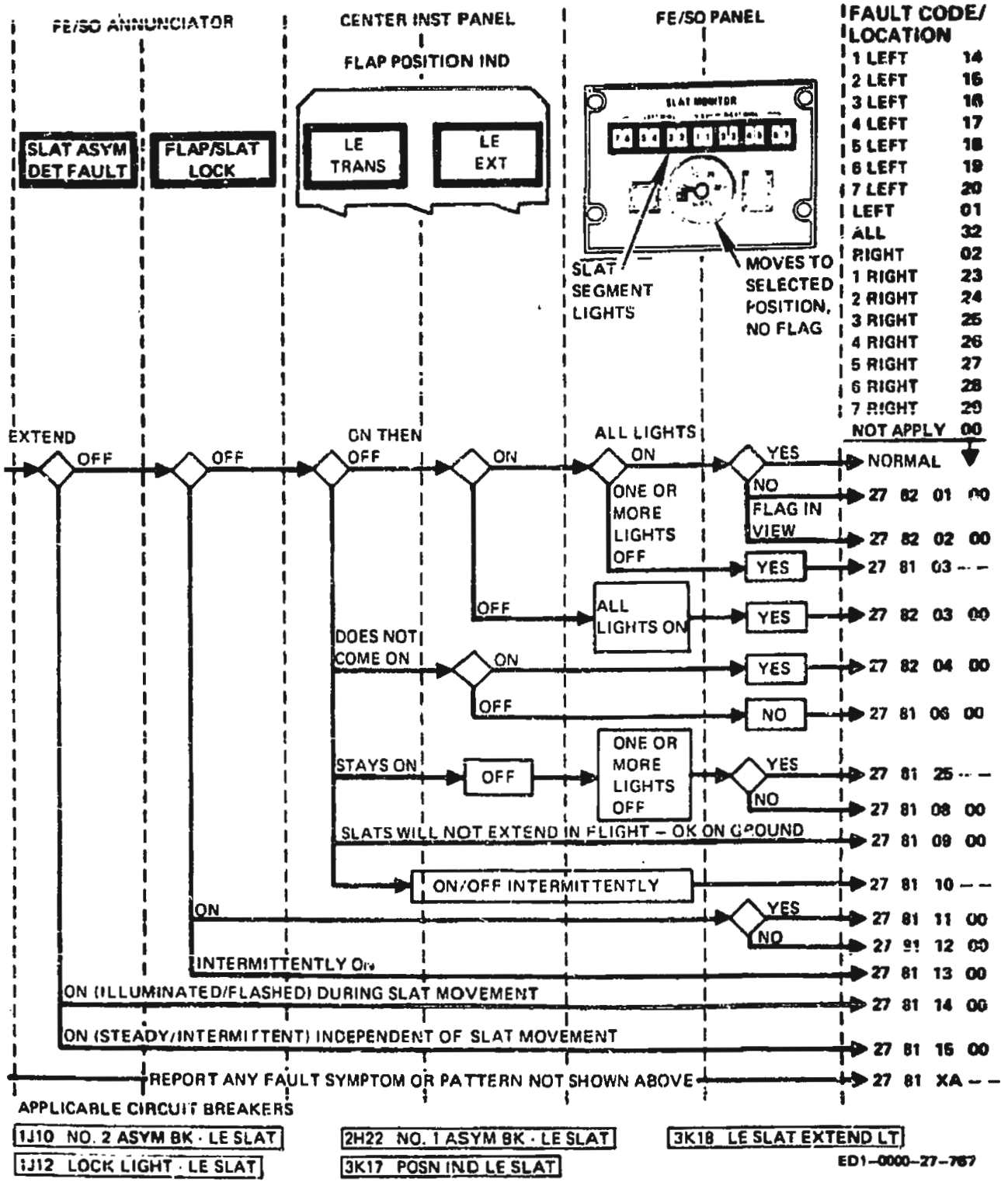
APPLICABLE CIRCUIT BREAKERS

1B4	FCES COMPUTER DC	2J15, 16, 17, 18	SPOILER SERVO A, B, C, AND D
1B5	FCES COMPUTER AC	3C3	IND LT PFCS/ADS/DH
1B7	SPOILER DWELL AC	3G9	FLT CONT ALT ALERT
1B8	SPOILER DWELL DC	3K16	POS IND TE FLAPS
1J23	SURF POSN IND		

EDI-0012-27-013

R
R BRAKE Ann/SPOILER L5&6 and ROLL SPEED R5&6 Switchlight Legend - Fault Codes
Figure 17

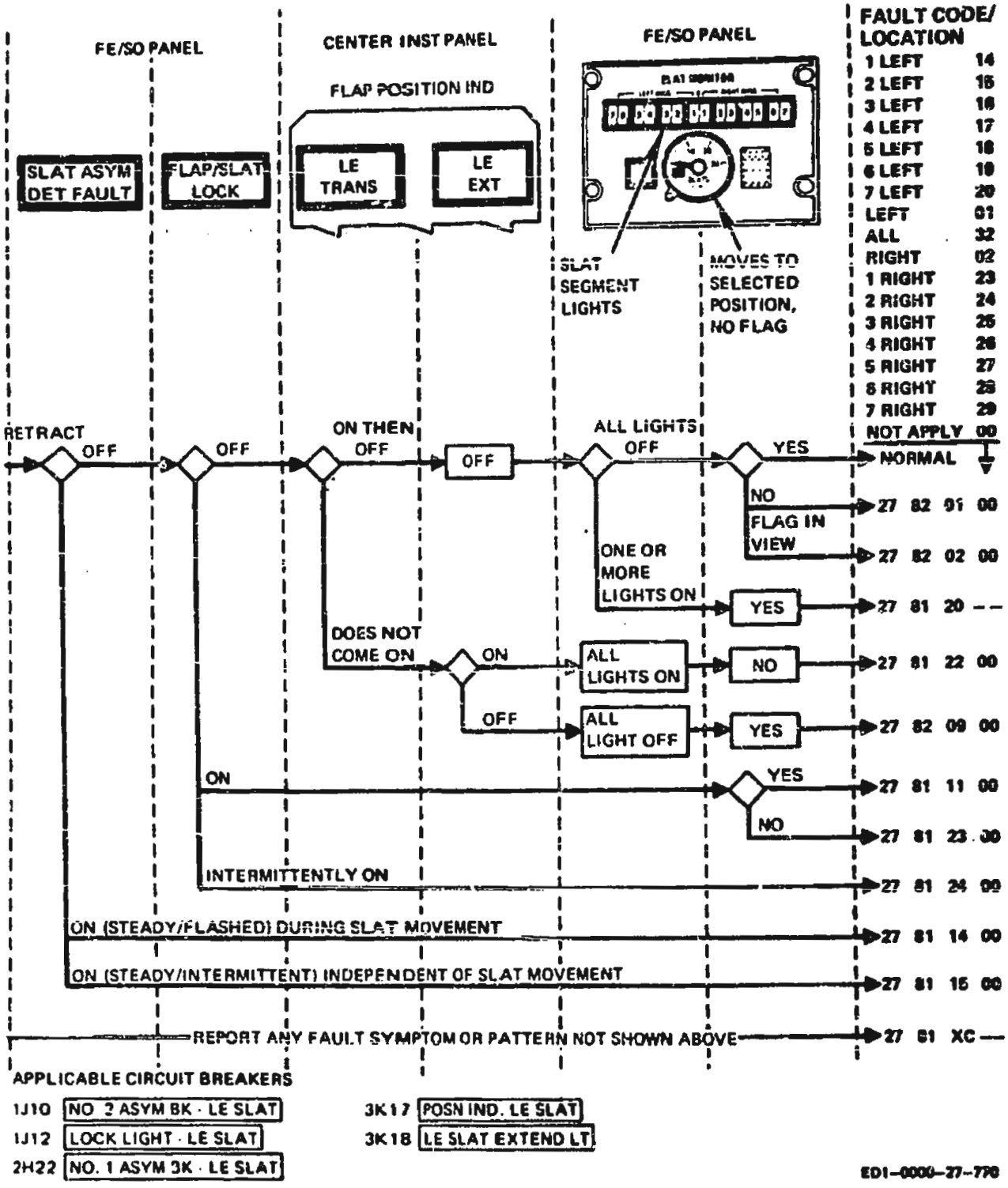
EFFECTIVITY: ALL



R Slat Extension Malfunction - Fault Codes
Figure 18

R EFFECTIVITY: ALL

27-FAULT CODE DIAGRAM



R Slat Retraction Malfunction - Fault Codes
Figure 19

R EFFECTIVITY: ALL

050B

FAULT CODE INDEX
TABLE 1

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 11 XA __	1. A Roll Axis Jam fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 27-11-00 Fig. 104, 106 Block 1
27 11 XB __	1. A Pitch/Roll Monitor FAIL Legend fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 27-11-00 Fig. 103, 109 Block 1 27-41-00 Fig. 104 Block 1
27 11 XC 00	1. An Abnormal Roll Control fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 27-11-00 Fig. 105, 107, 108, 110 Block 1 27-13-00 Fig. 103 Block 1
27 11 XD 00	1. A Flight Control Panel Light On fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 27-11-00 Fig. 109 Block 1
R 27 21 XA __	1. An Abnormal Rudder Operation fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 27-21-00 Fig. 104, 105, 106, 107, 108 Block 1 27-23-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE		
		1.	LOG BOOK REPORT
		2.	FAULT ISOLATION REFERENCE
	27 21 XC 00	1.	A Rudder Mechanical Limiter fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2.	27-21-00 Fig. 103, 109, 110, 111, 112 Block 1
	27 21 XE 00	1.	A Rudder Hydraulic Limiter fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2.	27-21-00 Fig. 103, 109, 110, 111, 112 Block 1
	27 21 XF 00	1.	A Rudder Hydraulic Limiter fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2.	27-21-00 Fig. 103, 109, 112 Block 1
	27 31 XA 00	1.	An Elevator Warning System fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2.	27-31-00 Fig. 103 Block 1
R			31-22-00 Fig. 109, 110, 111 Block 1
	27 41 XA __	1.	A Pitch Axis Jam or Open fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2.	27-41-00 Fig. 107, 110 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 41 XB __	1. A Stabilizer INOP Legend(s) fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-41-00 Fig. 103, 109 Block 1
27 41 XC 00	1. An Abnormal Pitch Control fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-41-00 Fig. 105, 106, 108 Block 1 27-43-00 Fig. 103 Block 1
27 51 XA 00	1. A Flap System Malfunction fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-51-00 Fig. 103, 104, 105, 106 Block 1 27-52-00 Fig. 103 Block 1
27 51 XB 00	1. A Flap LRS Malfunction fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-51-00 Fig. 110, 111 Block 1 31-22-00 Fig. 116 Block 1
27 51 XC 00	1. A Flap LRS Malfunction fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-51-00 Fig. 110, 111 Block 1 31-22-00 Fig. 116 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 61 XA __	1. A ROLL SPEED BRAKE Ann/SPOILER L5&6 and R5&6 Switchlight Legend fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-61-00 Fig. 105, 109, 110, 111 Block 1
27 61 XB __	1. An Abnormal Spoiler Operation fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 27-61-00 Fig. 106, 107, 110, 112, 113, 115 Blk 1
R	27-62-00 Fig. 103 Block 1
27 81 XA __	1. A Slat Extension Malfunction fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-81-00 Fig. 103, 104, 105, 109, 112 Block 1 27-81-00 Fig. 110 (Sheet 1) Block 1 27-82-00 Fig. 103, 104, 105 Block 1
27 81 XC __	1. A Slat Retraction Malfunction fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 27-81-00 Fig. 103, 104, 105, 109, 111 Block 1 27-82-00 Fig. 103, 105 Block 1
27 11 01 00	1. Left outboard and inboard aileron switchlight crosshatch legends and L5&6 and L&R 4 spoiler switchlight PUSH legends on. PULL ROLL DISC legend on. 2. 27-11-00 Fig. 104 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R 27 11 02 00	1. Left outboard and inboard aileron switchlight crosshatch legends and L5&6 and L&R 4 spoiler switchlight PUSH legends on. PULL ROLL DISC legend off.
R	2. 27-11-00 Fig. 104 Block 1
R 27 11 03 00	1. Right outboard and inboard aileron switchlight crosshatch legends and L&R 2, L&R 3 and R5&6 spoiler switchlight PUSH legends on. PULL ROLL DISC legend on.
R	2. 27-11-00 Fig. 104 Block 1
R 27 11 04 __	1. (03=CHAN 1, 04=CHAN 2) One PFCS MONITOR ROLL FAIL legend and pilots FLT CONT PANELS annunciator on. All other PFCS panel indications normal.
	2. 27-11-00 Fig. 103 Block 1
R 27 11 05 __	1. (03=CHAN 1, 04=CHAN 2) One PFCS MONITOR ROLL FAIL legend and pilots FLT CONT PANELS annunciator on. Report other PFCS panel annunciator legends on.
	2. 27-11-00 Fig. 103 Block 1
27 11 06 00	1. NOT USED.
27 11 07 00	1. NOT USED.
27 11 08 00	1. Aileron control wheel operation stiff or notchy.
	2. 27-11-00 Fig. 105 Block 1
27 11 09 00	1. Loose or excessive play in aileron control wheel.
	2. 27-11-00 Fig. 107 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 11 10 00	1. Aileron control wheel does not center to trim position when released.
	2. 27-11-00 Fig. 107 Block 1
27 11 11 00	1. NOT USED.
27 11 12 00	1. Aileron wheel operation stiff or notchy.
	2. 27-11-00 Fig. 108 Block 1
27 11 13 00	1. FLT CONT PANELS light on pilots annunciator panel comes on, other flight control fault lights off.
	2. 27-11-00 Fig. 109 Block 1
27 11 14 00	1. Aileron trim excessive. Required (___) marks (LWD, RWD) trim to maintain level flight. Tank (2L, 2R) inboard section contained (___ lbs) excess fuel per the Alternate Fuel Loading Schedule.
	2. 27-11-00 Fig. 110 Block 1
R 27 11 15 00	1. Right outboard and inboard aileron switchlight crosshatch legends and L&R 2, L&R 3 and R5&6 spoiler switchlight PUSH legends on. PULL ROLL DISC legend off.
R	2. 27-11-00 Fig. 104 Block 1
R 27 11 16 __	1. Any one aileron switchlight crosshatch legend on, other annunciator legends off.
R	2. 27-11-00 Fig. 104 Block 2
R 27 11 17 __	1. (03=CHAN 1, 04=CHAN 2) One PFCS MONITOR ROLL FAIL legend on. Pilots FLT CONT PANELS annunciator off.
R	2. 27-11-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	27 11 18 00	1. Both PFCS MONITOR ROLL FAIL legends on. Pilots FLT CONT PANELS annunciator off.
		2. 27-11-00 Fig. 103 Block 1
	27 13 01 00	1. NOT USED.
	27 13 02 00	1. Aileron pointer on Surface Position Indicator does not follow control wheel movement.
		2. 27-13-00 Fig. 103 (Sheet 1) Block 1
	27 13 03 00	1. Abnormal aileron pointer indication.
		2. 27-13-00 Fig. 103 Block 1
	27 21 01 00	1. NOT USED.
	27 21 02 00	1. NOT USED.
R	27 21 03 00	1. Rudder pedal operation stiff or notchy.
R		2. 27-21-00 Fig. 105 Block 1
R	27 21 04 00	1. Rudder pedals do not center.
R		2. 27-21-00 Fig. 106 Block 1
R R	27 21 05 00	1. Rudder pedal force excessive with either YAW SAS switchlight released (out).
R		2. 27-21-00 Fig. 105 Block 1
R R	27 21 06 00	1. Rudder pedal adjustment crank stiff, chatters, or inoperable.
R		2. 27-21-00 Fig. 108 Block 1
R	27 21 07 00	1. Rudder trim excessive.
R		2. 27-21-00 Fig. 104 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 21 08 00	1. YAW trim wheel operation stiff or notchy.
	2. 27-21-00 Fig. 107 Block 1
27 21 09 00	1. RUDDER LIMITER HYDRAULIC PUSH light on dim.
	2. 27-21-00 Fig. 109 Block 1
27 21 10 00	1. RUDDER HYDR LMTR annunciator light on. RUDDER LIMITER panel HYDRAULIC PUSH light off.
	2. 27-21-00 Fig. 110 Block 1
27 21 11 00	1. RUDDER HYDR LMTR annunciator and RUDDER LIMITER HYDRAULIC PUSH lights on. Flaps (retracted, extended) and airspeed (____) knots.
	2. 27-21-00 Fig. 103 (Sheet 1) Block 1
27 21 12 00	1. RUDDER HYDR LMTR annunciator and RUDDER LIMITER HYDRAULIC PUSH lights flash on and off between 164 and 260 knots.
	2. 27-21-00 Fig. 103 (Sheet 1) Block 1
27 21 13 00	1. RUDDER HYDR LMTR annunciator light flashes on/off at or above 260 knots.
	2. 27-21-00 Fig. 112 Block 1
27 21 14 00	1. RUDDER HYDR LMTR annunciator light flashes on/off and RUDDER HYDRAULIC LIMITER PUSH light on intermittent/dim. Flaps retracted or extended and airspeed (____) knots.
	2. 27-21-00 Fig. 103 (Sheet 1) Block 1
27 21 15 00	1. NOT USED.
27 21 16 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 21 17 00	1. RUDDER MECH LMTR and RUDDER HYDR LMTR annunciator lights on.
	2. 27-21-00 Fig. 110 Block 1
27 21 18 00	1. RUDDER MECH LMTR annunciator and rudder limiter mechanical PUSH lights on. Airspeed less than 164 knots and flaps extended more than 2.5 degrees.
	2. 27-21-00 Fig. 111 (Sheet 1) Block 3
27 21 19 00	1. RUDDER MECH LMTR annunciator and rudder limiter mechanical PUSH lights on. Airspeed less than 164 knots and flaps retracted.
	2. 27-21-00 Fig. 111 (Sheet 1) Block 3
27 21 20 00	1. RUDDER MECH LMTR annunciator and rudder limiter mechanical PUSH lights on. Airspeed greater than 164 knots and flaps extended more than 2.5 degrees.
	2. 27-21-00 Fig. 111 (Sheet 1) Block 3
27 21 21 00	1. RUDDER MECH LMTR annunciator and rudder limiter mechanical PUSH lights on. Airspeed greater than 164 knots and flaps retracted.
	2. 27-21-00 Fig. 111 (Sheet 2) Block 1
27 21 22 00	1. RUDDER MECH LMTR annunciator light on. Rudder limiter mechanical PUSH light off.
	2. 27-21-00 Fig. 111 (Sheet 1) Block 5
27 21 23 00	1. NOT USED.
27 21 24 00	1. RUDDER HYDR LMTR annunciator light on. Flaps retracted and airspeed (____) knots.
	2. 27-21-00 Fig. 103 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R R	27 23 01 00	1. Surface Position Indicator does not follow rudder movement.
R		2. 27-23-00 Fig. 103 Block 1
R R	27 23 02 00	1. RUD pointer on Surface Position Indicator stays full left or right with rudder centered.
R		2. 27-23-00 Fig. 103 Block 1
	27 31 01 00	1. ELEVATOR WARNING annunciator light comes on and unsafe takeoff horn sounds when control column is moved full aft.
		2. 27-31-00 Fig. 103 Block 1 31-22-00 Fig. 110 Block 1
	27 31 02 00	1. ELEVATOR WARNING light fails to come on when unsafe takeoff test horn sounds.
		2. 31-22-00 Fig. 111 Block 1
	27 41 01 __	1. (07=STAB A, 08=STAB B, 09=STAB C, 10=STAB D) PUSH light on.
		2. 27-41-00 Fig. 107 Block 5
	27 41 02 00	1. Stabilizer A and B PUSH lights on; A and B switchlights released (out). PULL PITCH DISC and AFT CPLR OPEN lights on.
		2. 27-41-00 Fig. 107 Block 1
	27 41 03 00	1. Stabilizer A and B PUSH lights on; A and B switchlights released (out). PULL PITCH DISC light on, AFT CPLR OPEN light off.
		2. 27-41-00 Fig. 107 Block 1 27-41-00 Fig. 110 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 41 04 00	1. STABILIZER A and B PUSH lights on; A and B switchlights released (out). PULL PITCH DISC light off, AFT CPLR OPEN light on. 2. 27-41-00 Fig. 107 Block 1 27-41-00 Fig. 110 Block 1
27 41 05 00	1. STABILIZER A and B PUSH lights on; A and B switchlights released (out). PULL PITCH DISC and AFT CPLR OPEN lights off. 2. 27-41-00 Fig. 110 Block 1
27 41 06 00	1. Stabilizer C and D PUSH lights on; C and D switchlights released (out). PULL PITCH DISC and AFT CPLR OPEN lights on. 2. 27-41-00 Fig. 107 Block 1
27 41 07 00	1. STABILIZER C and D PUSH lights on; C and D switchlights released (out). PULL PITCH DISC light on, AFT CPLR OPEN light off. 2. 27-41-00 Fig. 107 Block 1 27-41-00 Fig. 110 Block 1
27 41 08 00	1. Stabilizer C and D PUSH lights on; C and D switchlights released (out). PULL PITCH DISC light off, AFT CPLR OPEN light on. 2. 27-41-00 Fig. 107 Block 1 27-41-00 Fig. 110 Block 1
27 41 09 00	1. STABILIZER C and D PUSH lights on; switchlights released (out). PULL PITCH DISC and AFT CPLR OPEN lights off. 2. 27-41-00 Fig. 110 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 41 10 __	1. (07=STAB A, 08=STAB B, 09=STAB C, 10=STAB D) INOP light off with associated hydraulic system off. 2. 27-41-00 Fig. 109 Block 1
27 41 11 00	1. Stabilizer A and B INOP lights on with A, B switches in normal position. Hydraulic systems on. 2. 27-41-00 Fig. 103 Block 1
27 41 12 00	1. STABILIZER A and B INOP lights go off with only B hydraulic sys on. 2. 27-41-00 Fig. 109 Block 1
27 41 13 00	1. Stabilizer C and D INOP lights on with C, D switches in normal position. Hydraulic systems on. 2. 27-41-00 Fig. 103 Block 1
27 41 14 00	1. STABILIZER C and D INOP lights go off with only C hydraulic system on. 2. 27-41-00 Fig. 109 Block 1
27 41 15 __	1. (07=STAB A, 08=STAB B, 09=STAB C, 10=STAB D) INOP light on with switch in normal position. Hydraulic system on. 2. 27-41-00 Fig. 103 Block 1
27 41 16 00	1. NOT USED.
R 27 41 17 __	1. (03=CHAN 1, 04=CHAN 2) One PFCS MONITOR PITCH FAIL legend and pilots FLT CONT PANELS annunciator on. All other PFCS panel indications normal. 2. 27-41-00 Fig. 104 Sheet 1 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R	27 41 18 __	1. (03=CHAN 1, 04=CHAN 2) One PFCS MONITOR PITCH, FAIL legend on. Pilots FLT CONT PANELS annunciator off.
R		2. 27-41-00 Fig. 104 (Sheet 1) Block 1
	27 41 19 00	1. NOT USED.
	27 41 20 00	1. PITCH manual trim wheel operation stiff or notchy.
		2. 27-41-00 Fig. 105 Block 1
	27 41 21 00	1. NOT USED.
	27 41 22 00	1. Control column operation stiff or notchy.
		2. 27-41-00 Fig. 108 Block 1
R	27 41 23 00	1. Both PFCS MONITOR PITCH FAIL legends on. Pilots FLT CONT PANELS annunciator off.
R		2. 27-41-00 Fig. 104 (Sheet 1) Block 1
R	27 41 24 00	1. Pilots overheard PFCS panel AFT CPLR OPEN annunciator legend on. All other PFCS panel indications normal.
R		2. 27-41-00 Fig. 110 Block 8
R	27 41 25 00	1. Pilots overhead PFCS panel PULL PITCH DISC annunciator legend on. All other PFCS panel indicators normal.
R		2. 27-41-00 Fig. 110 Block 8
	27 43 01 00	1. STAB pointer on Surface Position Indicator does not follow pitch manual trim wheel rotation.
		2. 27-43-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 43 02 00	1. STAB pointer on Surface Position Indicator does not follow control column movement.
	2. 27-43-00 Fig. 103 Block 1
27 51 01 00	1. Flaps will not retract (stopped at ___ degrees). FLAP ASYM DET FAULT and FLAP/SLAT LOCK annunciator lights off.
	2. 27-51-00 Fig. 105 Block 1
27 51 02 00	1. FLAP/SLAT LOCK annunciator light on after flap retraction.
	2. 27-51-00 Fig. 103 Block 1
27 51 03 00	1. Flaps will not retract. FLAP/SLAT LOCK annunciator light on.
	2. 27-51-00 Fig. 103 Block 2
27 51 04 00	1. Flaps will not extend (stopped at ___ degrees). FLAP ASYM DET FAULT and FLAP/SLAT LOCK annunciator lights off. Flaps (extend, still inop) when airspeed reduced or aircraft on ground.
	2. 27-51-00 Fig. 105 Block 1 27-51-00 Fig. 106 (Sheet 1) Block 1
27 51 05 00	1. FLAP/SLAT LOCK annunciator light on after flap extension.
	2. 27-51-00 Fig. 103 Block 1
27 51 06 00	1. Flaps will not extend. FLAP/SLAT LOCK annunciator light on.
	2. 27-51-00 Fig. 103 Block 2
27 51 07 00	1. NOT USED.
27 51 08 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 51 09 00	1. LRS INOP switchlight on. No other indications.
	2. 27-51-00 Fig. 110 Block 1
27 51 10 00	1. LRS INOP switchlight and FLAP LRS INOP annunciator light on steady or intermittent. Flaps (____) degrees and airspeed (____) knots.
	2. 27-51-00 Fig. 111 (Sheet 1) Block 1
27 51 11 00	1. LRS INOP switchlight and, FLAP LRS INOP and FLAP LRS LIMITING annunciator lights on. Flaps (____) degrees and airspeed (____) knots.
	2. 27-51-00 Fig. 111 (Sheet 1) Block 1
27 51 12 00	1. LRS INOP switchlight, FLAP LRS INOP, FLAP LRS LIMITING, RUDDER MECH LMTR and RUDDER HYDR LMTR annunciator lights and rudder limiter mechanical PUSH light on with flaps retracted and airspeed (__) knots.
	2. 27-51-00 Fig. 111 (Sheet 1) Block 1
27 51 13 00	1. LRS INOP switchlight, FLAP LRS INOP, FLAP LRS LIMITING, RUDDER MECH LMTR and RUDDER HYDR LMTR annunciator lights and rudder limiter mechanical and hydraulic PUSH lights on with flaps extended and airspeed (___) knots.
	2. 27-51-00 Fig. 111 (Sheet 1) Block 1
27 51 14 00	1. LRS INOP switchlight, FLAP LRS INOP, and FLAP LRS LIMITING annunciator lights blinking. Flaps (____) degrees and airspeed (____) knots.
	2. 27-51-00 Fig. 111 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 51 15 00	1. FLAP LRS aural warning (Buzzer) failed to sound with FLAP LRS INOP light on and flap handle greater than 3 degrees. 2. 31-22-00 Fig. 116 Block 1
27 51 16 00	1. LRS INOP switchlight, FLAP LRS INOP, FLAP LRS LIMITING and RUDDER HYDR LMTR annunciator lights on with flaps retracted and airspeed (___) knots. 2. 27-51-00 Fig. 111 (Sheet 1) Block 1
27 51 17 00	1. LRS INOP switchlight, FLAP LRS INOP, FLAP LRS LIMITING and RUDDER HYDR annunciator and rudder limiter hydraulic PUSH lights on with flaps extended and airspeed (___) knots. 2. 27-51-00 Fig. 111 (Sheet 1) Block 1
27 51 18 00	1. NOT USED.
27 51 19 00	1. NOT USED.
27 51 20 00	1. NOT USED.
27 51 21 00	1. NOT USED.
27 51 22 00	1. NOT USED.
27 51 23 00	1. NOT USED.
27 51 24 00	1. NOT USED.
27 51 25 00	1. NOT USED.
27 51 26 00	1. FLAP ASYM DET FAULT annunciator light on (steady, intermittent) independent of flap movement. 2. 27-51-00 Fig. 104 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 51 27 00	1. FLAP ASYM DET FAULT annunciator light (on/flashes) during movement of flaps.
	2. 27-51-00 Fig. 104 (Sheet 1) Block 1
27 52 01 00	1. Flap position indicator tape(s) (do not agree with flap handle, do not indicate within range mark limits).
	2. 27-52-00 Fig. 103 Block 1
R 27 61 01 00 R R	1. Speedbrake spoiler actuation with flaps retracted. ROLL SPEED BRAKE light on Pilots annunciator panel on. No other indication.
	2. 27-61-00 Fig. 109 Block 1
27 61 02 00	1. Speedbrake spoiler actuation with flaps retracted. L5&6 and R5&6 spoiler PUSH lights on PFCS panel and FLT CONT PANELS light on Pilots annunciator panel on. ROLL SPEED BRAKE light on Pilots annunciator panel off.
	2. 27-61-00 Fig. 111 Block 1
27 61 03 00	1. Speedbrake spoiler actuation with flaps retracted. SPOILER L5&6 and R5&6 PUSH lights on PFCS panel on. ROLL SPEED BRAKE and FLT CONT PANELS lights on Pilots annunciator panel on.
	2. 27-61-00 Fig. 105 Block 1 27-61-00 Fig. 109 Block 1
27 61 04 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 01=Left, 32=All, 02=Right, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 21=LEFT OUTBD, 22=LEFT INBD, 31=RT INBD, 30=RT OUTBD) Spoiler(s) not fully retracted on ground with speedbrake lever full forward
	2. 27-61-00 Fig. 112 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 61 05 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 01=Left, 32=All, 02=Right, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 21=LEFT OUTBD, 22=LEFT INBD, 31=RT INBD, 30=RT OUTBD). Spoiler(s) not fully retracted in air with speedbrake lever full forward (spoiler float). 2. 27-61-00 Fig. 110 Block 1
27 61 06 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 01=Left, 32=All, 02=Right, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 21=LEFT OUTBD, 22=LEFT INBD, 31=RT INBD, 30=RT OUTBD). Spoiler(s) vibrate in air with speedbrake lever full forward and flaps at 10 degrees. 2. 27-61-00 Fig. 113 Block 1
27 61 07 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 01=Left, 32=All, 02=Right, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 21=LEFT OUTBD, 22=LEFT INBD, 31=RT INBD, 30=RT OUTBD) Spoiler(s) not responding to control system commands. 2. 27-61-00 Fig. 107 Block 1
27 61 08 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 01=Left, 32=All, 02=Right, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 21=Left Outbd, 22=Left Inbd, 30=Rt Outbd, 31=Rt Inbd) Spoiler(s) do not fully deploy. 2. 27-61-00 Fig. 115 Block 1
27 61 09 00	1. Speedbrake control lever stiff or notchy. 2. 27-61-00 Fig. 106 Block 1
27 61 10 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 61 11 __	1. (12=ROLL, 13=SPEEDBRAKE) spoiler actuation. Flaps extended. ROLL SPEED BRAKE light on Pilots annunciator panel on. No other indication.
	2. 27-61-00 Fig. 109 Block 1
27 61 12 __	1. (12=ROLL, 13=SPEEDBRAKE) spoiler actuation. Flaps extended. L5&6 and R5&6 spoiler PUSH lights on PFCS panel and FLT CONT PANELS light on Pilots annunciator panel on. ROLL SPEEDBRAKE light on Pilots annunciator panel off.
R	2. 27-61-00 Fig. 111 Block 1
27 61 13 __	1. (12=ROLL, 13=SPEEDBRAKE) spoiler actuation. Flaps extended. SPOILER L5&6 and R5&6 PUSH lights on PFCS panel on. ROLL SPEEDBRAKE and FLT CONT PANELS lights on Pilots annunciator panel on.
	2. 27-61-00 Fig. 105 Block 1 27-61-00 Fig. 109 Block 1
27 61 14 00	1. UNSAFE TAKEOFF aural warning sounds when go-around procedure initiated. (Ref. Chapter 31 for Fault Code diagram.)
	2. 27-61-00 Fig. 114 Block 1
27 61 15 00	1. Any one spoiler switchlight PUSH legend on, other annunciator legends off.
	2. 27-61-00 Fig. 111 Block 1
27 62 01 __	1. (21=L OUTBD, 22=L INBD, 31=R INBD, 30=R OUTBD) spoiler pointer(s) on Surface Position Indicator (does not follow spoiler movement, does not indicate actual spoiler position).
	2. 27-62-00 Fig. 103 Block 1
27 81 01 00	1. NOT USED.
27 81 02 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 81 03 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 20=7L, 01=LEFT, 32=All, 02=RIGHT, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 29=7R) slat segment light(s) on slat monitor panel off with slats fully extended. All other indications normal.
	2. 27-81-00 Fig. 110 (Sheet 1) Block 1
27 81 04 00	1. NOT USED.
27 81 05 00	1. NOT USED.
27 81 06 00	1. Slats will not extend. LE SLAT LOCK annunciator light off.
	2. 27-81-00 Fig. 105 Block 1
27 81 07 00	1. NOT USED.
27 81 08 00	1. LE slats failed to fully extend. LE TRANS light remained on. FLAP/SLAT LOCK annunciator light off.
	2. 27-81-00 Fig. 105 Block 1
27 81 09 00	1. Slats slow or will not extend in flight. OK on ground.
	2. 27-81-00 Fig. 112 Block 1
27 81 10 __	1. (01=LEFT, 02=RIGHT) LE TRANS, LE EXT, and slat segment light(s) come on intermittently.
	2. 27-81-00 Fig. 110 (Sheet 2) Block 1
27 81 11 00	1. FLAP/SLAT LOCK annunciator light on, slat operation normal.
	2. 27-81-00 Fig. 109 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 81 12 00	1. FLAP/SLAT LOCK annunciator light on, slats will not extend.
	2. 27-81-00 Fig. 103 Block 1
27 81 13 00	1. FLAP/SLAT LOCK annunciator light comes on intermittently when slats fully extended (not moving).
	2. 27-81-00 Fig. 109 Block 1
27 81 14 00	1. SLAT ASYM DET FAULT annunciator light (steady, flashed) during movement of slats.
	2. 27-81-00 Fig. 104 Block 1
27 81 15 00	1. SLAT ASYM DET FAULT annunciator light on (steady/intermittent) independent of slat movement.
	2. 27-81-00 Fig. 104 Block 1
27 81 16 00	1. NOT USED.
27 81 17 00	1. NOT USED.
27 81 18 00	1. NOT USED.
27 81 19 00	1. NOT USED.
27 81 20 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 20=7L, 01=LEFT, 32=All, 02=RIGHT, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 29=7R) slat segment light(s) on slat monitor panel on with slats fully retracted. All other indications normal.
	2. 27-81-00 Fig. 111 Block 1
27 81 21 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 81 22 00	1. Slats will not retract. FLAP/SLAT LOCK annunciator light off; LE EXT light on.
	2. 27-81-00 Fig. 105 Block 1
27 81 23 00	1. Slats will not retract. FLAP/SLAT LOCK annunciator light on.
	2. 27-81-00 Fig. 103 Block 1
27 81 24 00	1. FLAP/SLAT LOCK annunciator light on intermittently when slats fully retracted (not moving).
	2. 27-81-00 Fig. 109 Block 1
27 81 25 __	1. (14=1L, 15=2L, 16=3L, 17=4L, 18=5L, 19=6L, 20=7L, 01=LEFT, 32=All, 02=RIGHT, 23=1R, 24=2R, 25=3R, 26=4R, 27=5R, 28=6R, 29=7R) wing slat monitor lights off. LE TRANS light remains on and LE EXTEND light fails to come on when slats fully extended.
	2. 27-81-00 Fig. 110 (Sheet 1) Block 1
27 82 01 00	1. Slat position pointer does not follow slat movement. All other indications normal.
	2. 27-82-00 Fig. 105 Block 1
27 82 02 00	1. Slat position indicator off flag showing, indicator pointers work normally.
	2. 27-82-00 Fig. 105 Block 1
27 82 03 00	1. LE EXT light off with slats fully extended. All other indications normal.
	2. 27-82-00 Fig. 104 Block 1

FAULT CODE INDEX
TABLE 1

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
27 82 04 00	1. LE TRANS light off during slat extension. LE EXT light on when slats fully extended. 2. 27-82-00 Fig. 103 Block 1
27 82 05 00	1. NOT USED.
27 82 06 00	1. NOT USED.
27 82 07 00	1. NOT USED.
27 82 08 00	1. NOT USED.
27 82 09 00	1. LE TRANS light off during slat retraction. Slat operation normal. 2. 27-82-00 Fig. 103 Block 1

FLIGHT CONTROLS - DESCRIPTION AND OPERATION

1. General

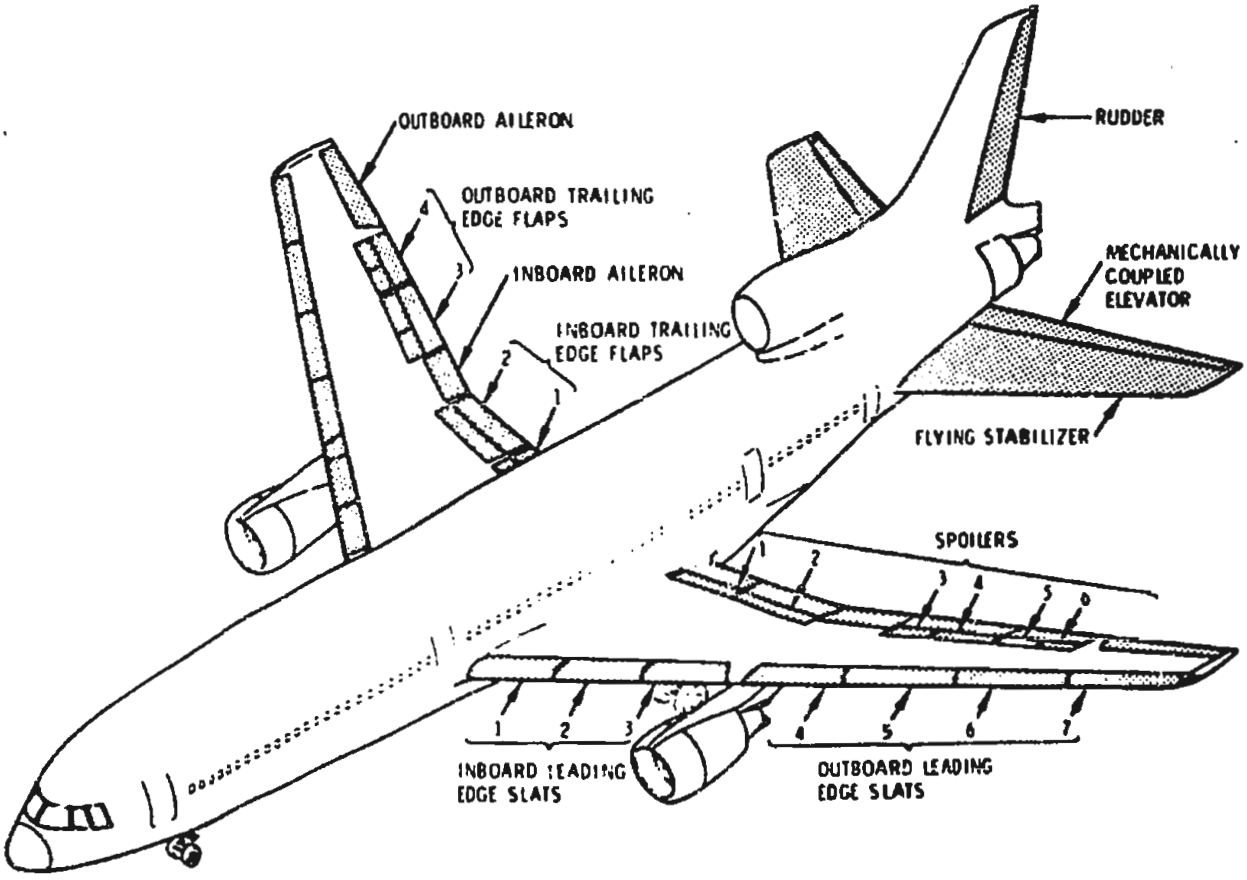
The primary flight control system consists of the movable surfaces that control the aircraft around the three control axes (Ref. Fig. 1). Lateral control (roll) is provided by deflecting the ailerons and deploying spoiler panels; longitudinal control (pitch) is accomplished by positioning the horizontal stabilizer/elevator combination; directional control (yaw) is achieved by rotating the rudder. The ailerons, elevators, and rudder are balanced surfaces. The secondary flight controls consist of leading edge slats and trailing edge flaps. The flaps and slats provide high-lift augmentation for landing and takeoff.

Aircraft trim for the three axes is provided by mechanical trim control wheels on the pilots center console and electrical pitch control thumbwheels on the control wheels (Ref. Fig. 2). Trim actuation is accomplished by mechanical actuators in roll and yaw, and mechanical and electrical actuators in pitch. In all cases, the actuator output is applied through a feel spring to shift the neutral force position of the control system and apply an input to the system servo, which positions the control surface. No trim tabs are used on any surface.

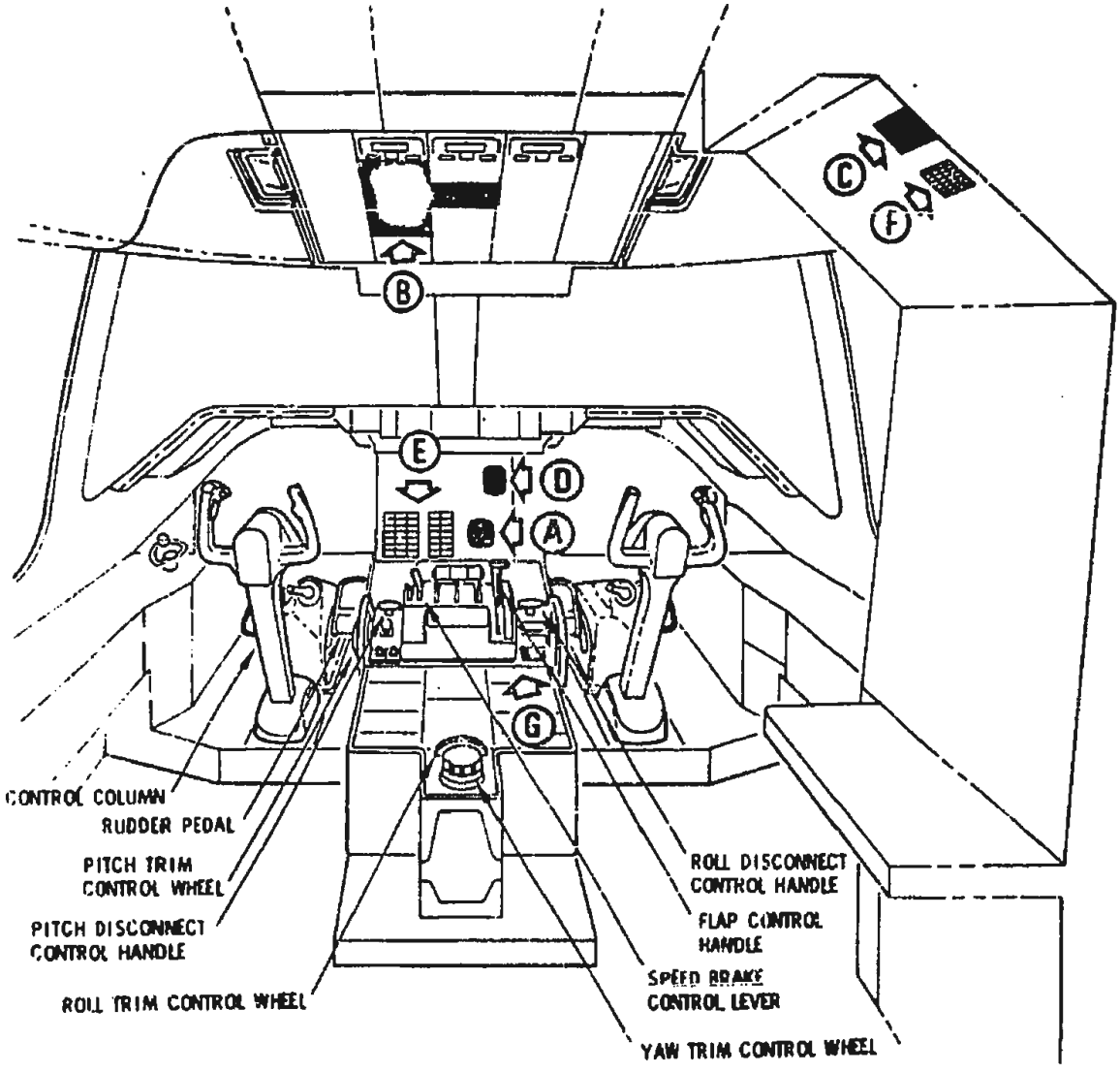
R Visual indication of surface position is provided for pilot
R information. A surface position indicator on the pilots center instrument panel displays the position of the inboard and outboard ailerons, rudder, stabilizer, and spoilers. A flap position indicator on the pilots center instrument panel and a slat indicator on the Flight Engineer/Second Officers panel show surface position of their respective systems (Ref. Fig. 2, Sheet 2).

Artificial stall warning is provided to the pilots by stick shakers which vibrate the control columns when the aircraft speed is less than 1.07 times the stall speed. The stall warning signal also initiates spoiler retraction. The intelligence to operate the stick shaker is derived from a combination of angle-of-attack, landing gear position, slat position, and flap position (Ref. Fig. 3). Dual sensors are used for fail-safe operation; the Captains and First Officers systems are independent (Ref. 22-17-00).

A takeoff aural warning system is provided. Sensors or switches detect the position of the speed brake lever, throttle levers, trailing edge flaps, leading edge slats, and horizontal stabilizer. The pilots are provided with an audible warning if any of the above controls are not in the proper position when



Control Surface Arrangement
Figure 1



HH 6555
M1-5101-27-004

Flight Station Controls
Figure 2 (Sheet 1)

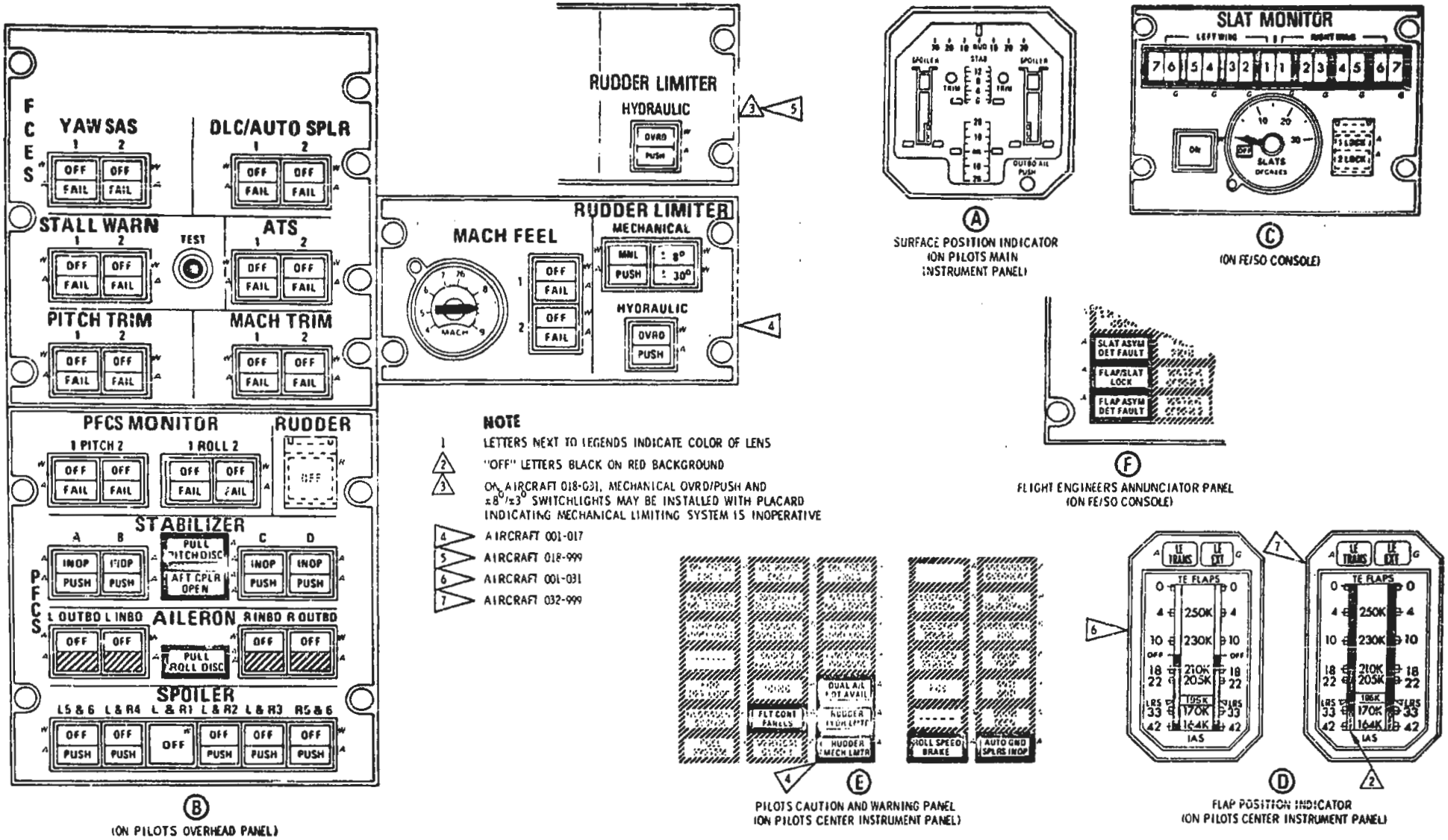
R

the aircraft is on the ground and the throttles are advanced beyond 50 percent of takeoff thrust (Ref. Fig. 4). The sensors or switches provide signal inputs to a proximity switch logic box which activates the aural warning unit and produces an
CR intermittent horn sound (Ref. 31-22-00). Sensors and switches
CR detect the position of the speedbrake lever, throttle levers,
CR trailing edge flap lever and flaps, leading edge slats, and
CR horizontal stabilizer. A flap limit switch also provides "Flaps
CR in landing or not in landing" configuration to the Ground
CR Proximity Warning System.

On aircraft 001-031 with SB27-174, an elevator jam warning system is incorporated (Ref. Fig. 4). The elevator jam warning system is integrated with the takeoff aural warning system to produce an intermittent horn if an elevator jams prior to takeoff. The elevator control configuration is such that an elevator jam in an extreme nose-up condition will normally only be experienced during the preflight controls check when the stabilizer/elevator is fully deflected, consequently the elevator jam warning system is enabled only with aircraft on ground and all three throttles are retarded below takeoff position.

The system is configured so that with both elevator break detectors intact, 28V dc is routed through both break detectors in series to energize the elevator warning relay and open the circuit to the aural warning unit. With the aircraft in the air mode or with any one of the three throttles advanced past takeoff, 28V dc is applied to a set of closed contacts on the elevator warning relay to maintain the relay coil energized, thus inhibiting the elevator jam warning system. If, during ground check of the stabilizer/elevator control system, either elevator jams, the affected elevator down cable is loaded and causes the shear rivet in the down cable tie-rod to shear. This action causes the break detector to separate and break the circuit to the elevator warning system relay coil. The relay deenergizes and closes a set of contacts which supplies 28V dc to the aural warning unit to activate the intermittent horn and to turn on the ELEVATOR warning light on the pilots caution and warning panel.

The flight controls are positioned by full-power irreversible hydraulic servos. The hydraulic servos are controlled by conventional flight station controls through cables and pushrods. Fail-safe operation of the cable systems is accomplished by using dual cable runs for pitch and roll. Hydraulic supply fail-safe operation is provided by using four independent hydraulic supply systems to deliver hydraulic power to the flight control servos in various combinations. The hydraulic supply arrangement (Ref. Figs. 5 and 6) prevents the loss of control of any flight control system in the event of multiple hydraulic failures.



NOTE

1. LETTERS NEXT TO LEGENDS INDICATE COLOR OF LENS
2. "OFF" LETTERS BLACK ON RED BACKGROUND
3. ON AIRCRAFT 018-031, MECHANICAL OVRD/PUSH AND ±8°/±3° SWITCHLIGHTS MAY BE INSTALLED WITH PLACARD INDICATING MECHANICAL LIMITING SYSTEM IS INOPERATIVE
4. AIRCRAFT 001-017
5. AIRCRAFT 018-999
6. AIRCRAFT 001-031
7. AIRCRAFT 032-999

(B) (ON PILOTS OVERHEAD PANEL)

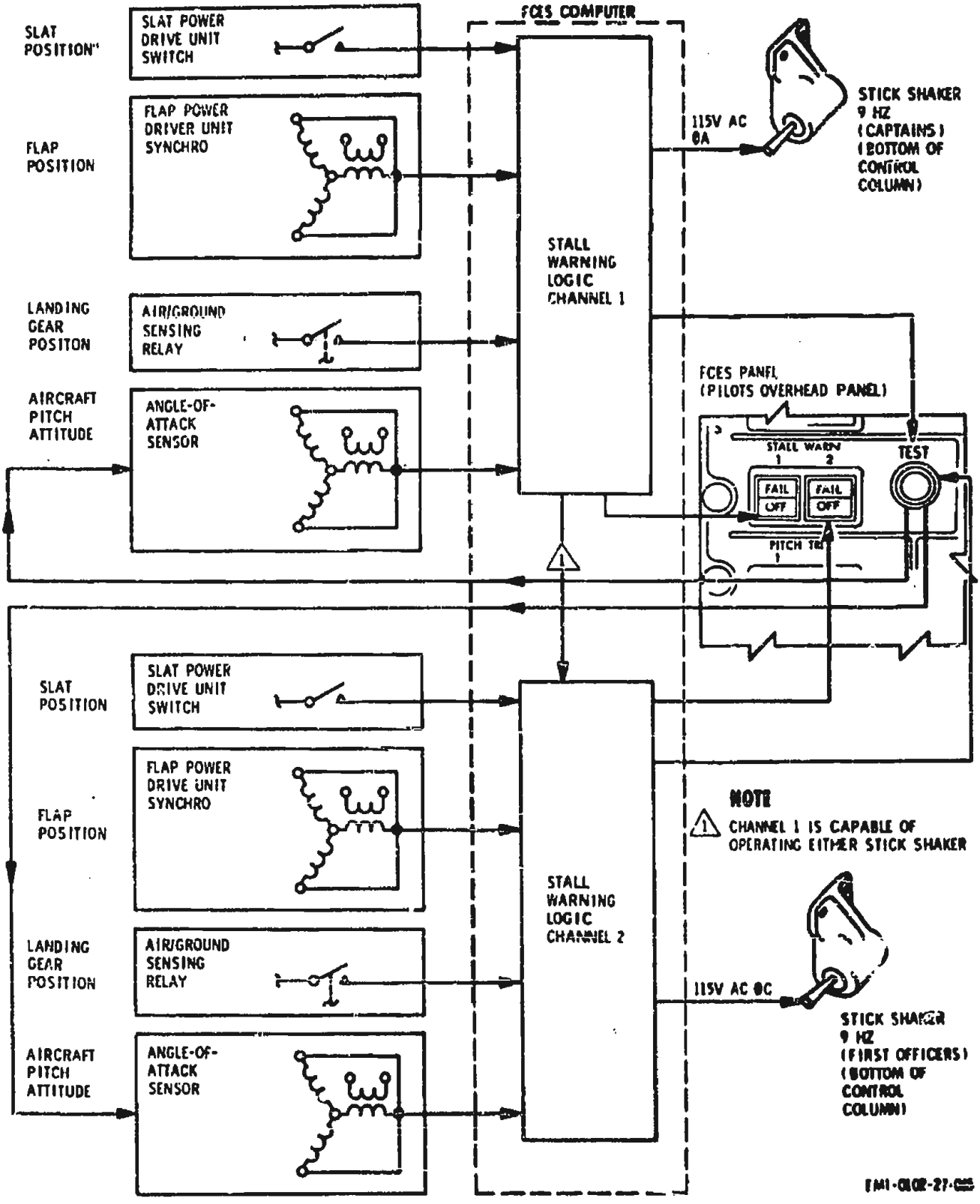
(A) (C) (D) (E) (F)

M1-0006-27-334

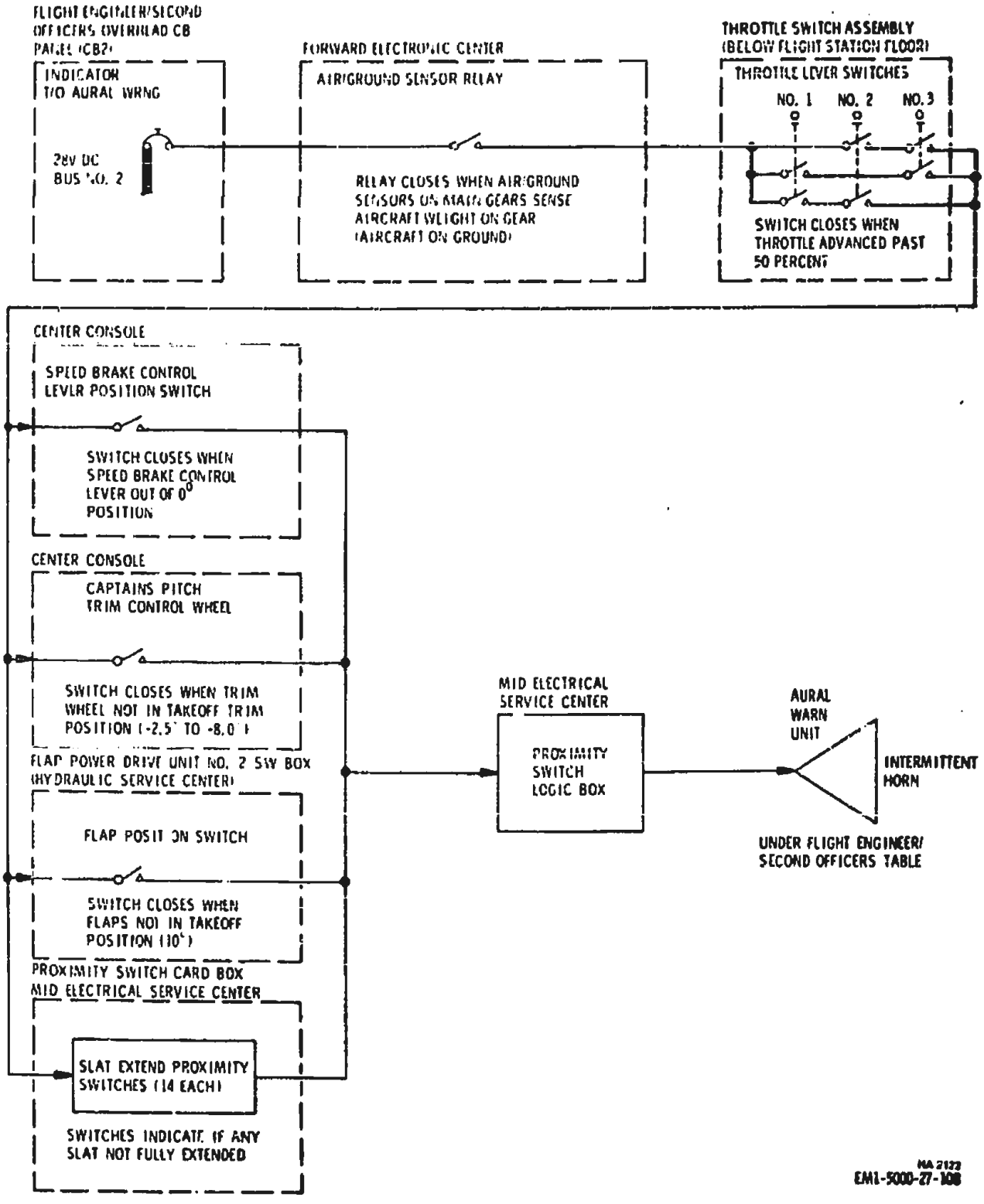
R R Flight Station Controls
Figure 2 (Sheet 2)

EFFECTIVITY: ALL

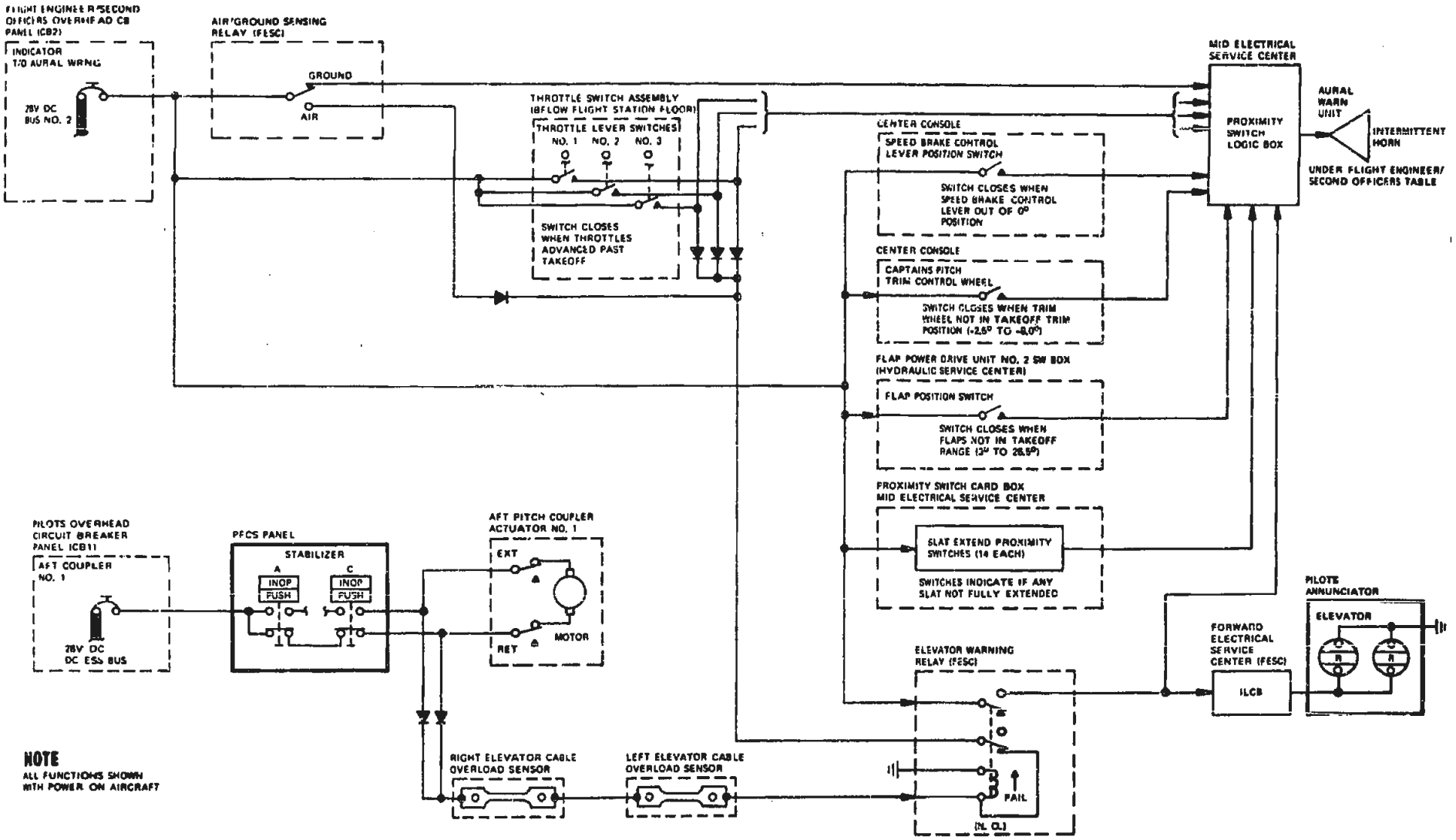
001B



R Artificial Stall Warning System Simplified Schematic
R Figure 3


FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CB PANEL (CB2)
INDICATOR T/O AURAL WRNG
28V DC BUS NO. 2
FORWARD ELECTRONIC CENTER
AIR/GROUND SENSOR RELAY
RELAY CLOSES WHEN AIR/GROUND SENSORS ON MAIN GEARS SENSE AIRCRAFT WEIGHT ON GEAR (AIRCRAFT ON GROUND)
THROTTLE SWITCH ASSEMBLY (BELOW FLIGHT STATION FLOOR)
THROTTLE LEVER SWITCHES
NO. 1
NO. 2
NO. 3
SWITCH CLOSES WHEN THROTTLE ADVANCED PAST 50 PERCENT
CENTER CONSOLE
SPEED BRAKE CONTROL LEVER POSITION SWITCH
SWITCH CLOSES WHEN SPEED BRAKE CONTROL LEVER OUT OF 0° POSITION
CENTER CONSOLE
CAPTAINS PITCH TRIM CONTROL WHEEL
SWITCH CLOSES WHEN TRIM WHEEL NOT IN TAKEOFF TRIM POSITION (-2.5° TO -8.0°)
FLAP POWER DRIVE UNIT NO. 2 SW BOX (HYDRAULIC SERVICE CENTER)
FLAP POSITION SWITCH
SWITCH CLOSES WHEN FLAPS NOT IN TAKEOFF POSITION (10°)
PROXIMITY SWITCH CARD BOX MID ELECTRICAL SERVICE CENTER
SLAT EXTEND PROXIMITY SWITCHES (14 EACH)
SWITCHES INDICATE IF ANY SLAT NOT FULLY EXTENDED
MID ELECTRICAL SERVICE CENTER
PROXIMITY SWITCH LOGIC BOX
AURAL WARN UNIT
INTERMITTENT HORN
UNDER FLIGHT ENGINEER/ SECOND OFFICERS TABLE
NA 2122
EM1-5000-27-108

R R Takeoff Aural Warning System Functional Schematic
Figure 4


FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CB PANEL (CB2)
INDICATOR T/O AURAL WRNG
28V DC BUS NO. 2
AIR/GROUND SENSING RELAY (FESC)
GROUND
AIR
THROTTLE SWITCH ASSEMBLY (BELOW FLIGHT STATION FLOOR)
THROTTLE LEVER SWITCHES
NO. 1 NO. 2 NO. 3
SWITCH CLOSES WHEN THROTTLES ADVANCED PAST TAKEOFF
MID ELECTRICAL SERVICE CENTER
PROXIMITY SWITCH LOGIC BOX
AURAL WARN UNIT
INTERMITTENT HORN
UNDER FLIGHT ENGINEER/ SECOND OFFICERS TABLE
CENTER CONSOLE
SPEED BRAKE CONTROL LEVER POSITION SWITCH
SWITCH CLOSES WHEN SPEED BRAKE CONTROL LEVER OUT OF 0° POSITION
CENTER CONSOLE
CAPTAINS PITCH TRIM CONTROL WHEEL
SWITCH CLOSES WHEN TRIM WHEEL NOT IN TAKEOFF TRIM POSITION (-2.6° TO -8.0°)
FLAP POWER DRIVE UNIT NO. 2 SW BOX (HYDRAULIC SERVICE CENTER)
FLAP POSITION SWITCH
SWITCH CLOSES WHEN FLAPS NOT IN TAKEOFF RANGE (3° TO 28.5°)
PROXIMITY SWITCH CARD BOX MID ELECTRICAL SERVICE CENTER
SLAT EXTEND PROXIMITY SWITCHES (14 EACH)
SWITCHES INDICATE IF ANY SLAT NOT FULLY EXTENDED
PILOTS OVERHEAD CIRCUIT BREAKER PANEL (CB11)
AFT COUPLER NO. 1
28V DC DC ESS BUS
PFCS PANEL
STABILIZER
A
C
INOP
PUSH
AFT PITCH COUPLER ACTUATOR NO. 1
EXT
RET
MOTOR
ELEVATOR WARNING RELAY (FESC)
FAIL
(N. O.)
FORWARD ELECTRICAL SERVICE CENTER (FESC)
ILCB
PILOTS ANNUNCIATOR
ELEVATOR
RIGHT ELEVATOR CABLE OVERLOAD SENSOR
LEFT ELEVATOR CABLE OVERLOAD SENSOR
NOTE
ALL FUNCTIONS SHOWN WITH POWER ON AIRCRAFT
M1-0000-27-718

Takeoff Aural Warning System Schematic
Figure 4

EFFECTIVITY: 001-031 WITH SB27-174 AND 032-999

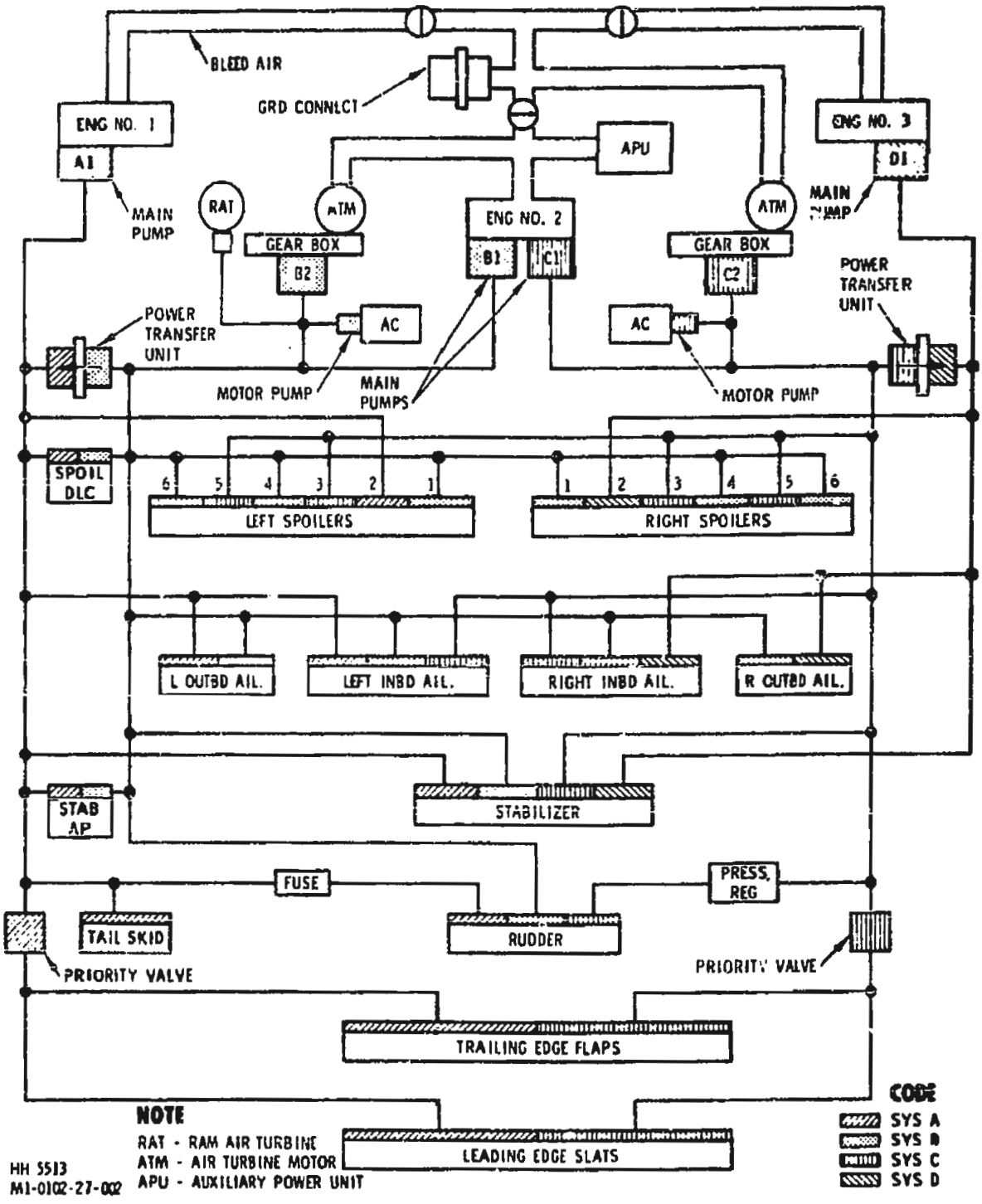
Hydraulic supply to the servos is as follows: the horizontal stabilizer is powered by all four hydraulic systems (A, B, C, and D); the rudder is powered by three hydraulic systems (A, B and C). The ailerons are also supplied by four hydraulic systems as follows: the left inboard aileron is supplied by system A, B and C; the left outboard aileron is supplied by system A and B; the right inboard aileron is supplied by system B, C and D; the right outboard aileron is supplied by system B and D. The six spoiler panels on each wing, numbered 1 to 6 with number 1 being the most inboard panel, are powered by all four hydraulic systems as follows: system A supplies spoiler 2 (left wing); system B supplies spoilers 1, 4, and 6 (both wings); system C supplies spoilers 3 and 5 (both wings); and system D supplies spoiler 2 (right wing).

A. Aileron (Roll) Control System

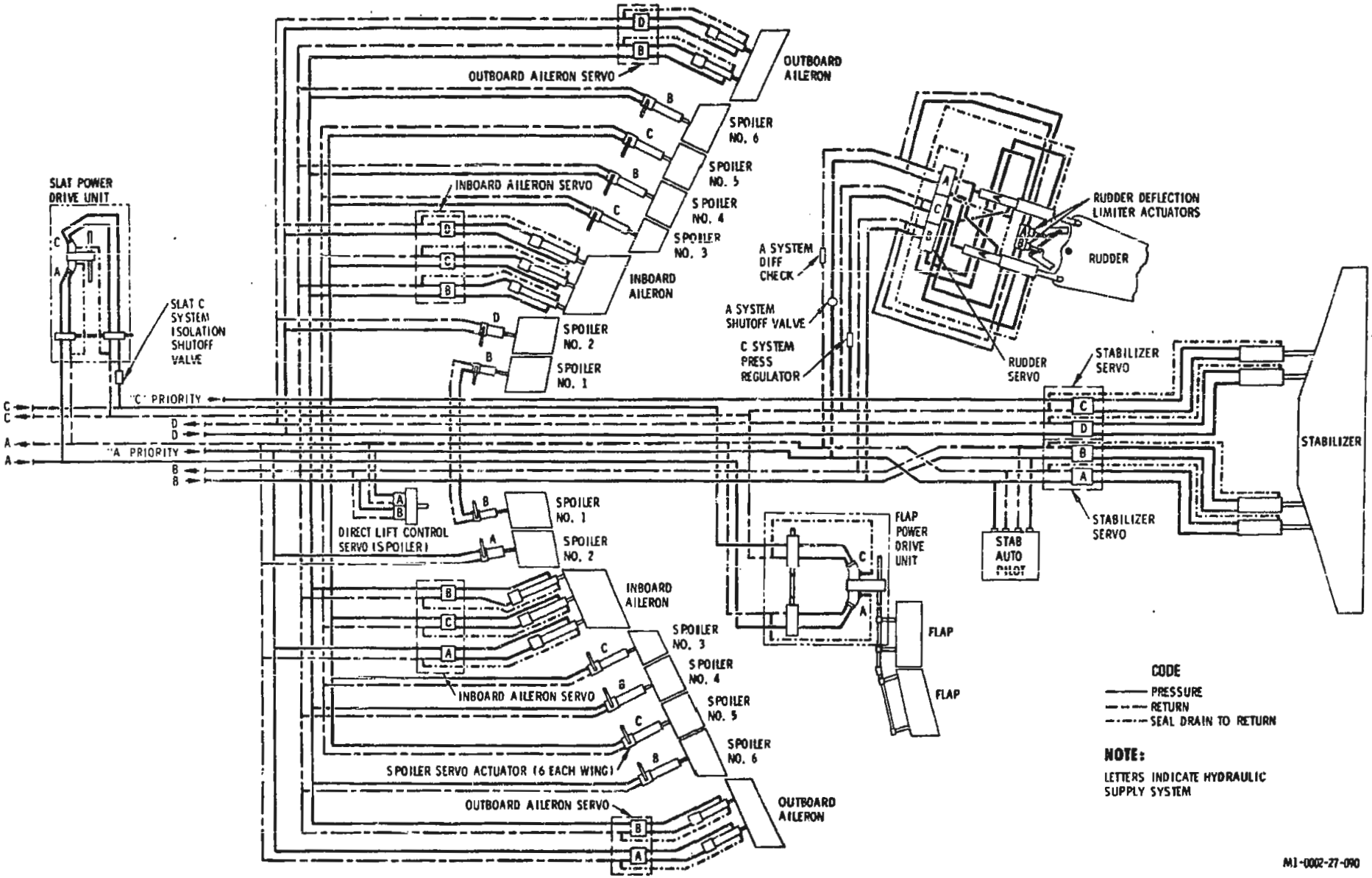
The roll control surfaces consist of two ailerons and five spoilers on each wing. [A sixth spoiler on each wing (No. 1 spoiler) is used for ground spoilers and DLC.]Roll assist by the spoilers is used only during low-speed (flaps-down) flight. Two independent cable systems are used to position the aileron servos. The Captains and First Officers controls are linked by a mechanical disconnect in the flight station and an aileron interconnecting spring bungee in the hydraulic service center (Ref. Fig. 7). The Captains control system operates the left inboard aileron servo which serves as the master servo. The left inboard aileron actuates the right inboard aileron servo through the rear interconnecting linkage and spring bungee. Both outboard aileron servos are slaved to their respective inboard ailerons through a pushrod and cable system.

The First Officers cable-linkage control path connects the flight station controls to the right inboard aileron servo. This control path is similar to the Captains, except that the cable drive bellcrank contains a lost-motion device which allows 15 percent of control wheel motion before the control system is actuated. The lost-motion device effectively decouples the First Officers control wheel from his cable system. Thus, movement of either control wheel operates the Captains cable system.

If either the Captains or First Officers aileron control path is jammed, the disconnect coupler is actuated by pulling the roll disconnect handle on the center console to separate the control wheels. Pulling the roll disconnect handle also actuates the lost-motion device which eliminates the lost-motion and directly couples the First Officers control wheel to his cable system. Deflection travel of all four ailerons is 20 degrees up and 20 degrees down from neutral.

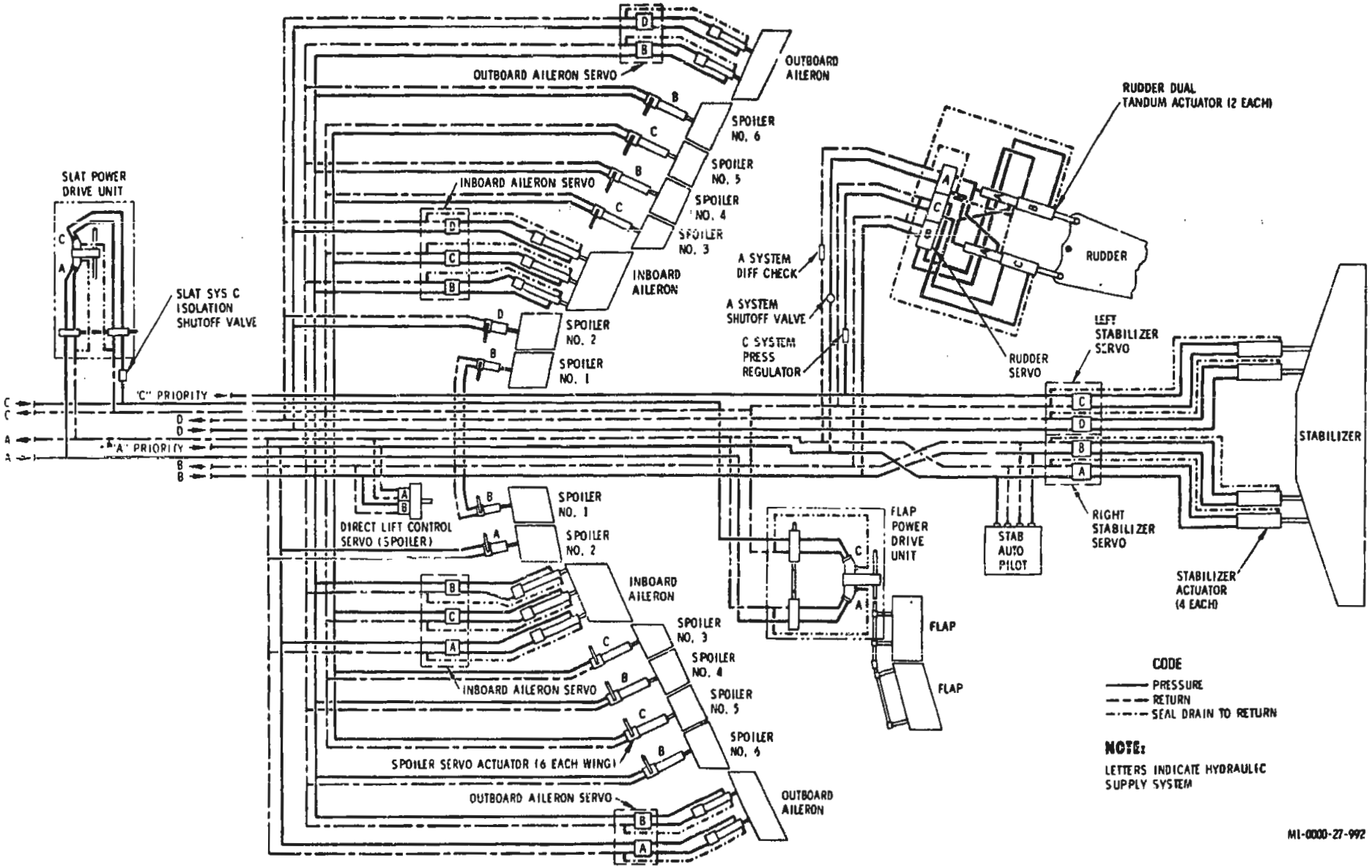


Flight Controls Hydraulic Power Distribution Block Diagram
Figure 5



Flight Controls Hydraulic Power Distribution Schematic
Figure 6

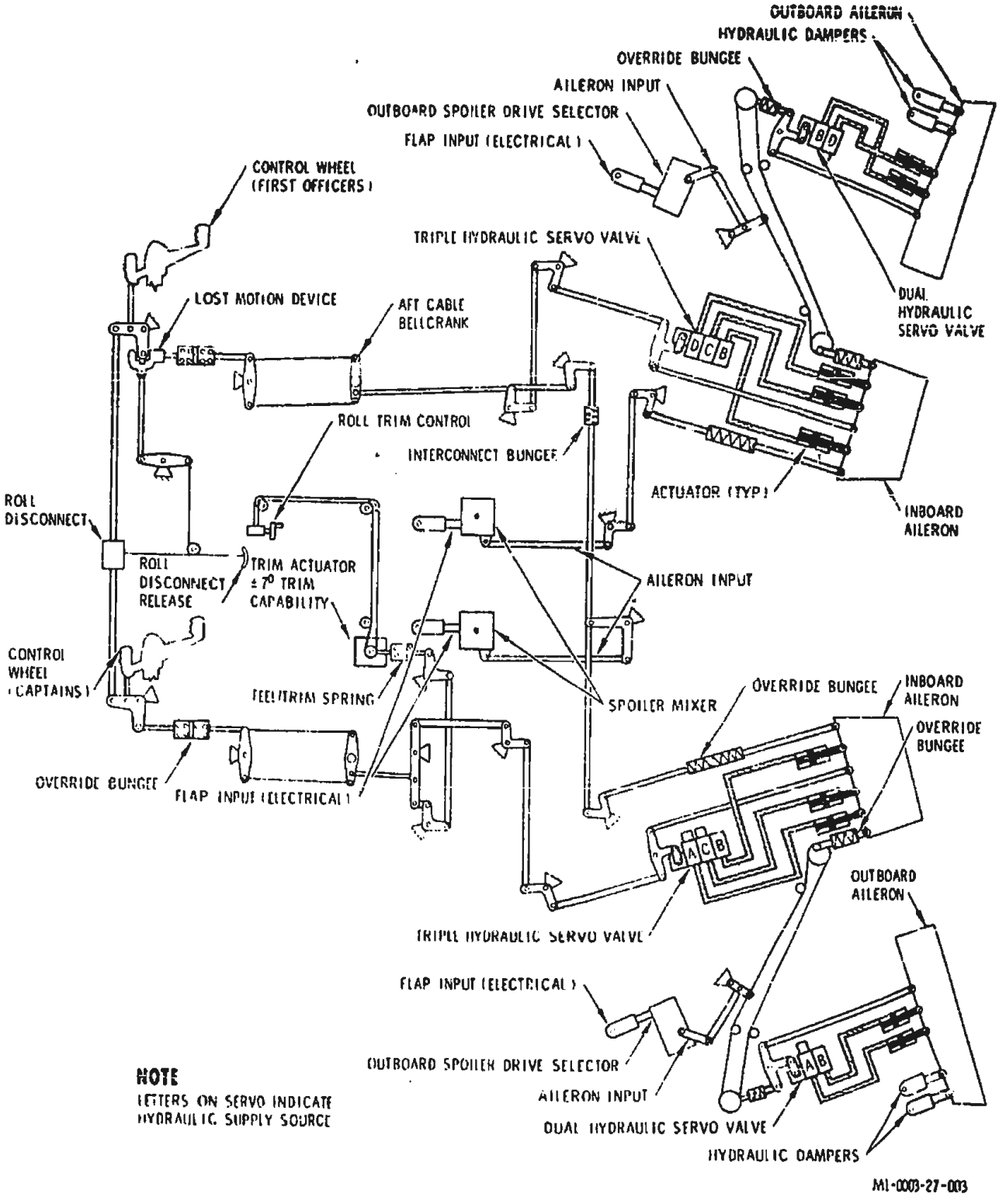
R EFFECTIVITY: 001-018, 021, 022
R
001B



R R Flight Controls Hydraulic Power Distribution Schematic
Figure 6

EFFECTIVITY: 019, 020, 023-036

001B



R
R

Aileron Control System Schematic
Figure 7

EFFECTIVITY: ALL

001B

Roll trim is accomplished by rotating the aileron trim control wheel on the center console (Ref. Fig. 2). Trim control wheel motion is transmitted by cables to a mechanical trim actuator in the hydraulic service center. Trim actuator output is applied to the Captains aileron control system through a feel spring to shift the neutral force position of the control system. The shift of aileron control system neutral causes the aileron servos to respond and position the ailerons to the new neutral force position. Aileron trim is reflected back to the control wheels. Trim capability is ±7 degrees.

The aileron control system is monitored for condition and performance. Aileron position is displayed on a surface position indicator on the pilots main instrument panel. Aileron servo status is shown on the primary flight control system (PFCS) monitor panel on the pilots overhead panel (Ref. Fig. 2, Sheet 2).

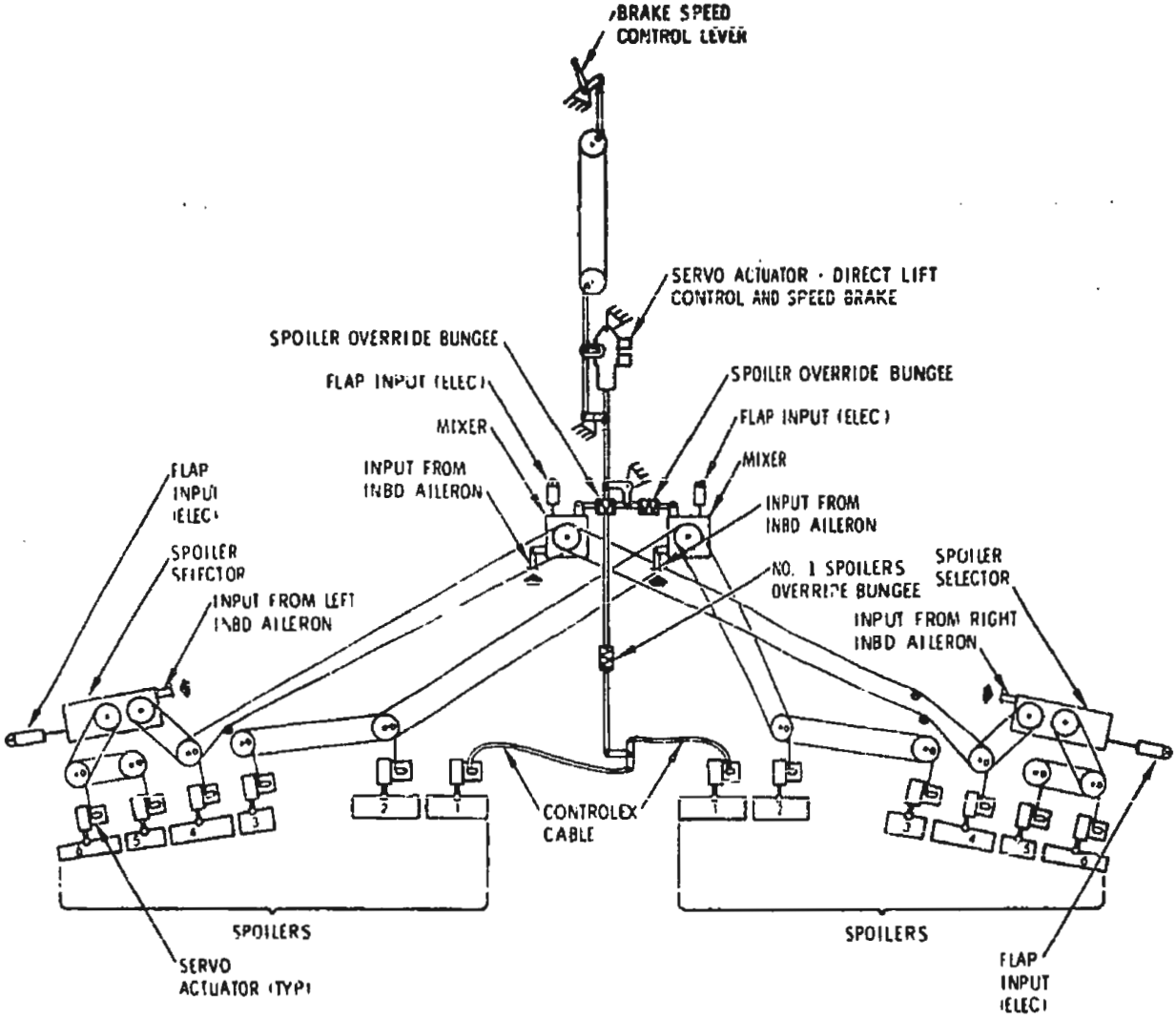
B. Spoiler and Speedbrake Control System

Spoilers are installed to improve roll control and to provide aerodynamic braking during flight and landing modes. Six symmetrical sets of wing spoilers are provided, numbered 1 through 6, with number 1 the most inboard panel on each wing (Ref. Fig. 8). Spoilers 2 through 6 are used to supplement the ailerons for roll control during low speed (flaps extended) flight, and are used for air speed brakes at high air speeds (flaps retracted). Spoilers 1 through 4 are used for ground speed brakes during the touchdown and rollout mode, and for lift control during the approach and landing mode. The spoilers may be manually operated by the speed brake lever on the center console (Ref. Fig. 2) or may be automatically operated by the direct lift control (DLC) servo in the hydraulic service center.

The spoiler control system is monitored by a surface position indicator on the pilots main instrument panel and a PFCS monitor panel on the pilots overhead panel (Ref. Fig. 2, Sheet 2). Spoiler position is displayed on the surface position indicator; Spoiler servo status is shown on the PFCS monitor panel.

The twelve spoiler servos are controlled by two mixer mechanisms in the wheel wells and two outboard spoiler selectors in the trailing edge of the outer wings. These mechanical mixers and selectors receive inputs from the flaps, ailerons, and the DLC servo.

The DLC servo is controlled by the speed brake control lever on the center console or by autopilot inputs (when engaged). In the manual mode, speed brake lever movement controls the



HH 4391
M1-A01-27-005

Spoiler Control System Schematic
Figure 8

DLC servo, which deploys the spoilers in proportion to lever movement. In the automatic mode, the DLC servo responds to autopilot commands for flight path vertical control during approach, and deploys spoilers as ground speed brakes upon touchdown.

C. Rudder (Yaw) Control System

The rudder control system (Ref. Fig. 9) consists of a single cable control path from the flight station rudder pedals to the rudder servo located in the base of the vertical stabilizer. The rudder servo is composed of three independent servo control valves housed in a single assembly. Hydraulic systems A, B, and C supply fluid pressure to the rudder servo. Actuation of the single rudder surface is accomplished by two dual-tandem actuators which provide three independent actuation paths.

In addition to manual inputs from the Captain or First Officer, the rudder servo accepts electrical inputs from the autopilot and the yaw damper. Total rudder deflection is 30.5 degrees left and right from neutral.

A system is provided to reduce rudder authority as aircraft speed increases.

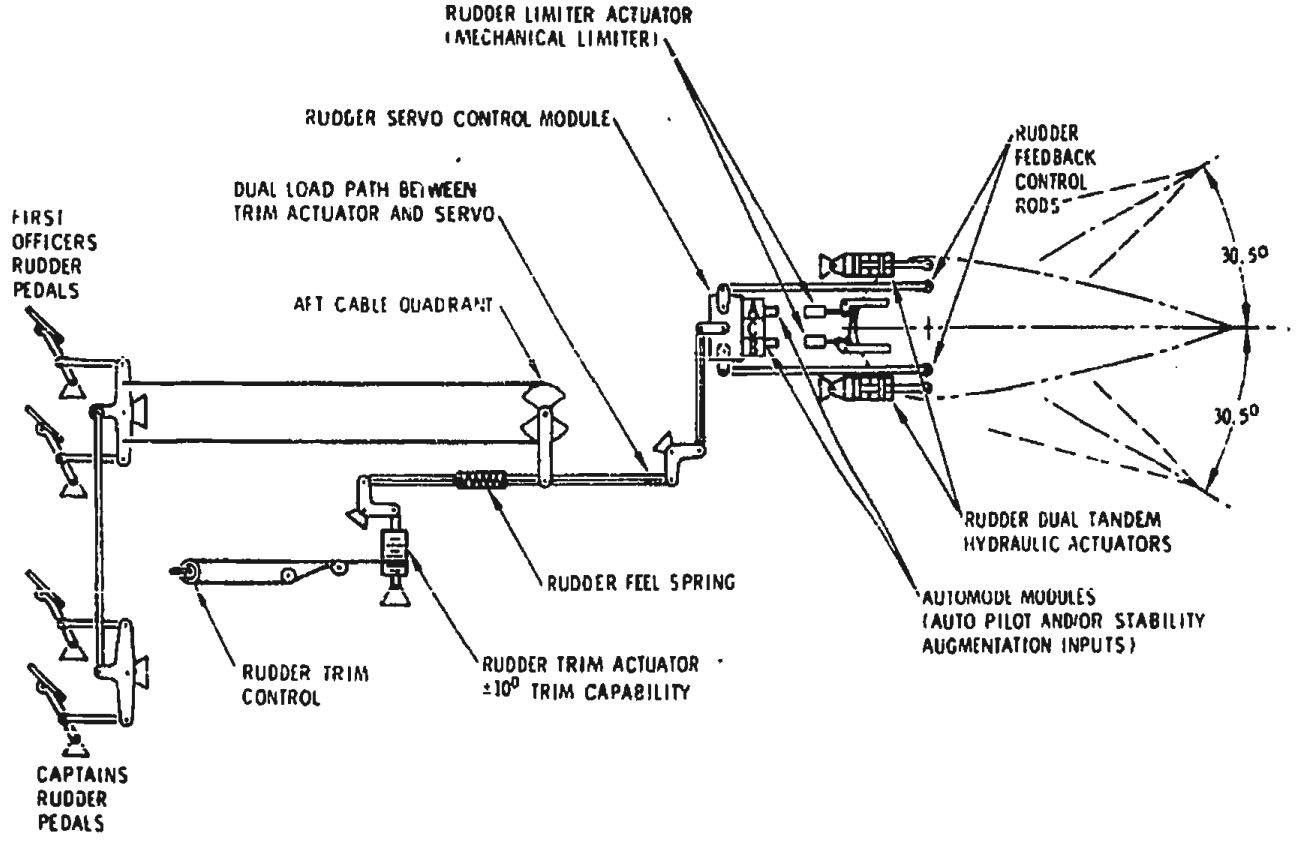
On aircraft 001-018, 021, 022,
when aircraft exceeds 164 knots, pressure to the rudder from hydraulic systems A and B is automatically shut off, and at over 260 knots pressure to the rudder from hydraulic system C is reduced from 3000 psi to 2000 psi.

On aircraft 019, 020, 025-999,
when aircraft exceeds 164 kts, pressure to the rudder from hydraulic system A is automatically shut off and pressure to the rudder from hydraulic system C is reduced from 3000 psi to 2000 psi. At over 260 knots, pressure to the rudder from hydraulic system B is also shut off.

R On aircraft 001-017
in addition to hydraulic limiting of the rudder, mechanical limiting is also used.

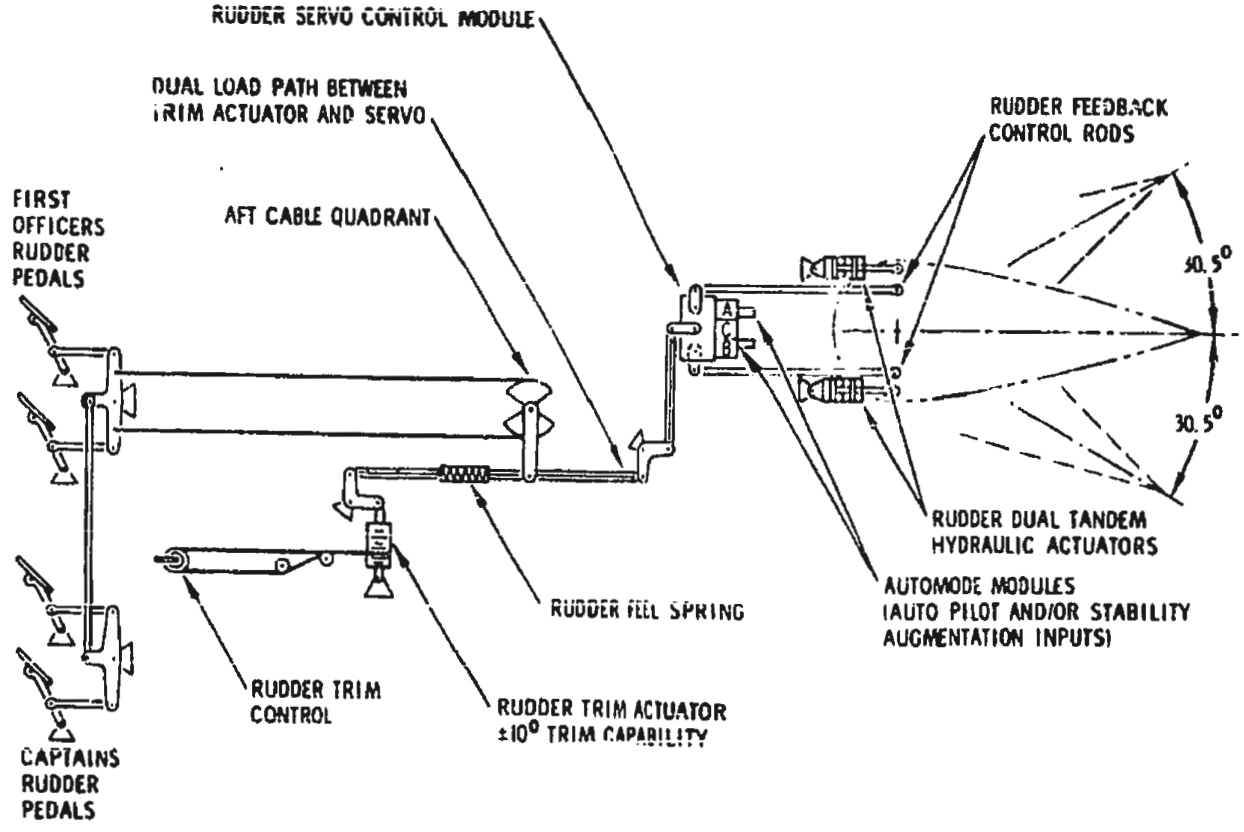
At speeds above 164 knots, limiter arms are actuated within the rudder hinge mechanism to limit rudder travel to 8 degrees left and right from neutral.

Rudder trim is accomplished by rotating a rudder trim wheel on the flight station center console (Ref. Fig. 2) which positions a mechanical trim actuator located below the rudder servo. The output of the trim actuator is applied to the pilots rudder servo control system through a feel spring



M1-0102-27-006

Rudder Control System Schematic
Figure 9


RUDDER SERVO CONTROL MODULE
DUAL LOAD PATH BETWEEN TRIM ACTUATOR AND SERVO
AFT CABLE QUADRANT
FIRST OFFICERS RUDDER PEDALS
RUDDER FEEDBACK CONTROL RODS
30.5°
30.5°
RUDDER DUAL TANDEM HYDRAULIC ACTUATORS
AUTOMODE MODULES (AUTO PILOT AND/OR STABILITY AUGMENTATION INPUTS)
RUDDER FEEL SPRING
RUDDER TRIM CONTROL
RUDDER TRIM ACTUATOR ±10° TRIM CAPABILITY
CAPTAINS RUDDER PEDALS

M1-0000-27-663

Rudder Control System Schematic
Figure 9

to trim the rudder. Rudder trim is reflected back to the rudder pedals. Rudder trim capability is ten degrees left and right from neutral.

The rudder control system is monitored for both condition and performance. Rudder position is displayed on a surface position indicator on the pilots main instrument panel. Rudder servo status is shown on the PFCS monitor panel on the pilots overhead panel (Ref. Fig. 2, Sheet 2).

D. Stabilizer (Pitch) Control System

The pitch control system uses a flying stabilizer and mechanically coupled elevator to control the pitch attitude of the aircraft. Conventional flight station control columns drive two independent cable systems that terminate at tension regulators in the ceiling of the aft cargo compartment (Ref. Fig. 10).

The output of the tension regulators is applied through pushrods and bellcranks to two dual hydraulic servos in the afterbody. Each servo contains two hydraulically independent control valves. Each of the four servo control valves are supplied by a separate hydraulic system (A, B, C, and D) and, in turn, each servo control valve controls a seperate stabilizer actuator. This arrangement provides maximum protection by providing two servo control paths and four hydraulic actuation paths.

The flying stabilizer is an effective pitch control surface, especially at high speeds. The low-speed characteristics of the stabilizer is improved by using a mechanically coupled elevator. The elevator positioning mechanism is mounted in the stabilizer and is connected by cables to the afterbody structures. When the stabilizer moves in a leading-edge-down direction (aircraft nose up), the elevator is positioned in an up direction. Elevator displacement effectively changes the camber of the stabilizer/elevator airfoil to improve pitchup control during the landing flareout. The stabilizer and elevator deflection ratios are: with the stabilizer leading edge 1 degree up from neutral, the elevator trailing edge is essentially faired to the stabilizer; with the stabilizer leading edge 14 degrees down from neutral, the elevator trailing edge is 25 degrees up from faired with stabilizer.

The pitch control system is capable of receiving autopilot inputs from a dual autopilot servo installed near the stabilizer servos. Autopilot servo outputs are applied to the pilot-to-stabilizer servo control linkage which controls the positioning of the stabilizer servo control valves.

Stabilizer trim (manual and electric) and artifical feel is provided by two feel/trim assemblies located between the two stabilizer servos. The right feel/trim assembly receives manual inputs from the trim control wheels on the flight station center pedestal. The left feel/trim assembly receives all electric trim inputs (pilot electric, autopilot trim, and mach trim). The pilot electric trim is controlled by thumbwheels on both control wheels.

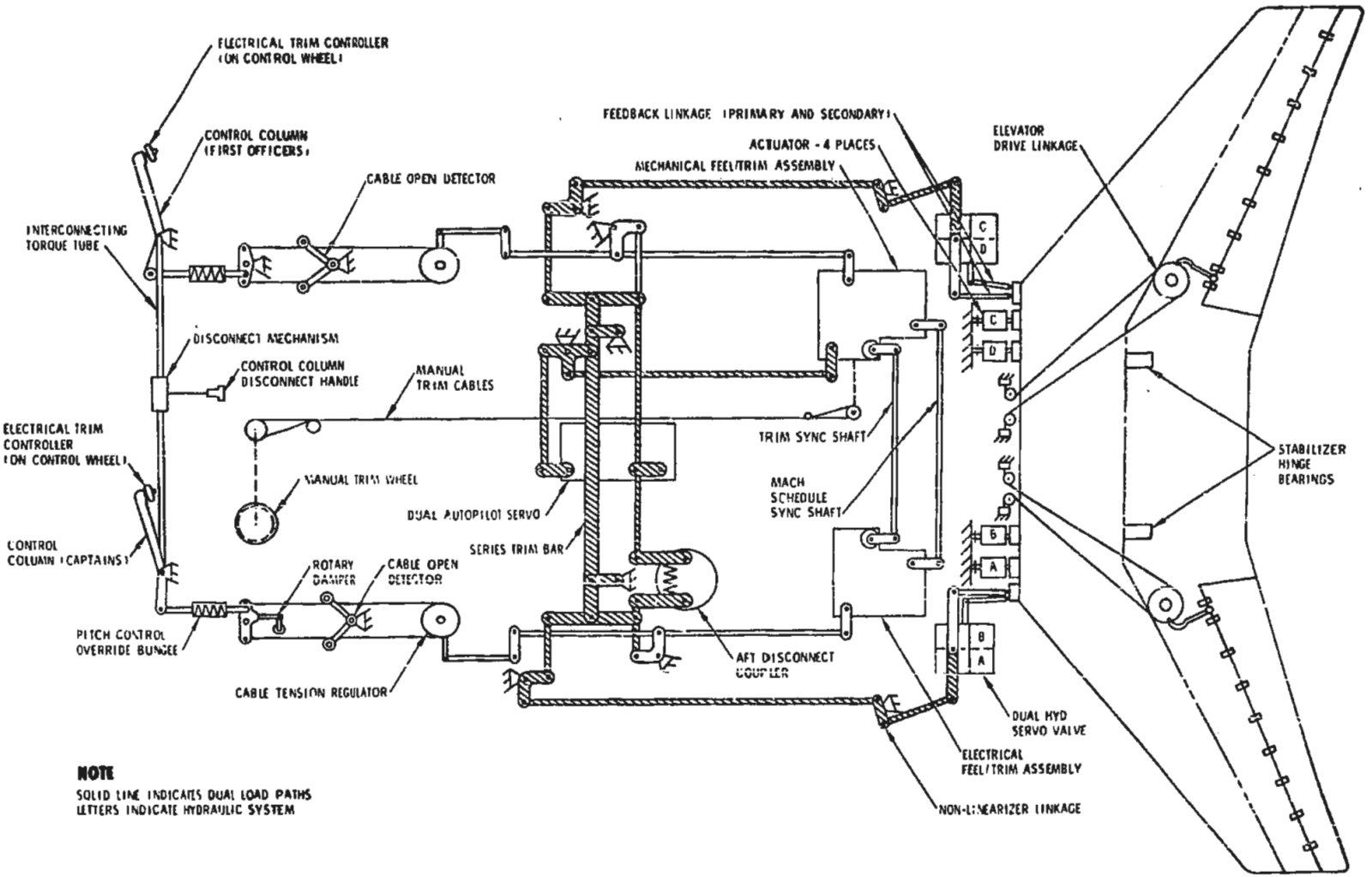
The two trim/feel assemblies are coupled together by two torque tubes so that all manual and electric trim commands are shared equally by both feel/trim assemblies. Trim output (manual and electric) is applied through the feel spring of both feel/trim assemblies and shifts the neutral force position of the pilots stabilizer control system. The force of the feel springs applies an input to both stabilizer servos and positions the stabilizer to the new neutral force position. All stabilizer trim is reflected back to the control columns.

The position of the stabilizer and the condition of the hydraulic servos are monitored by a surface position indicator on the pilots main instrument panel and a PFCS monitor panel on the pilots overhead panel (Ref. Fig. 2, Sheet 2).

E. Lift Augmentation Control System

Lift augmentation is provided by double-slotted Fowler trailing edge flaps and leading edge slats. The flap and slat systems are hydromechanically operated and are controlled from the same flap control handle (Ref. Fig. 2). Flap and slat extend and retract sequence is manually controlled by the flap handle. The flap handle contacts a pawl gate at the 4 degree position for both flaps extend or retract. The pilot can release the gate at any time, but normal operation is to allow the slats to fully extend (flap extend sequence) or the slats to fully retract (flap retract sequence) before the pilot release the pawl gate and positions the flap handle past 4 degrees. The trailing edge flaps consist of four flap surfaces on each wing; two inboard surfaces and two outboard surfaces (Ref. Fig. 11). Each flap surface is supplemented aerodynamically by a vane surface which is mechanically positioned by flap movement through a spring-loaded folding link assembly. The vane surface improves flap performance by helping to control airflow over the flap surface.

The flap system is powered by a dual power drive unit (PDU) supplied by hydraulic systems A and C. Two hydraulic motors controlled by dual control valves power a single gearbox which drives the flaps through a system of torque tubes,

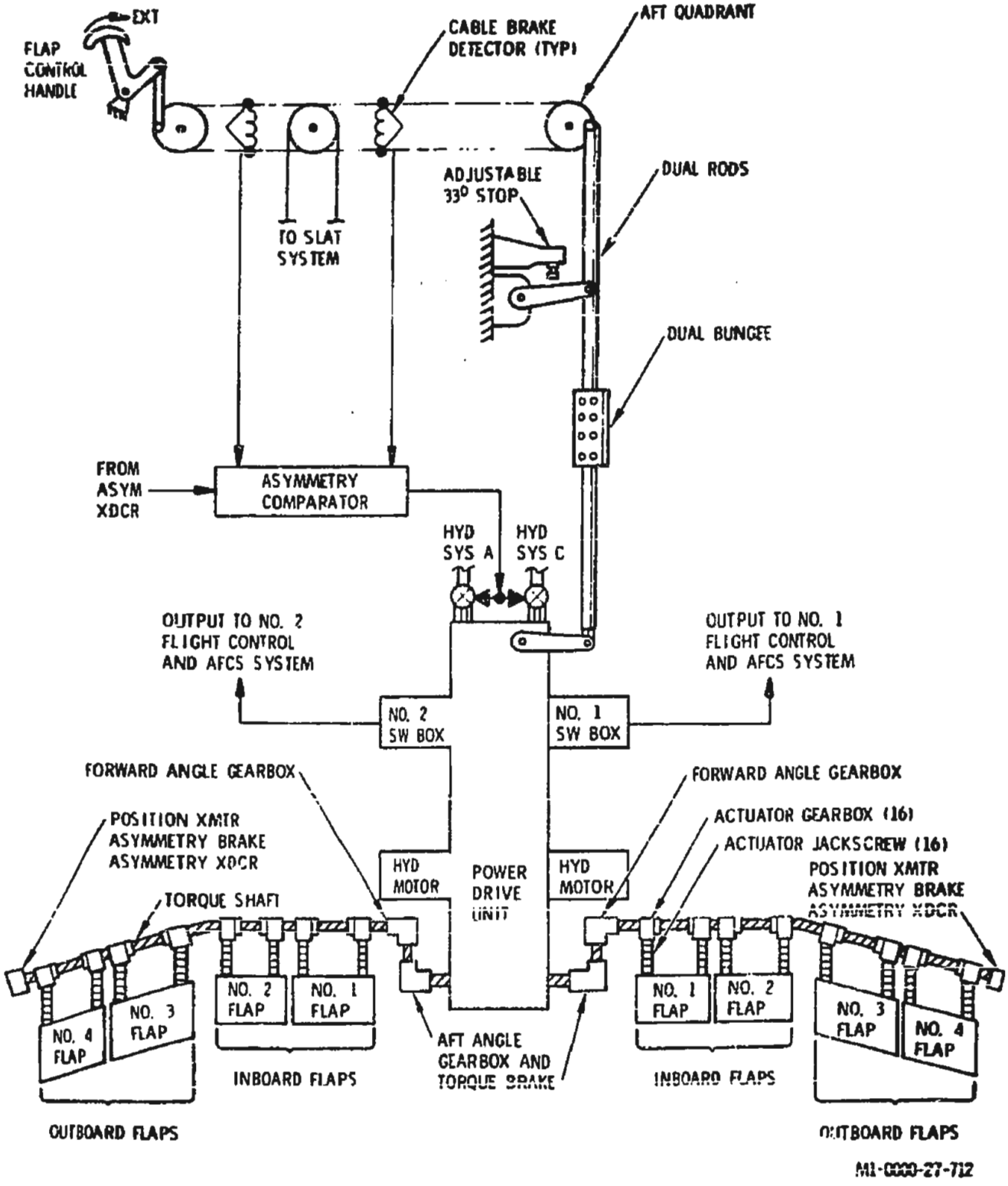


NOTE
SOLID LINE INDICATES DUAL LOAD PATHS
LETTERS INDICATE HYDRAULIC SYSTEM

M1-0101-27-007

Stabilizer Control System Schematic
Figure 10

R
R
0018 EFFECTIVITY: ALL



R Flap Control System Schematic
R Figure 11

EFFECTIVITY: ALL

001B

gearboxes, and jackscrews. The flaps are protected from a jammed or broken flap drive component by an asymmetry detection system that will shut off the hydraulic drive system and actuate the torque tube brakes to lock the flaps. Flap position is displayed on a flap position indicator mounted on the pilots center instrument panel (Ref. Fig. 2, Sheet 2).

The leading edge slat system consists of seven slat panels on each wing and a hydraulically operated drive system (Ref. Fig. 12). The slat system is driven by a dual power drive unit (PDU) located in the left wing leading edge. The PDU contains dual control valves and two hydraulic motors to operate the torque shaft system that extends along the leading edge of the wings. The PDU receives hydraulic power from systems A and C. Fourteen jackscrew actuators convert the rotary power of the torque shaft to lineal travel of the fourteen track-guided slat panels. The three inboard slat panels can deflect 28 degrees, and the four outboard slat panels can deflect 30 degrees.

The slat system is protected from a jammed or broken slat drive unit by an asymmetry detection system. Rotary transducers coupled to the outboard ends of the torque tube automatically shut off hydraulic power to the slat system and apply torque tube brakes when a slat asymmetry is detected.

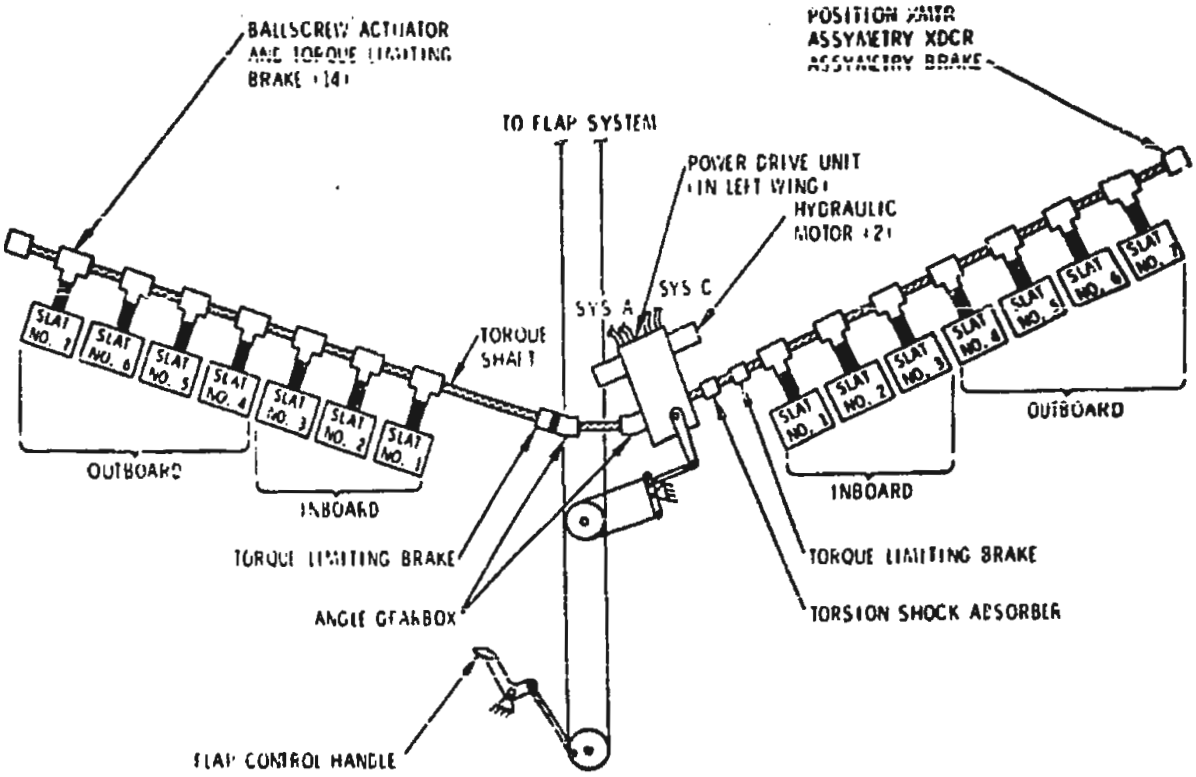
Slat position is displayed on a slat monitor panel. The slat monitor panel is mounted on the Flight Engineer/Second Officers console panel and depicts slat position for the left and right slat system as well as the full extend position of each individual slat (Ref. Fig. 2, Sheet 2).

2. Surface Position Indicator

A. Description

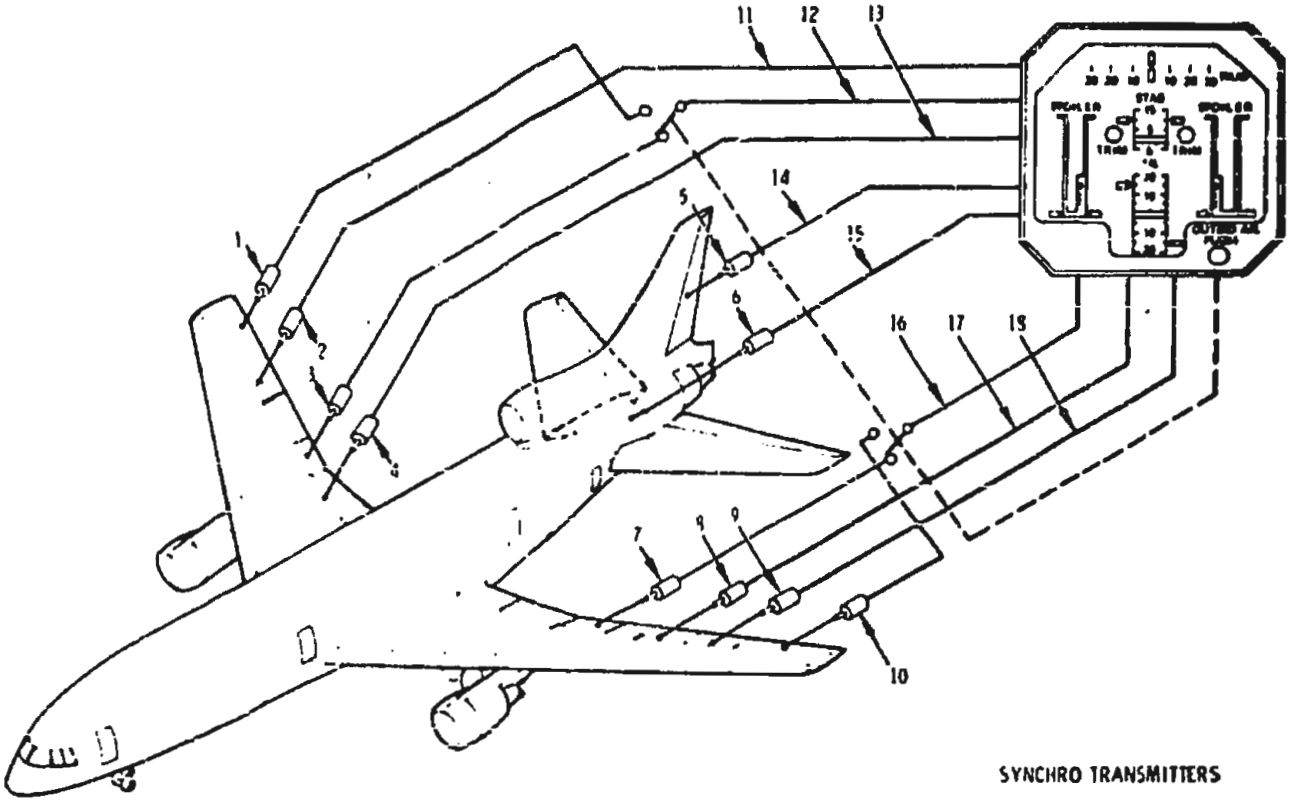
The surface position indicator displays the relative position of the primary aircraft control surfaces and provides a visual indication of control surface motion.

Eight pointers, driven by surface position synchro transmitters are used in the surface position indicator (Ref. Fig. 13). The eight pointers indicate position of the rudder, stabilizer, left and right wing inboard and outboard ailerons, and left and right wing inboard and outboard spoilers. The surface position indicator is mounted on the pilots main instrument panel (Ref. Fig. 2).



M1-A01-27-009

Slat Control System Schematic
Figure 12



SYNCHRO TRANSMITTERS

1 R OUTBD AILERON
2 NO. 3 SPOILER
3 R INBD AILERON
4 NO. 2 SPOILER
5 RUDDER
6 STABILIZER
7 L INBD AILERON
8 NO. 4 SPOILER
9 NO. 5 SPOILER
10 L OUTBD AILERON

POSITION INDICATOR POINTERS

11 R OUTBD SPOILER
12 R AILERON
13 R INBD SPOILER
14 RUDDER
15 STABILIZER
16 L AILERON
17 L INBD SPOILER
18 L OUTBD SPOILER

A11-A00-27-075

Surface Position Indicator Functional Diagram
Figure 13

The aileron pointers normally show the inboard aileron positions; however, when the OUTBD AIL pushbutton on the indicator is depressed the pointers show the outboard aileron position.

The outboard spoiler pointers show the position of spoiler 5 on the left wing and spoiler 6 on the right wing. The inboard spoiler pointers show the position of spoiler 4 on the left wing and spoiler 2 on the right wing. When the direct lift control (DLC) servo is operating in the automatic mode (flaps and throttles positioned for landing) the inboard spoiler pointers are in the DLC portion of the display. Full scale deflection of the spoiler pointers represents 60 degrees of spoiler deflection.

The two trim warning indicators show when an autotrim signal has been generated in the Trim Augmentation Computer (Ref. 22-18-00). Normally, the two trim indicators show black; however, when autotrim signals are driving the two trim motors on the electrical pitch feel/trim assembly, the indicators will momentarily show yellow. A continuous yellow indication shows that a channel of the autotrim system is malfunctioning.

For a description and location of the surface position indicator transmitters refer to the following:

Aileron Position Indicating System (27-13-00)

Rudder Position Indicating System (27-23-00)

Horizontal Stabilizer Position Indicating System (27-43-00)

Spoiler Position Indicating System (27-62-00)

B. Operation

Electrically, the aileron and spoiler indicating circuits, and the rudder and stabilizer indicating circuits are interconnected and operate as follows (Ref. Fig. 14).

The spoiler and stabilizer indicators are driven by the rectified position transducer signals. These indicators follow the amplitude of the signals which change as a function of surface position.

The aileron and rudder indicators must not only indicate amount of surface travel, but must also discriminate between up/down aileron travel and between right/left rudder travel.

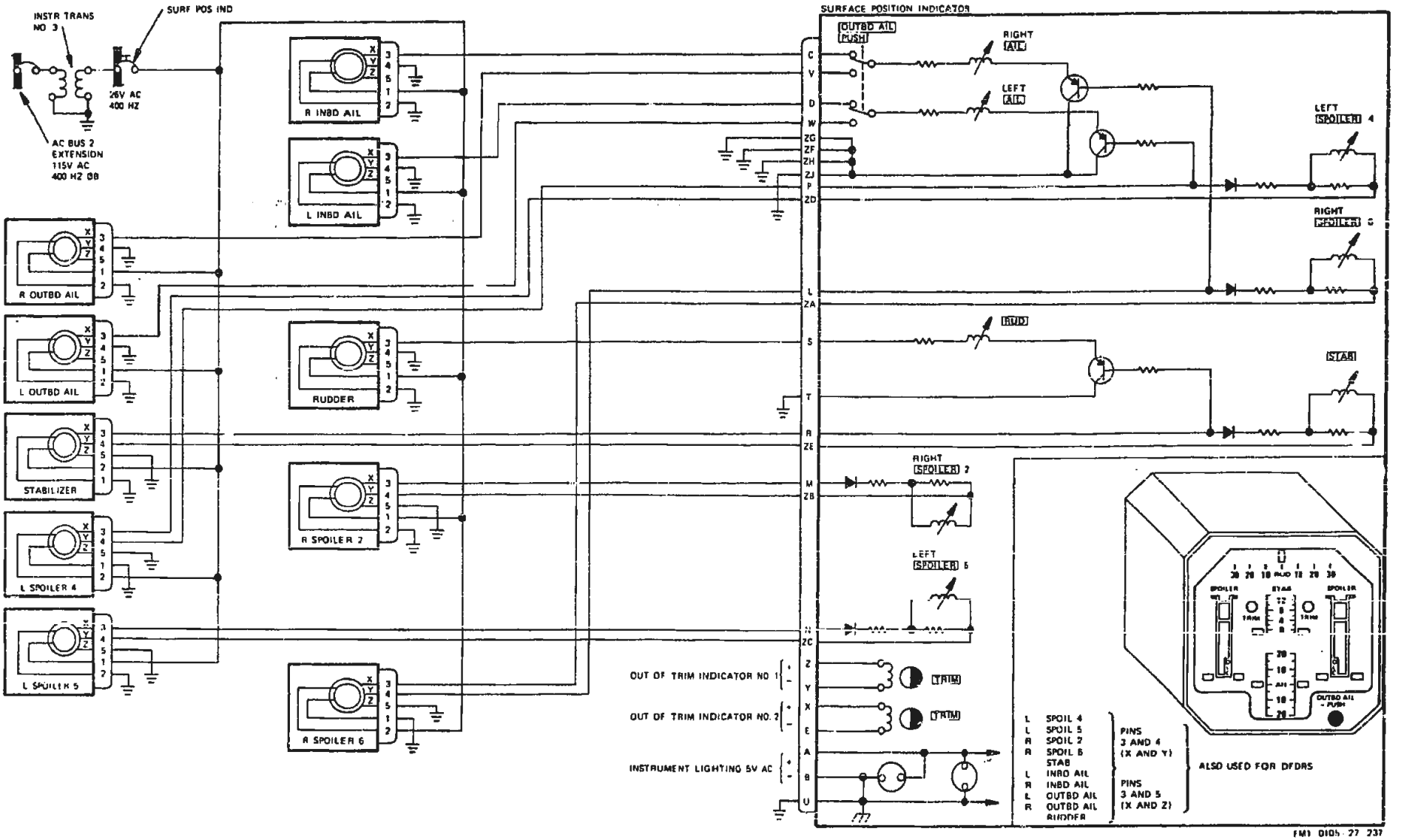
The aileron and rudder indicators are placed in series with transistorized circuits that provide the required position signal rectification and control of current flow direction that results in the necessary right/left and up/down discrimination.

The 2N3910 PNP type transistor is turned on by the negative portion of the reference signal, thus providing the required rectification. The rudder indicator uses the stabilizer position transducer for reference; the left and right aileron indicators use left and right spoiler position transducers, respectively, for reference.

The transistor's high reverse gain characteristics will cause it to conduct from emitter-to-collector or from collector-to-emitter as a function of the phase of the incoming position signal at the instant of time the transistor is turned on by the phase of the reference signal.

The inherent meter movement damping characteristics allow a steady deflection presentation of the half wave rectified signal. The direction of transistor current flow enables the meter to present the proper right/left and up/down deflections.

Reference voltages are provided from the X-Z or Y-Z legs of spoiler and stabilizer position synchros in order to maintain the proper phase relationship. In essence, the surface position indicating system uses the stabilizer position transducer X-Z legs to provide the reference signal for the rudder indicator and Y-Z legs of the following spoiler position transducers to provide the reference signal for the associated aileron indicator: right spoiler No. 6, right ailerons; left spoiler No. 4, left ailerons.



Surface Position Indicating System Electrical Schematic
Figure 14

R
R
001B EFFECTIVITY: ALL

SURFACE POSITION INDICATOR - MAINTENANCE PRACTICES

1. General

The following procedures specify the method used to deactivate the surface position indicator. The eight surface position pointers on the position indicator are powered from one circuit breaker. The TRIM indicators (autopilot trim) on the surface position indicator are powered from the trim augmentation computer (Ref. 22-03-00).

2. Deactivation

NOTE: These deactivation procedures apply only when an aircraft is to be dispatched in accordance with the MEL.

A. Malfunction of One or More But Not All, Surface Position Pointers

R (1) Prior to each flight, visually verify operation of surface of malfunctioning pointer.

(2) Make appropriate entry in aircraft log book.

(3) Install surface position indicator inoperative placard in flight station (specify surface).

B. Malfunction of All Eight Pointers

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and collar SURF POSN IND circuit breaker (J23).

R (2) Prior to each flight, visually verify operation of primary control surfaces.

(3) Make appropriate entry in aircraft log book.

(4) Install surface position indicator inoperative placard in flight station.

C. Malfunction of TRIM (Autopilot Trim) Indicators

(1) Make appropriate entry in aircraft log book.

(2) Install Autopilot Trim Indicator inoperative placard in flight station.

SURFACE POSITION INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

27-00-01 Surface Position Indicator - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag SURF POSN IND circuit breaker.

(2) Release fasteners and slide out instrument panel assembly containing surface position indicator.

(3) Disconnect electrical connector from indicator.

(4) Loosen two round head clamp adjusting screws on face of instrument panel to release clamps.

(5) Remove surface position indicator.

B. Installation

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

(2) Insert surface position indicator into panel.

(3) Torque two round head clamp adjusting screws on face of instrument panel 5 to 8 lb in.

(4) With instrument panel out (Step A(2)), connect electrical connector to indicator.

(5) Slide in and secure instrument panel assembly.

(6) Remove tag and close circuit breaker opened in Step A(1).

(7) Perform Operational Test, reference 27-00-01, Adjustment/Test.

SURFACE POSITION INDICATOR - ADJUSTMENT AND TEST

1. Referenced Procedures

24-41-00 External Power/Ground Service Systems - Maintenance Practices

29-11-00 Hydraulic Power - Maintenance Practices

2. Adjustment/Test

A. Operational Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic systems A,B,C, and D (Ref. 29-11-00).

CAUTION: THE SURFACE POSITION TRANSMITTERS ARE USED TO PROVIDE SIGNALS TO THE SURFACE POSITION INDICATOR AND THE DIGITAL FLIGHT DATA RECORDER SYSTEM (DFDRS), AND ARE CALIBRATED TO PROVIDE ACCURATE SIGNALS TO THE DFDRS. DO NOT ADJUST OR CALIBRATE THE TRANSMITTERS TO ALIGN POSITION INDICATOR NEEDLES. REFER TO ASSOCIATED POSITION TRANSMITTER REMOVAL AND INSTALLATION PROCEDURE FOR TRANSMITTER ALIGNMENT.

R THE OUTBOARD AILERONS, RUDDER, AND ELEVATOR
R HAVE HYDRAULIC SURFACE DAMPERS. RAPID
R CYCLING OF CONTROLS CAN DAMAGE DAMPER SEALS.
R OPERATE CONTROLS SLOWLY WHEN ACCOMPLISHING
R FOLLOWING TEST (MINIMUM 4 SECONDS,
R STOP-TO-STOP).

R (3) Slowly operate control wheel full left. Verify that
R AIL pointers follow control wheel for inboard aileron
R positions. Verify that left AIL pointer moves up and
R that right AIL pointer moves down.

R (4) Slowly operate control wheel full right. Verify that
R AIL pointers follow control wheel for inboard aileron
R positions. Verify that left AIL pointer moves down and
R that right aileron pointer moves up. Allow control
R wheel to return to neutral.

R (5) Depress and hold button marked OUTBD AIL PUSH, then
R accomplish Steps (3) and (4) for outboard ailerons.

R (6) Slowly move control column forward. Verify that STAB
R pointer moves down and follows control column movement.

R (7) Slowly move control column aft. Verify that STAB
R pointer moves up and follows control column movement.
R Allow control column to return to neutral.

R (8) Slowly move rudder pedals left. Verify that pointer
R RUD follows pedals. Verify that RUD pointer moves
R left.

R (9) Slowly move rudder pedals right. Verify that RUD
R pointer moves right and follows pedals.

R (10) Slowly pull either control column aft and hold.

R (11) Repeat Steps (8) and (9).

R (12) Allow control column to return to neutral.

R (13) Verify that flap handle is in the zero position (to
R couple spoilers 5 and 6 to spoiler mixer).

R (14) Move speed brake lever full aft to maximum spoiler
R position. Verify that SPOILER pointers follows spoiler
R deployment left and right.

R (15) With spoilers fully extended, repeat Steps (3), (4),
R and (5).

R (16) Position speedbrake lever full forward to zero degrees.

R (17) If surface position indicator pointers do not respond
R as outlined above, see the associated system fault
R isolation.

R (18) Turn off hydraulic power (Ref. 29-11-00).

R (19) Turn off electrical power (Ref. 24-41-00).

NOTE: With electrical power removed, needles will position as follows: AIL and RUD at zero; SPOILER and STAB at bottom of scale.

CR

CONTROL CABLE - MAINTENANCE PRACTICES

CR 1. General

CR A. Control Cable Prestretching Procedures

CR Existing maintenance procedures, when new flight control
CR system cable is being installed, require pre-stretching the
CR cable. This pre-stretching, as now defined, requires
CR cycling the affected system 25 times with cables tightened
CR to twice the normal tension. The following amplified
CR procedure is to be used for pre-stretching newly installed
CR cable (see notes at end of procedure).

CR (1) Tension the cable to twice the normal load specified in
CR the applicable maintenance manual for the ambient
CR (airplane) temperature.

CR (2) Cycle the affected system three times.

CR (3) Check tension, and if below 2x normal, restore it to 2x
CR normal tension load.

CR (4) If tension needed increasing in Step (3), cycle the
CR system three times. If tension remained 2x normal then
CR cycle system 5 times.

CR (5) Repeat Step (3).

CR (6) If tension needed increasing in Step (5), cycle the
CR system three times. If tension remained 2x normal then
CR cycle system ten times.

CR (7) Repeat Step (3).

CR (8) If tension needed increasing in Step (7), cycle the
CR system three times. If tension remained 2x normal then
CR cycle system seven times.

CR (9) Repeat Step (3).

CR (10) If tension remained at 2x normal in all the previous
CR steps, then per the above procedure, 25 cycles of
CR pre-stretching operation have been completed and the
CR cable tension should now be lowered to the normal
CR maintenance manual value. If tension did not remain at
CR 2x normal tension in Step (9), proceed with Step (11).

CR (11) If tension needed increasing in Step (9), alternately
CR cycle system and readjust tension to 2x normal every 4

CR or 5 cycles until a total of 25 cycles has been
CR reached. After 25 cycles of operation readjust tension
CR to normal maintenance manual value.

CR NOTE: A. If cable won't retain the 2x normal tension
CR load for at least 10 minutes after completion of
CR the 25 cycles, that cable should be rejected and
CR replaced.

CR

CONTROL SURFACES - MAINTENANCE PRACTICES

CR 1. Grease Seals - Control Surface Hinge Bearings

CR A. Hinge bearings, on aileron/rudder/elevator surfaces that CR have grease seals which have lifted from their normal CR position but are still intact, may remain in service as is.

CR B. Nevertheless, when a bearing with a lifted grease seal is CR found on a Base Visit airplane (a visit of at least five CR days), the following requirements must be met:

CR (1) Bearing must be checked for smooth operation.

CR (2) Bearing radial play must not exceed 0.010 inch.

CR (3) Bearing is relubricated until clean grease flows out.

CR NOTE: Excessive grease must be wiped off bearing.

AILERON CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

The aileron control system provides aircraft roll control through four full-time inboard and outboard ailerons (inboard and outboard ailerons operate at all flight speeds). The four ailerons are positioned by hydraulic servos which are controlled by cables and pushrods from conventional flight station control wheels (Ref. Fig. 1). The four ailerons are balanced surfaces.

Aileron trim is provided by manual inputs into the aileron control system which positions the aileron servo.

Each aileron is controlled by a separate servo assembly. Each inboard aileron servo contains three independent control valve assemblies that control three actuators. The inboard servos are supplied by three hydraulic systems as follows: The left inboard servo is supplied by systems A, B, and C.; and the right inboard servo is supplied by systems B, C, and D. The outboard aileron servos are dual assemblies that control two actuators each. These servos are supplied by two hydraulic systems as follows: The left outboard servo is supplied by systems A and B, and the right outboard servo is supplied by B and D. Thus, the aileron system is served by all four hydraulic systems to insure roll control in the event of multiple hydraulic power failures (Ref. Fig. 2).

The ailerons are positioned by irreversible hydro-mechanical servos. The control linkage of an irreversible servo is designed so that all surface loads are absorbed by the actuators and no aerodynamic loads are fed back into the control system. Consequently, the only load the pilot feels is the friction of the servo input control system, which is fairly low. Therefore, artificial feel is provided by a double-acting spring bungee which also serves as a centering spring. The spring bungee is located in the hydraulic service center, zone 147.

The four aileron servos contain fixed external stops to limit servo input lever movement. The stops hydraulically limit aileron travel to 20 degrees up and 20 degrees down from neutral.

R On aircraft without SB27-162,
R inboard aileron neutral is faired (in contour) with flap torque
R boxes.

R On aircraft with SB27-162,
R inboard aileron neutral is 1.5 degrees up from faired with the
R flap torque boxes.

R On aircraft 001-017,
R outboard aileron neutral is faired with fixed trailing edge.

R On aircraft 018-999,
R outboard aileron neutral is 3 degrees up from faired with fixed
R trailing edge.

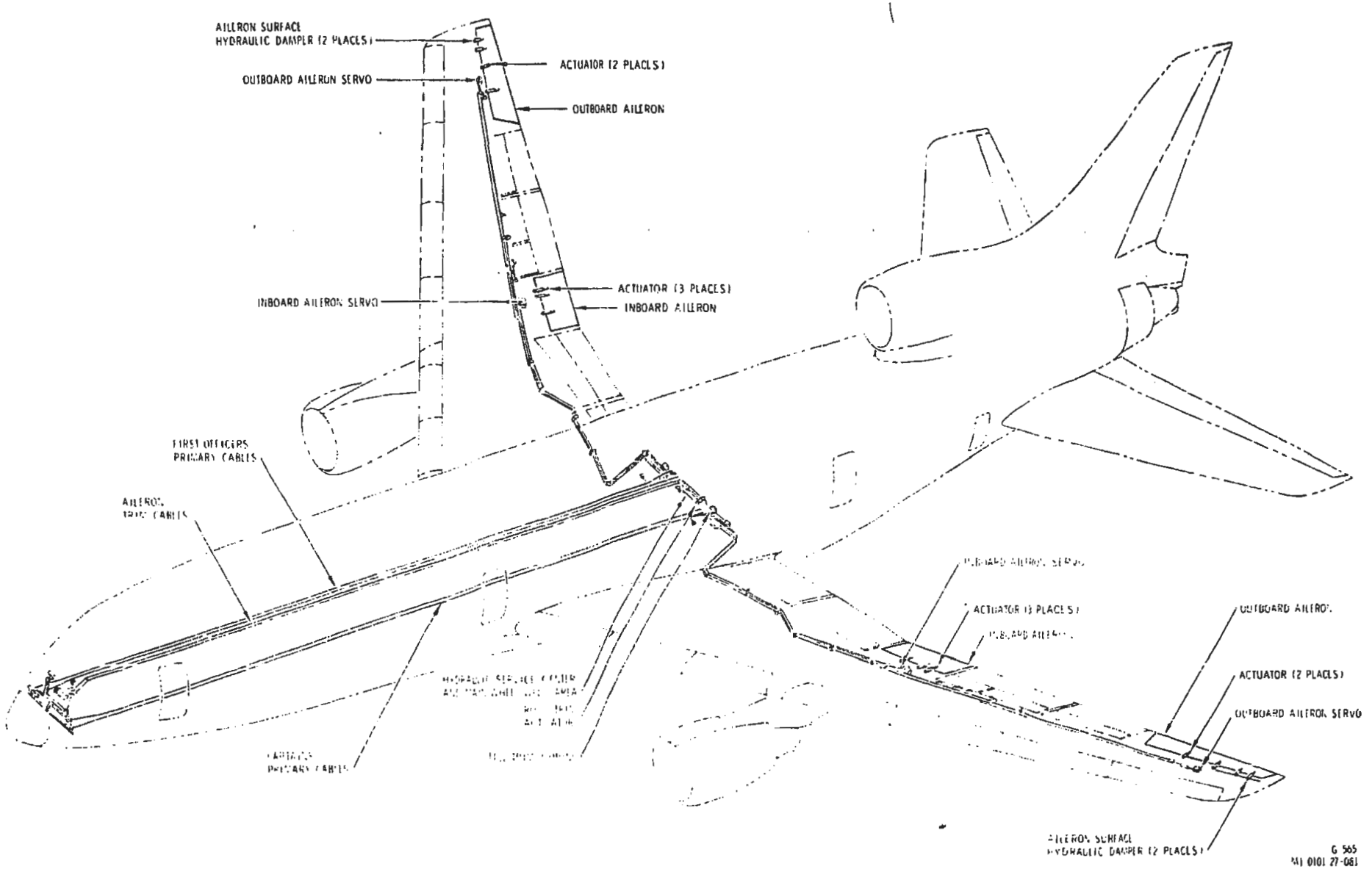
The four aileron servos are controlled through two independent cable and pushrod control paths to insure fail-safe operation (Ref. Fig. 3). The two control paths are coupled together at the flight station through a roll disconnect assembly (Ref. Fig. 4) and in the hydraulic service center through an aileron interconnect bungee (Ref. Fig. 5).

The Captains control wheel drives a cable system that terminates at a cable bellcrank mounted above the ceiling of the left main wheel well, zone 146 (Ref. Fig. 5). The output shaft of the cable bellcrank extends through a cabin pressure seal into the left wheel well where it takes two paths. One path extends inboard and is pushrod-connected through a trim and feel spring bungee to the mechanical trim actuator in the hydraulic service center, zone 147. The second pushrod path extends outboard to the left inboard aileron servo.

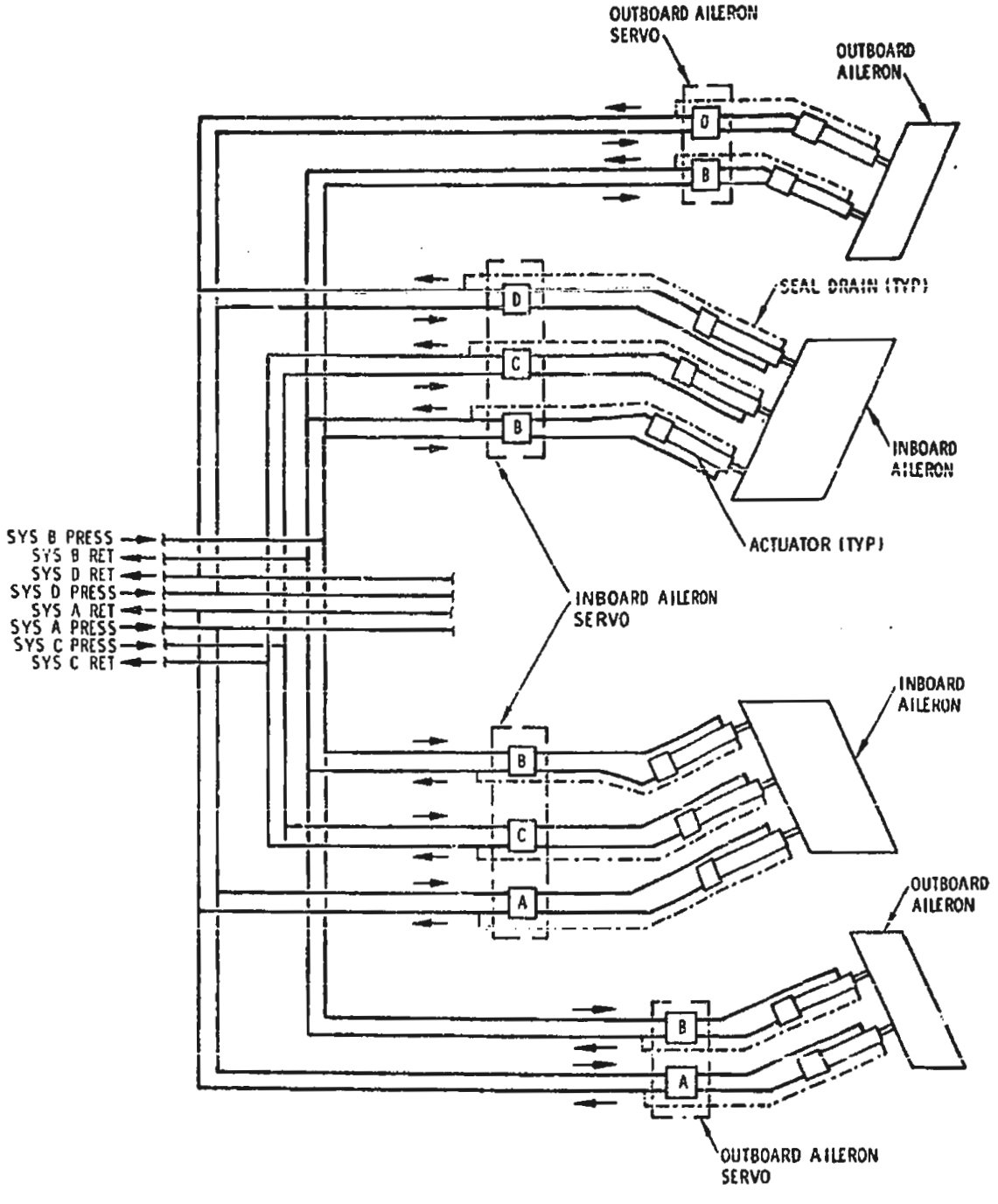
The output of the trim actuator is applied to the trim and feel spring. Application of roll trim causes the trim actuator to stroke and shift the trim and feel spring neutral force position. The trim and feel spring force applies an input into the left inboard aileron servo and causes the servo to reposition the aileron to the feel spring new neutral force position.

The First Officers control wheel drives a cable system that terminates at a cable bellcrank mounted above the ceiling of the right main wheel well, zone 146. The output shaft of the cable bellcrank extends through a cabin pressure seal into the right wheel well. The output arm of the cable bellcrank is pushrod-connected to a dual bellcrank which takes two paths. One path extends inboard and is pushrod-connected to the left inboard aileron surface through the interconnecting bungee (Ref. Fig. 5). The second pushrod path extends outboard to the right inboard aileron servo.

A lost-motion device is incorporated in the First Officers control path which allows approximately 15 degrees of control wheel rotation before producing cable displacement (Ref. Fig. 4). The lost motion device effectively decouples the First Officers control cables. However, the First Officers control wheel is connected to the Captains control wheel through interconnecting linkages and the roll disconnect. Rotation of the First Officers control wheel operates the Captains control path. Consequently, rotation of either control wheel will



Aileron Control System Components Location
Figure 1



R Aileron Controls Hydraulic System Distribution
R Figure 2

EFFECTIVITY: ALL

001B

position the left inboard aileron servo, which acts as the master servo.

Movement of the left inboard aileron will position the right inboard aileron servo through the aileron interconnecting linkage. The outboard aileron servos are pushrod and cable-connected (slaved) to their respective inboard ailerons so that the outboard ailerons will follow the inboard ailerons.

Roll augmentation is provided to improve roll control. Inboard aileron movement is directed to the spoiler mixers in the main wheel wells. With flaps extended more than 2.5 degrees, the mixers are coupled to the inboard ailerons. Spoilers on the up-aileron wing are deployed in proportion to aileron displacement. It takes approximately 5 degrees of aileron movement to initiate spoiler deployment. Full aileron displacement of 20 degrees will deploy spoilers 40 degrees.

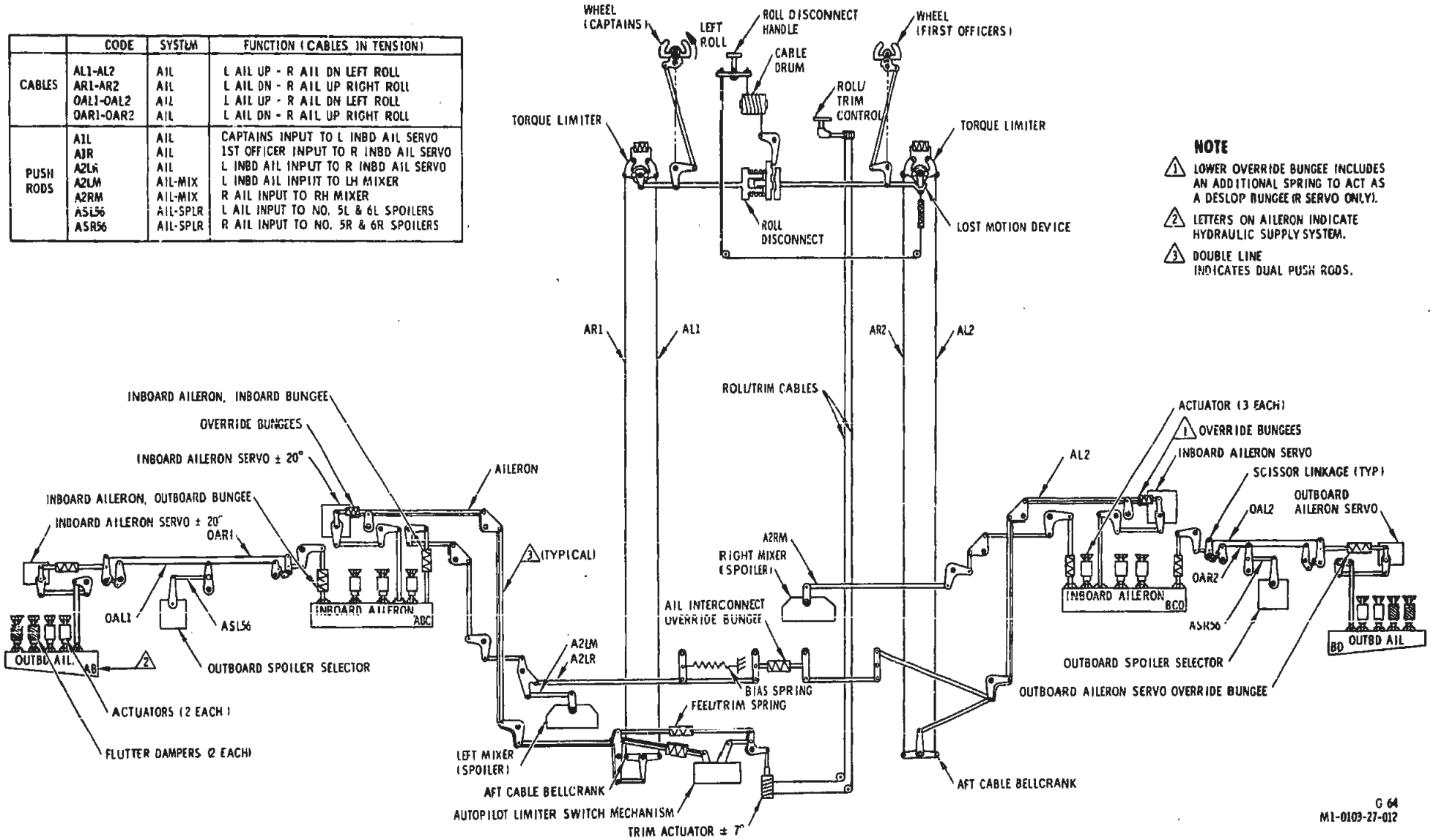
Fail-safe operation of the ailerons is further improved by incorporating torque limiters, zone 112, in both pilots control paths (Ref. Fig. 3). The torque limiter functions as the forward cable bellcrank and consists of a spring-cam device that transmits control wheel motion to the associated cable system. The torque limiter ensures continuous roll control in the event of a control path jam. If a jam occurs, the pilot can overcome the force of the torque limiter spring in the malfunctioning system and maintain roll control. With control established, the roll disconnect handle on the center console can be pulled to actuate the roll disconnect device and separate the two control paths. Thus, normal control forces can be returned to the functioning control system.

When the roll disconnect handle is pulled, the lost-motion device is also actuated to couple the First Officers control wheel directly to his cable system.

Additional protection against a malfunction in the roll control system is provided by using spring bungees in those pushrod systems driven by hydraulic power. Both inboard ailerons, which are positioned by hydraulic actuators, drive two pushrod systems each: the outboard aileron servo input system and the spoiler mixer input system. If either of the outboard ailerons, mixer units, or associated control systems jam, the hydraulically driven aileron could damage the malfunctioning control system. The spring bungees are installed between the inboard aileron and associated pushrod system, zone 550 and 650, and are designed to compress when a predetermined tension or compression load is reached (Ref. Fig. 3).

In addition to manual inputs from the pilot, the aileron servos receive autopilot input signals. The left inboard aileron servo (master servo) includes a dual automode module which receives

	CODE	SYSTEM	FUNCTION (CABLES IN TENSION)
CABLES	AL1-AL2	AIL	L AIL UP - R AIL DN LEFT ROLL
	AR1-AR2	AIL	L AIL DN - R AIL UP RIGHT ROLL
	OAL1-OAL2	AIL	L AIL UP - R AIL DN LEFT ROLL
	OAR1-OAR2	AIL	L AIL DN - R AIL UP RIGHT ROLL
PUSH RODS	AIL	AIL	CAPTAINS INPUT TO L INBD AIL SERVO
	AIR	AIL	1ST OFFICER INPUT TO R INBD AIL SERVO
	A2LM	AIL	L INBD AIL INPUT TO R INBD AIL SERVO
	A2LM	AIL-MIX	L INBD AIL INPUT TO LH MIXER
	A2RM	AIL-MIX	R AIL INPUT TO RH MIXER
	ASL56	AIL-SPLR	L AIL INPUT TO NO. 5L & 6L SPOILERS
	ASR56	AIL-SPLR	R AIL INPUT TO NO. 5R & 6R SPOILERS



NOTE

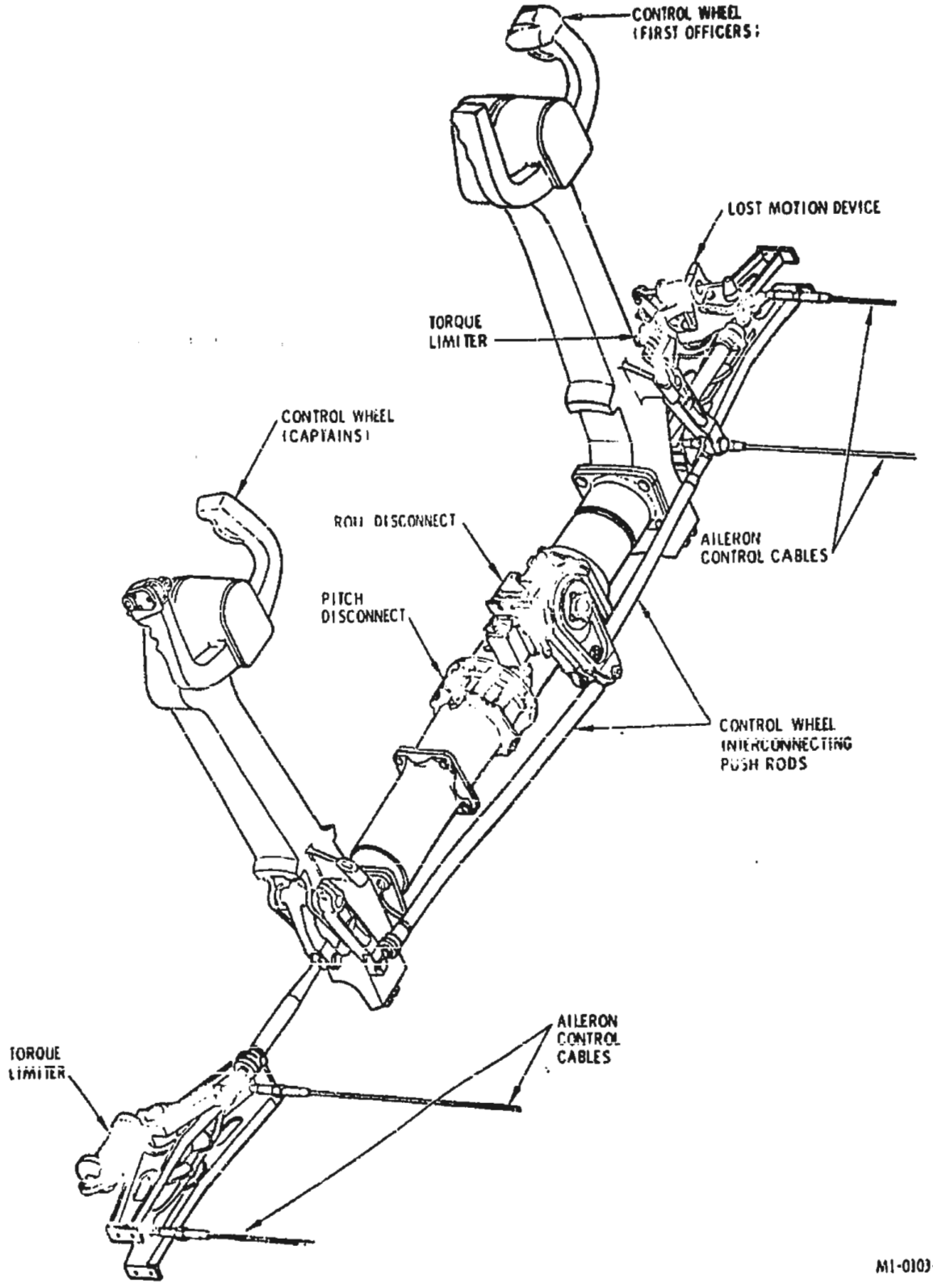
1. LOWER OVERRIDE BUNGEE INCLUDES AN ADDITIONAL SPRING TO ACT AS A DESLOP BUNGEE (R SERVO ONLY).
2. LETTERS ON AILERON INDICATE HYDRAULIC SUPPLY SYSTEM.
3. DOUBLE LINE INDICATES DUAL PUSH RODS.

G 64
M1-0103-27-012

R Aileron Control System Schematic
R Figure 3

EFFECTIVITY: ALL

001B



R
R

Aileron Controls-Flight Station
Figure 4

EFFECTIVITY: ALL

001B

autopilot position error signals (Ref. 22-01-00). The error signals result in positioning of the servo power control valves which positions the aileron. The left inboard aileron controls the positioning of the other three ailerons, consequently, autopilot signals are reflected in all four ailerons.

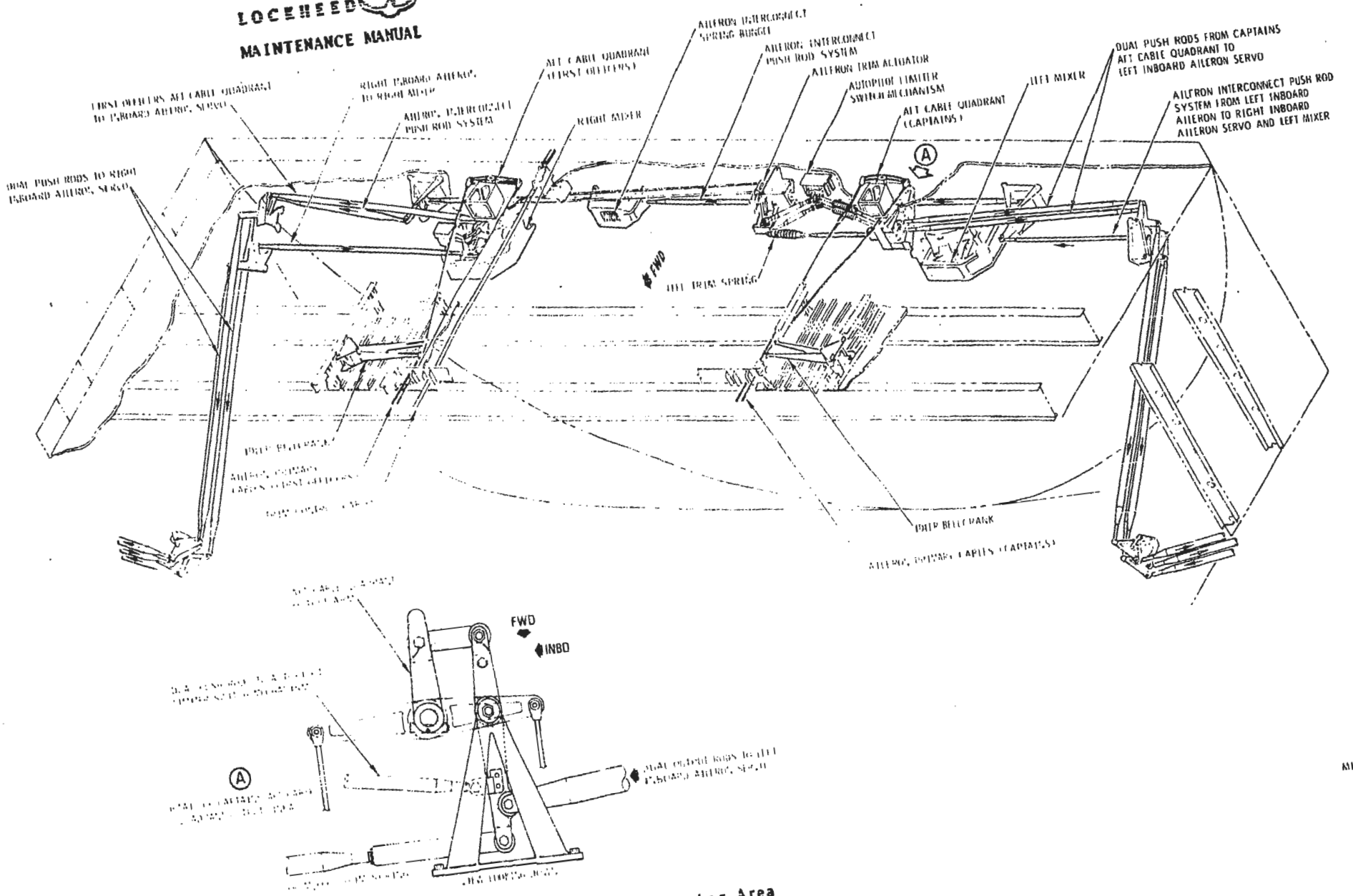
The autopilot command to the left inboard aileron servo is electronically limited in the autopilot system. To retain autopilot authority limit in the event of a system electronic limiting failure, an autopilot limiter switch mechanism is incorporated in the aileron control (Ref. Fig. 5). The switch mechanism measures the aileron angle relative to the mechanical trim. When the autopilot command causes the aileron angle to exceed a given limit, the switch mechanism sends discrete signals that disengage the autopilot system. The switch mechanism autopilot limiting is provided during all phases of autopilot operation except an autoland track mode or a control wheel steering influenced mode of operation.

Monitoring of the roll control system is accomplished by using control sensors and flight station displays. The monitor system provides a means of notifying the pilots of trouble in the roll system and to suggest remedial action that can be taken to alleviate the condition. The monitor system consists of a sensor switch in each torque limiter, an annunciator light and four switchlights on the PFCS panel located on the pilots overhead panel (Ref. Fig. 6 and 7), and monitor logic circuits which are part of the flight controls electronics system (Ref. 22-17-00). A jam in either control system actuates the affected torque limiter switch. This action will turn on the affected servo switchlight crosshatch legend and the PULL ROLL DISC legend on the PFCS panel. Depressing the illuminated servo switchlight will shut off the hydraulic systems supplying that servo and turn on the OFF legend on the switchlight. The monitor system is advisory only and no system action is automatically triggered by a control malfunction.

2. Operation

Rotation of either control wheel applies an input to the left inboard servo, which serves as the master servo. Subsequent movement of the left inboard aileron surface is transmitted to the right inboard servo through the interconnecting linkage, which causes the right inboard surface to respond and move opposite to the left inboard surface. The outboard aileron servos are cable and linkage-connected (slaved) to their respective inboard ailerons, so the outboard ailerons will follow the movement of the inboard ailerons.

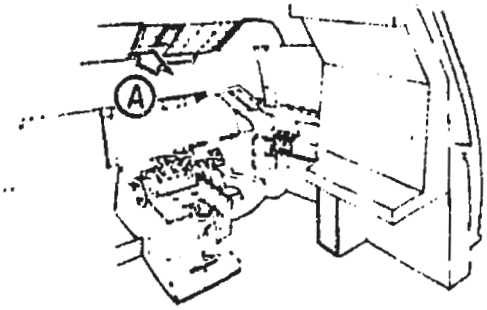
Normal operation of the aileron control system through the Captains control path will control the four ailerons. If the

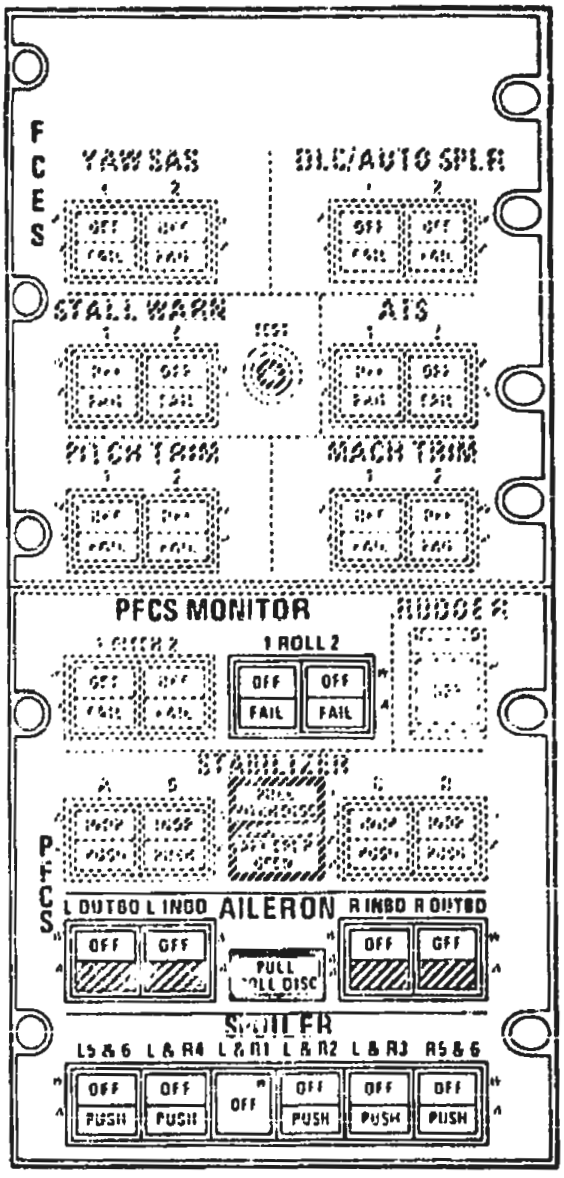

AILERON INTERCONNECT SPRING BUNGEE
AILERON INTERCONNECT PUSH ROD SYSTEM
AILERON TRIM ACTUATOR
AUTOPILOT LIMITER SWITCH MECHANISM
AFT CABLE QUADRANT (CAPTAINS)
LEFT MIXER
DUAL PUSH RODS FROM CAPTAINS AFT CABLE QUADRANT TO LEFT INBOARD AILERON SERVO
AILERON INTERCONNECT PUSH ROD SYSTEM FROM LEFT INBOARD AILERON TO RIGHT INBOARD AILERON SERVO AND LEFT MIXER
FIRST OFFICERS AFT CABLE QUADRANT TO R.BOARD AILERON SERVO
RIGHT INBOARD AILERON TO RIGHT AILERON
AILERON INTERCONNECT PUSH ROD SYSTEM
AFT CABLE QUADRANT (FIRST OFFICERS)
RIGHT MIXER
DUAL PUSH RODS TO RIGHT INBOARD AILERON SERVO
FWD
LEFT TRIM SPRING
A
DRIVE BELLCRANK
FWD
INBD
A

G 542
M1-0102-27-015

R Aileron Controls - Wheel Well and Hydraulic Service Center Area
R Figure 5

EFFECTIVITY: ALL





A

NOTE
LETTERS NEXT TO LEGENDS INDICATE COLOR OF LENS

HH 5368
M1-0102-27-025

R
R Aileron System Flight Station Control Panels
Figure 6

roll disconnect is actuated because of a jam in the left inboard servo or the Captains control path, rotation of the First Officers control wheel will control only the right inboard and right outboard aileron. However, if flaps are extended, the right inboard ailerons position inputs to the right mixer and selector are forwarded to the spoilers. The right mixer controls spoiler 2 and 3 on both wings; consequently, spoilers 2 and 3 on both wings and spoilers 5 and 6 on the right wing will still provide roll augmentation.

If a jam is experienced in the First Officers control path and the roll disconnect is actuated, the Captains control wheel will control only the left inboard and left outboard ailerons. If the flaps are extended, the left inboard aileron position inputs to the left mixer and selector are forwarded to the spoilers. The left mixer controls spoiler 4 on both wings; thus spoiler 4 on both wings and spoilers 5 and 6 on the left wing will provide roll augumentation.

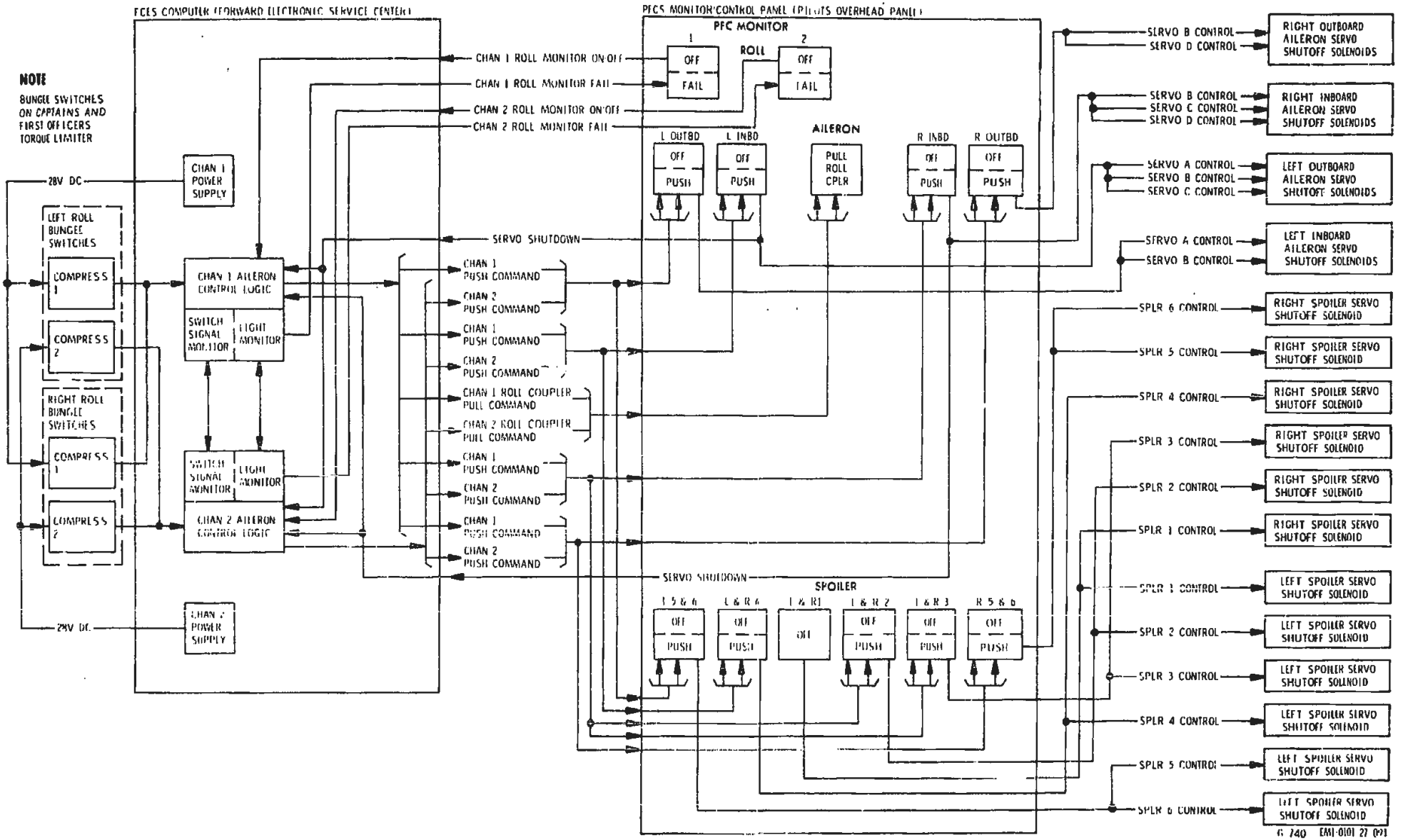
Operation of each of the four aileron servo installations is identical and is as follows: Rotation of the servo input arm causes the multiple control valves to port hydraulic pressure differentials to the actuators. Hydraulic flow to the actuators is proportionate to control valve displacement. The actuators respond and position the aileron surface against the aerodynamic load.

Aileron surface displacement is fed back to the servo through dual feedback links to reposition the control valves towards neutral. When the surface reaches the commanded position, control valve flow is reduced to the point where actuator stroke ceases and the surface is hydraulically held in the commanded position. If the pilot releases the control wheel, the trim and feel spring will position the aileron control system to the previous trim position, and the ailerons will return to the trim position.

3. Control Wheel

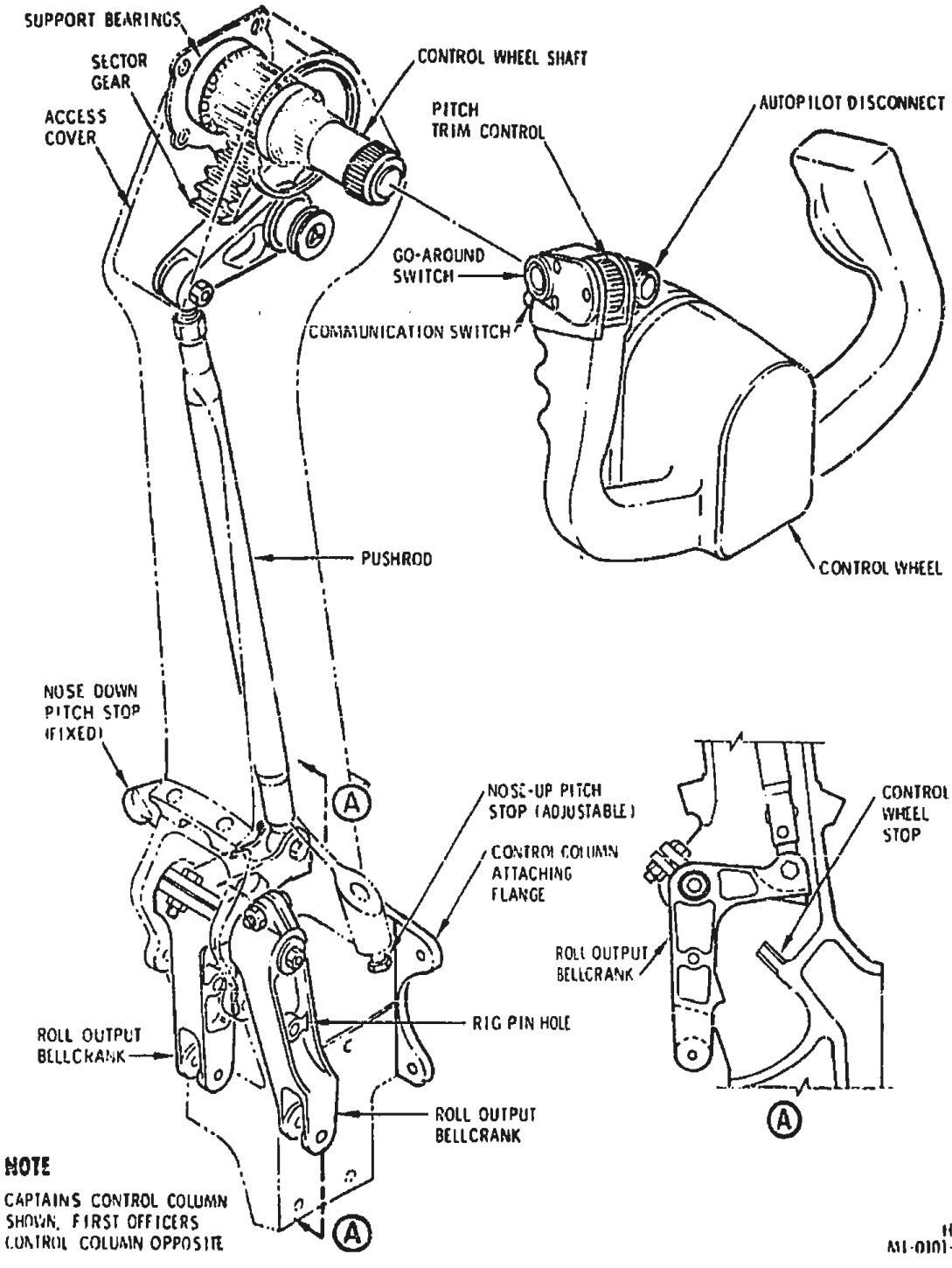
A. Description and Operation

The control wheel is mounted to the control wheel shaft on the control column, zone 210, and provides aileron manual control inputs (Ref. Fig. 8). A number of electrical functions are provided on the control wheel by pushbutton switches and a thumbwheel control. The control wheel assembly also contains a pitch and roll force sensor that supplies control wheel steering commands to the pitch and roll autopilot (Ref. 22-01-00). The force sensors provide an electrical output signal in proportion to pitch and roll forces applied to the control wheel.



PFCS Monitoring and Control Functional Block Diagram
Figure 7

EFFECTIVITY: ALL



Aileron Control Wheel and Control Column
Figure 8

The wheel assembly is spline-connected to the control wheel shaft and retained by a threaded sleeve. A nylon insert plug in the sleeve locks the sleeve to the shaft. The control wheel shaft is hollow and provides access for a wire bundle. The end of the shaft contains an electrical connector which provides the electrical interface between the control column and the control wheel. Both control wheels contain the same control switches, however, the switches on the Captains wheel are on the left grip; the switches on the First Officers wheel are on the right grip.

Control wheel rotation is transmitted by a sector gear and pushrod to a bellcrank in the base of the control column. Machined stops on the lower bellcrank contact a fixed stop on the control column housing to limit control wheel rotation to ±85 degrees. Control wheel stops are the secondary stops. The primary aileron control system stops are the fixed stops on the aileron servos that limit servo input arm movement.

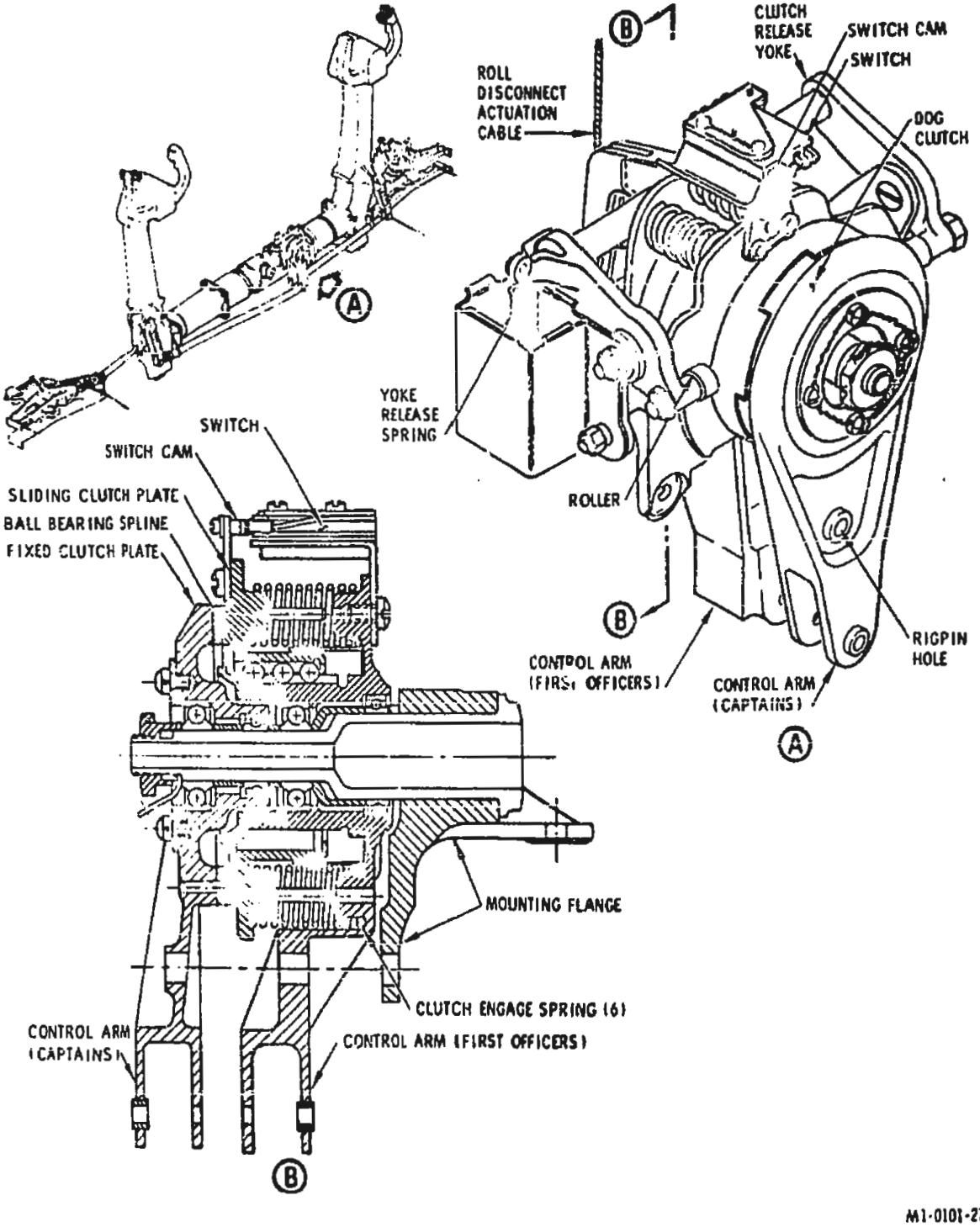
4. Roll Disconnect Mechanism

A. Description and Operation

The roll disconnect mechanism provides a means of separating the Captains and First Officers control wheels in the event a roll control path is jammed. The roll disconnect assembly is bolted to the Captains control column interconnecting torque tube, zone 112, and consists of two bellcranks coupled together by a spring-operated dog clutch (Ref. Fig. 9). The forward bellcrank is pushrod-connected to the First Officers control wheel; the rear bellcrank is pushrod-connected to the Captains control wheel.

The roll disconnect clutch contains a manual release mechanism that is cable-connected to the AIL DISC handle on the center console. Clutch engagement is maintained by six compression springs. The clutch release mechanism consists of a yoke assembly mounting two clutch release rollers. The release mechanism is held in the deactuated (clutch engaged) position by a tension spring. Both bellcranks and the housing have rig pin provisions to rig the control wheel interconnecting linkage.

The roll disconnect is operated by pulling up on the AIL DISC handle and rotating the handle 90 degrees to lock. The release yoke is rotated against the tension spring which causes the yoke rollers to bear against the clutch plate shoulder and drive the clutch (splined to the First Officers bellcrank) out of engagement with the Captains bellcrank, thus disconnecting the control wheels from one another.



M1-0101-27-013

R
R

Roll Disconnect Mechanism
Figure 9

EFFECTIVITY: ALL

001B

Releasing the AIL DISC handle from the disconnect position allows the engaging springs to couple the dog clutch. The dog clutch is designed so that recoupling will occur only when the control wheels are synchronized.

5. Roll Disconnect and Lost Motion Device Control System

A. Description and Operation

The roll disconnect and lost-motion device control system provides the flight crew with a means of separating the Captains and First Officers control wheels. The control system has an additional function of actuating the lost motion device on the First Officers torque limiter assembly.

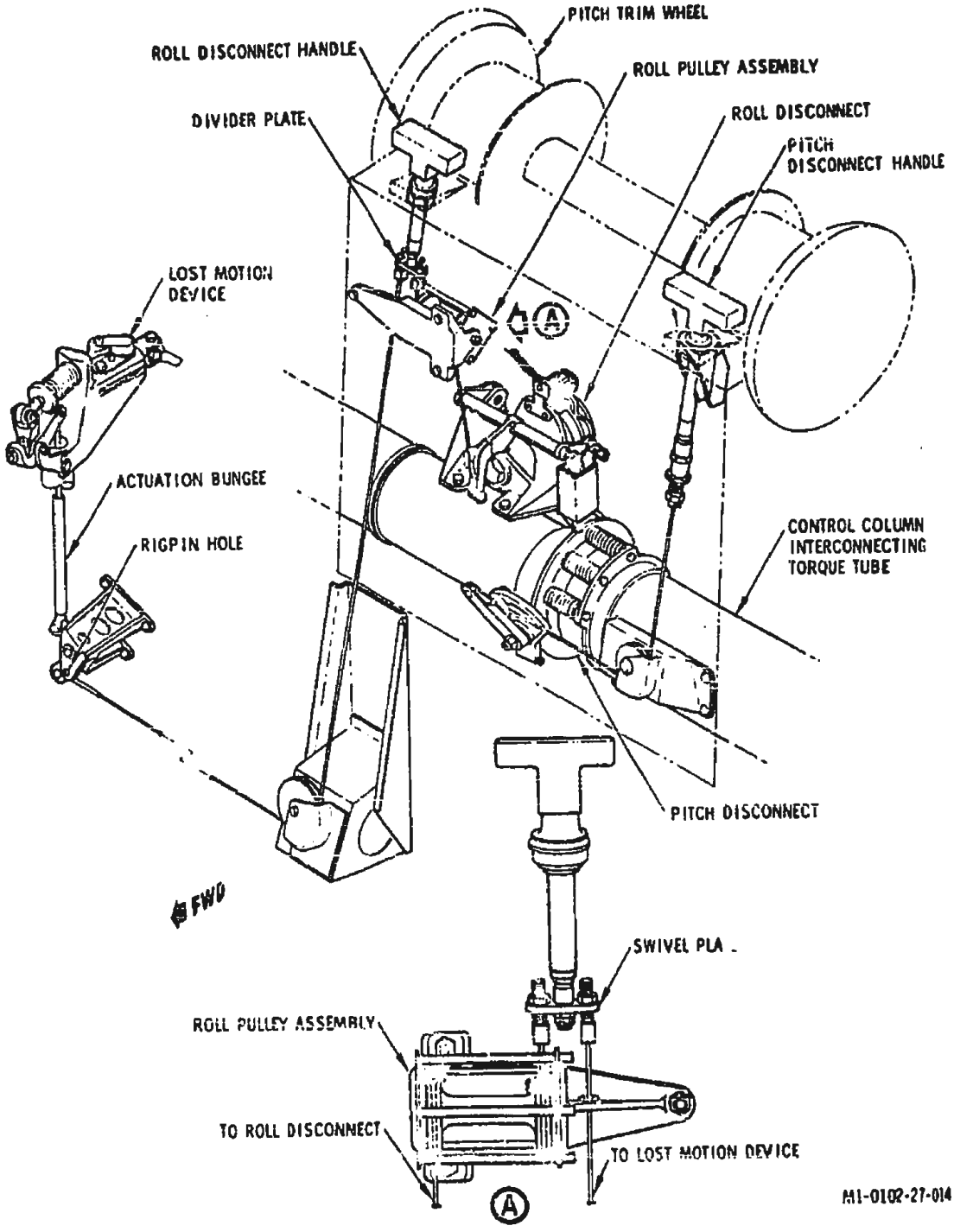
The control system (Ref. Fig. 10) consists of a T-handle on the right side of the center console, zone 210, and two cable runs. The lower end of the T-handle assembly contains a divider swivel plate that accepts the threaded ends of two cable assemblies. One cable from the divider plate extends to a pulley assembly and then to the actuation arm of the roll disconnect assembly. This cable run is made up of two cables and actuates the roll disconnect. Rigging and adjustment of the roll disconnect cable system is accomplished at the threaded cable attachment to the divider swivel plate.

The second cable is connected to the divider plate and travels over a pulley and is connected to one arm of a bellcrank assembly that is mounted directly below the First Officers torque limiter, zone 112. Another cable, attached to the other arm of the bellcrank assembly, extends upward through the hollow torque limiter shaft and is connected to the actuation arm of the lost motion device. Rigging and adjustment of this cable system is accomplished by inserting a rig pin through the bellcrank assembly and adjusting the threaded cable attachment to the divider swivel plate. The T-handle is held in the actuated position by a bayonet locking mechanism, and is locked by pulling out on the handle and rotating 90 degrees counterclockwise.

6. Torque Limiter

A. Description and Operation

A torque limiter is installed in the Captains and First Officers forward cable systems, zone 112, so that in the event an aileron control cable system is jammed, either pilot has the capability of driving the operable cable system. The torque limiter is a roller-detented cam



R Roll Disconnect and Lost Motion Device Control System
R Figure 10

mechanism that releases, or "breaks out" when a predetermined torque is reached.

The torque limiter consists of a vertical shaft that is bearing-mounted to two structure supports (Ref. Fig. 11). Splined to the shaft is the input arm and cam. The output arm is also mounted on the vertical shaft but it can rotate on two bushings. The output arm provides the support for two bearing-mounted follower arms. A spring cartridge forces the two follower arm rollers into engagement with the cam detents.

The spring cartridge consists of a compression spring retained between two end caps. The end caps contain an adjustable clevis fitting for adjusting the cartridge detent force. Spring alignment is maintained by an external sleeve and a telescoping center guide.

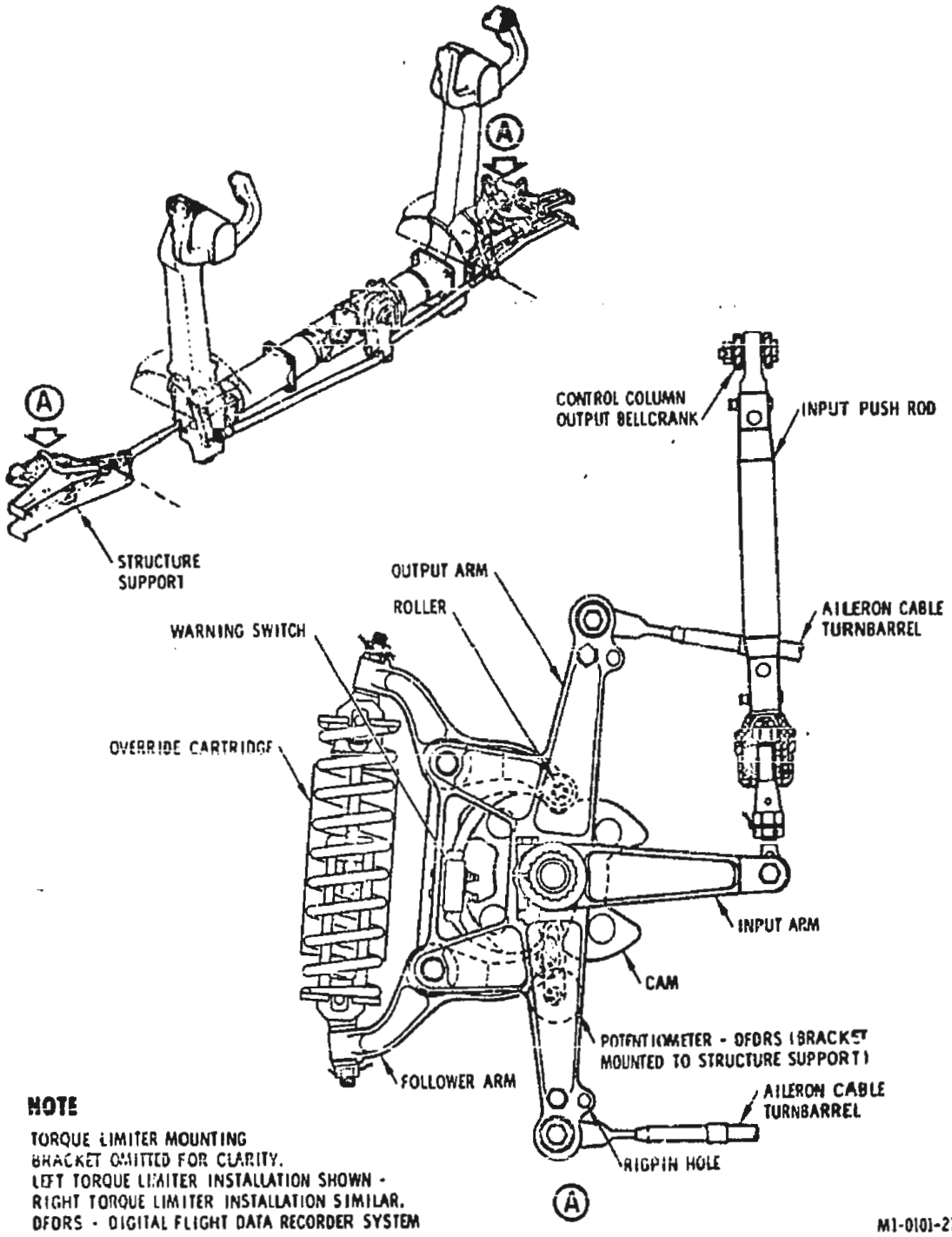
As long as the control path loads are below the detent "breakout" force, any motion applied to the input arm drives the cam and, through the detented follower arms, drives the output arms and aileron cables. If resistance in the cable control path is met and the pilot applies a 33-pound force to the control wheel rim, the cam will overcome the spring detent force and drive the rollers out of the way, which allows the cam to rotate. This frees the pilots controls and allows him to drive the operable control path and thus maintain aileron control.

When the torque limiter "breaks out," the relative motion of the cam to the output arms actuates a switch. Switch signals are supplied to the flight controls electronics system (FCES) computer (Ref. 22-17-00) which turns on the appropriate aileron and spoiler switchlight on the PFCS panel on the pilots overhead panel (Ref. Fig. 6). The switch is mounted to the output arm assembly with the switch lever roller contacting the cam. Switch adjustment is provided by slotted switch mounting holes.

7. Lost-Motion Device

A. Description and Operation

In normal operation, the left inboard aileron servo serves as the master servo and the right inboard aileron servo is slaved to the left inboard aileron. To ensure proper phasing of the inboard aileron servos, a lost-motion device is installed in the First Officers control system. The lost-motion device provides the First Officer with approximately 15 degrees of control wheel rotation before his cable system is actuated. The lost-motion device



Torque Limiter Assembly
Figure 11

effectively uncouples the First Officers control wheel from his cable system so that rotation of either control wheel will drive the Captains cable system and control the master servo.

The lost-motion device is splined to the top of the First Officers torque limiter shaft, zone 112, (Ref. Fig. 12) and functions to transmit the rotation of the First Officers control wheel to his torque limiter. Rotation of the torque limiter drives the aileron cables. The lost-motion device consists of an auxiliary arm that can rotate within the main input arm. The rotation of the auxiliary arm is limited by a cam that is positioned within the auxiliary arm slot. The cam is normally held in the deactuated (lost-motion) position by a compression spring.

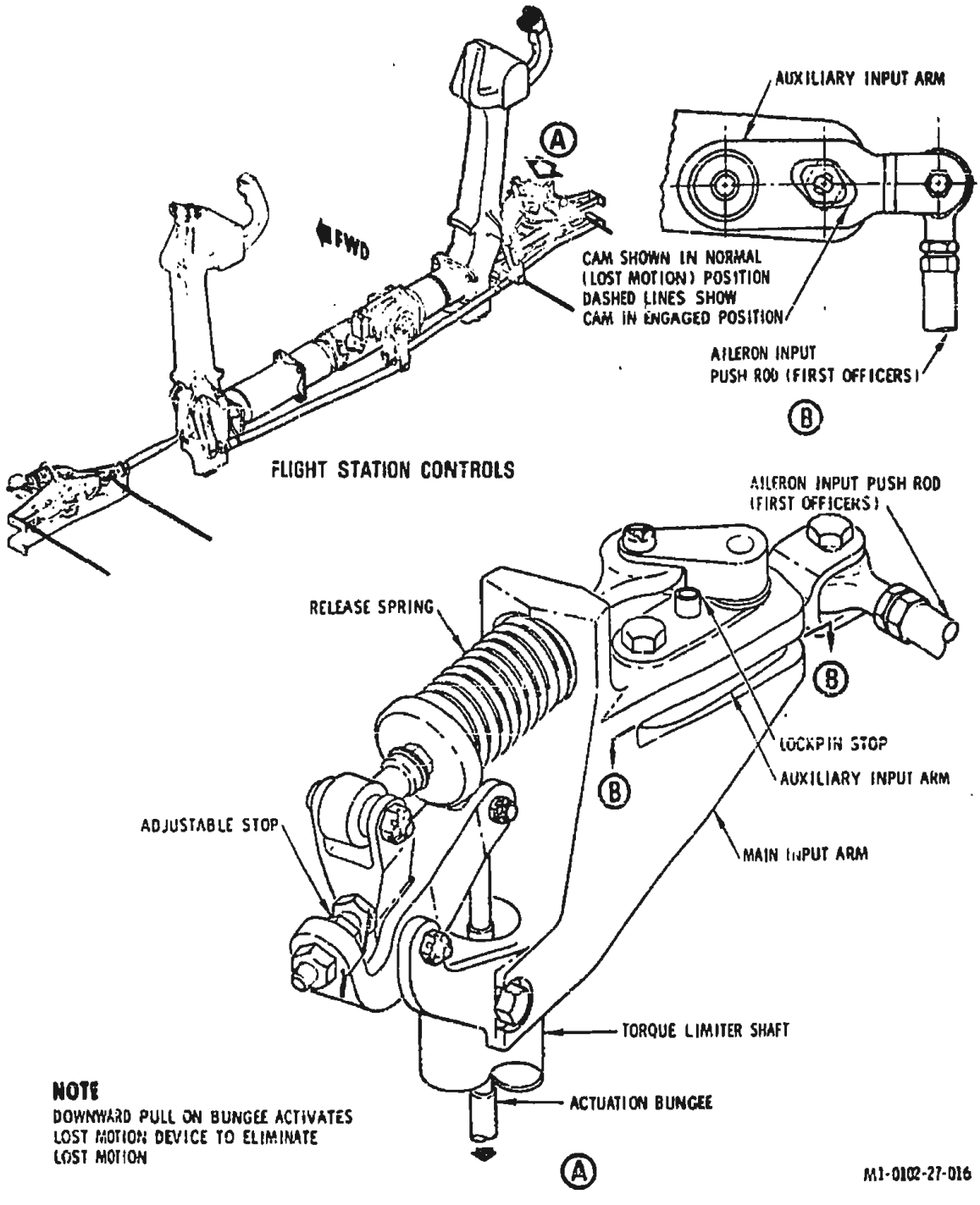
If a jam is experienced in one of the aileron control paths, the pilot can elect to separate the control paths by pulling up on the AIL DISC T-handle on the center console to actuate the roll disconnect. A second cable system from the AIL DISC T-handle acutates the bellcrank on the lost-motion device and rotates the cam against the compression spring force. The cam now fills the gap in the auxiliary arm slot and effectively locks the auxiliary arm to the main input arm, eliminating the lost motion. Rotation of the First Officers control wheel will now directly control the right inboard aileron servo. The cam is held in the engage position (lost-motion removed) by a bayonet locking mechanism on the T-handle that holds the T-handle in the actuated position.

8. Aileron Primary Control Cables

A. Description

The aileron primary control cables are used to transmit the Captains and First Officers control wheel outputs to rotation of their respective rear cable bellcranks, above the main wheel wells, zone 146, and to transmit inboard aileron motion to the outboard aileron servo. The primary cables are one-eight inch-diameter 7 by 19 cables made from
C zinc coated carbon-steel wire. Cable friction is reduced in the fuselage cable runs by using idler bellcranks instead of pulleys to change cable direction.

Lockclad is used on the straight runs of the primary aileron control cables to stabilize the cable system by reducing cable stretch. Lockclad cable consists of normal flexible cable that has an aluminum tube swaged around the cable. The swaging operation puts the cable in tension. Thus, normal control system operating loads are lower than the



Lost-Motion Device
Figure 12

pre-stretched loads so that no elastic stretching of the cables takes place during control operation. The Lockclad process also results in a control cable with a coefficient of expansion similar to that of the airframe structure, and the effect of ambient temperature changes on the flight controls is considerably reduced.

The lockclad cable assemblies are made in approximately 22-foot lengths and are coupled together by a quick-disconnect shear pin arrangement (Ref. Fig. 13). Standard turnbuckles are used in the cable runs for rigging adjustment. The aileron primary fuselage cables are straight runs that extend through the cabin floor beams and are supported every 80 inches by fairlead rollers. The wing cables are also straight runs that are supported by fairlead rollers.

The control cables that are exposed to lavatory or galley spillage are protected from corrosion by clear plastic tubing shrunk-fit over the Lockclad cable.

The Lockclad cable assembly is a fairly rigid assembly. However, it can be bent for removal and installation, without producing a permanent bend in the cable, as long as the radius of the bend is not less than 48 inches.

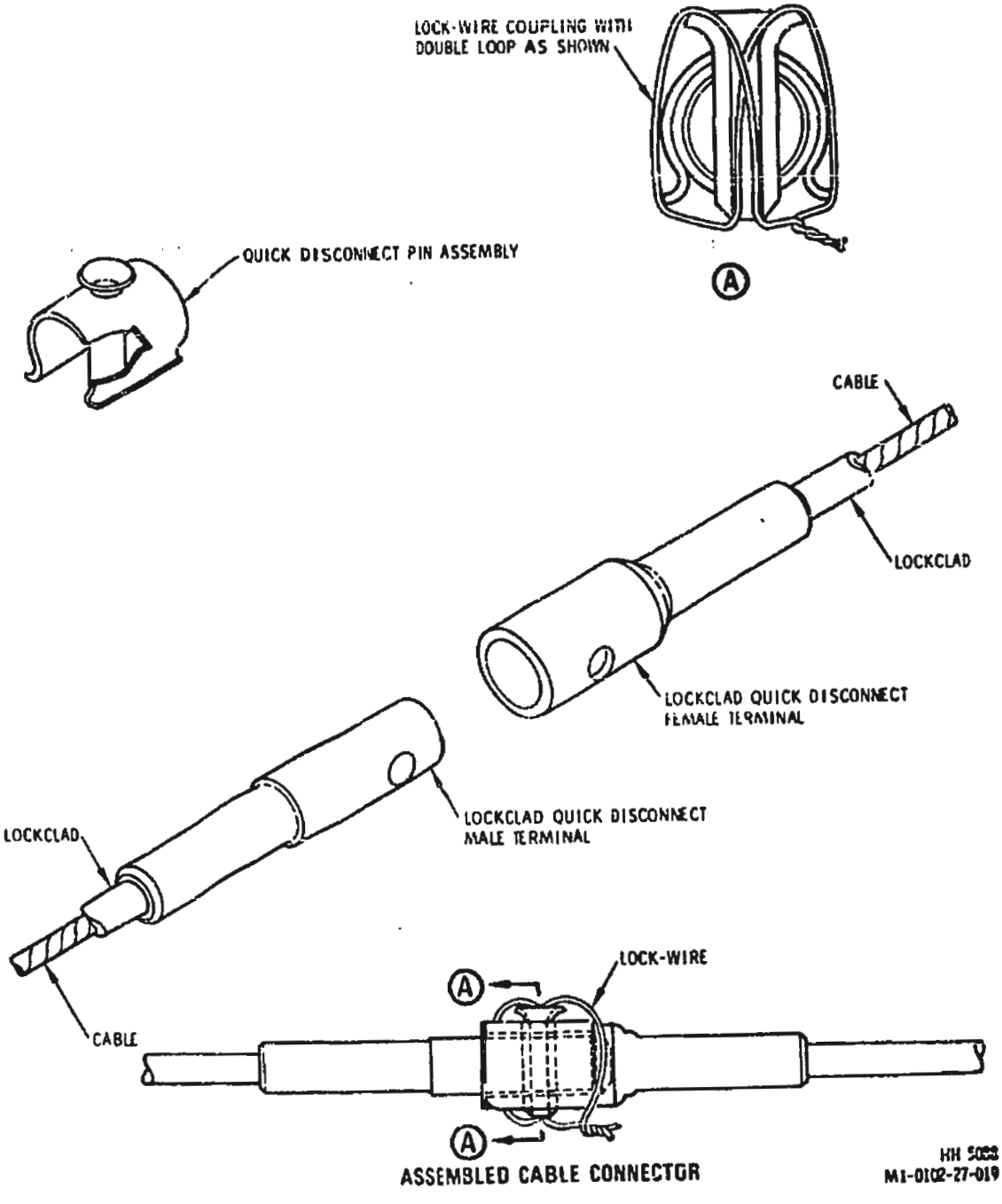
For information on fabrication of replacement cable assemblies for the flight control system, refer to Chapter 91.

9. Scissor Linkage Assembly

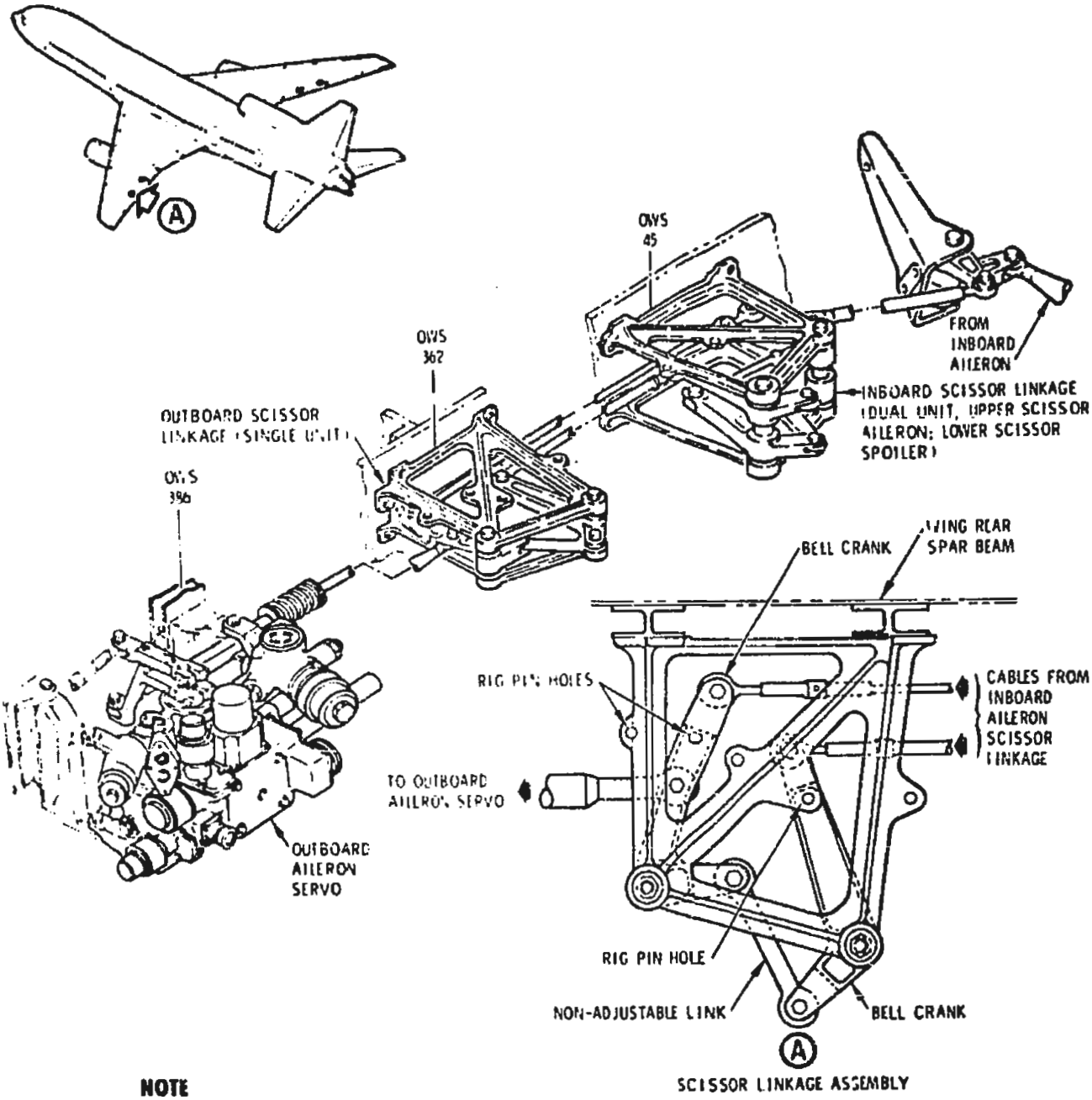
A. Description and Operation

The scissor linkage assembly is a simple arrangement of linkages for converting either pushrod motion to cable motion or cable motion to pushrod motion. The scissor linkage assembly consists of a bracket that provides pivot bearing support for two bellcranks and a short nonadjustable link that interconnects the two bellcranks. Rig pin provisions are included for rigging the control cables and pushrods (Ref. Fig. 14).

The aileron control system contains two scissor linkage assemblies in the trailing edge of each wing. These assemblies are used in the inboard aileron to outboard aileron servo control linkage. One scissor assembly is located just inboard of the No. 3 spoiler servo actuator, zone 560 and 660. The other scissor assembly is located just inboard of the outboard aileron servo, zone 570 and 670.



Lockclad Cable Coupling
Figure 13



SCISSOR LINKAGE ASSEMBLY

NOTE

LEFT WING SHOWN - RIGHT WING OPPOSITE

M1-0101-27-094

R
R

Scissor Linkage Assembly
Figure 14

10. Aileron Control System Trim and Feel Bungee

A. Description and Operation

The aileron control system includes full power servos which require low control forces to operate. Consequently, artificial feel and centering forces have to be provided to produce control loads that increase with control inputs and provide the pilot with more normal control system feel.

A trim and feel bungee is installed in the linkage between the Captains rear cable bellcrank and the mechanical trim actuator (Ref. Fig. 15) and consists of a caged double-acting bungee. The bungee is located in the hydraulic service center near the rear bulkhead, zone 147.

Rotation of the Captains rear cable bellcrank is resisted by the trim and feel bungee. Stroking of the trim actuator shifts the neutral force position of the trim and feel bungee and applies an input into the Captains aileron control system.

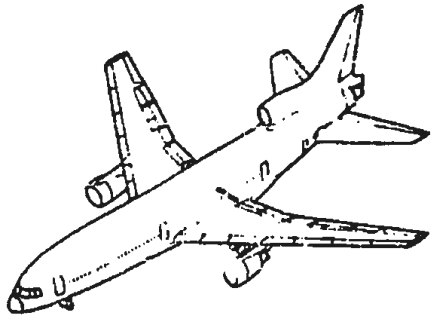
11. Aileron Interconnect Override Bungee

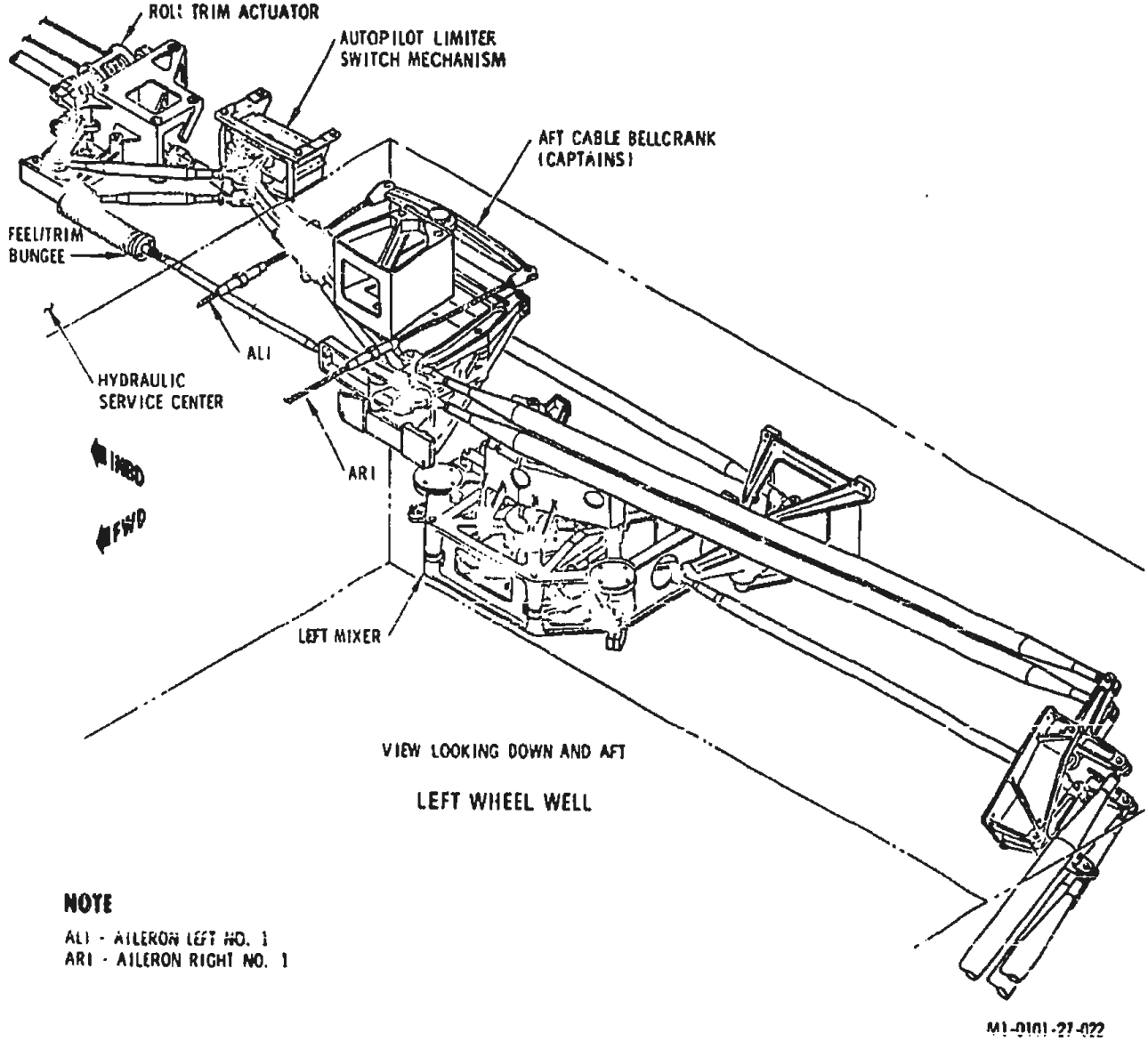
A. Description and Operation

The aileron interconnect override bungee is installed in the pushrod system between the left inboard aileron and the right inboard servo (Ref. Fig. 3 and 16). The spring bungee is located in the hydraulic service center near the rear bulkhead, zone 147.

During normal operation the bungee acts as a rigid part of the aileron interconnecting pushrod system, as the normal loads necessary to drive the right inboard servo are lower than the bungee breakout force. However, if the Captains aileron control system jams, either pilot can control the aircraft through the First Officers control system by compressing the interconnect bungee spring.

The normal roll system trim and feel bungee is connected directly to the Captains control system. If the Captains control system is jammed and the roll disconnect is actuated to separate the Captains and First Officers control paths, operation of the ailerons through the First Officers controls will be without benefit of the trim and feel bungee. Under this condition, the interconnect bungee will provide feel and centering forces similar to the trim and feel bungee.



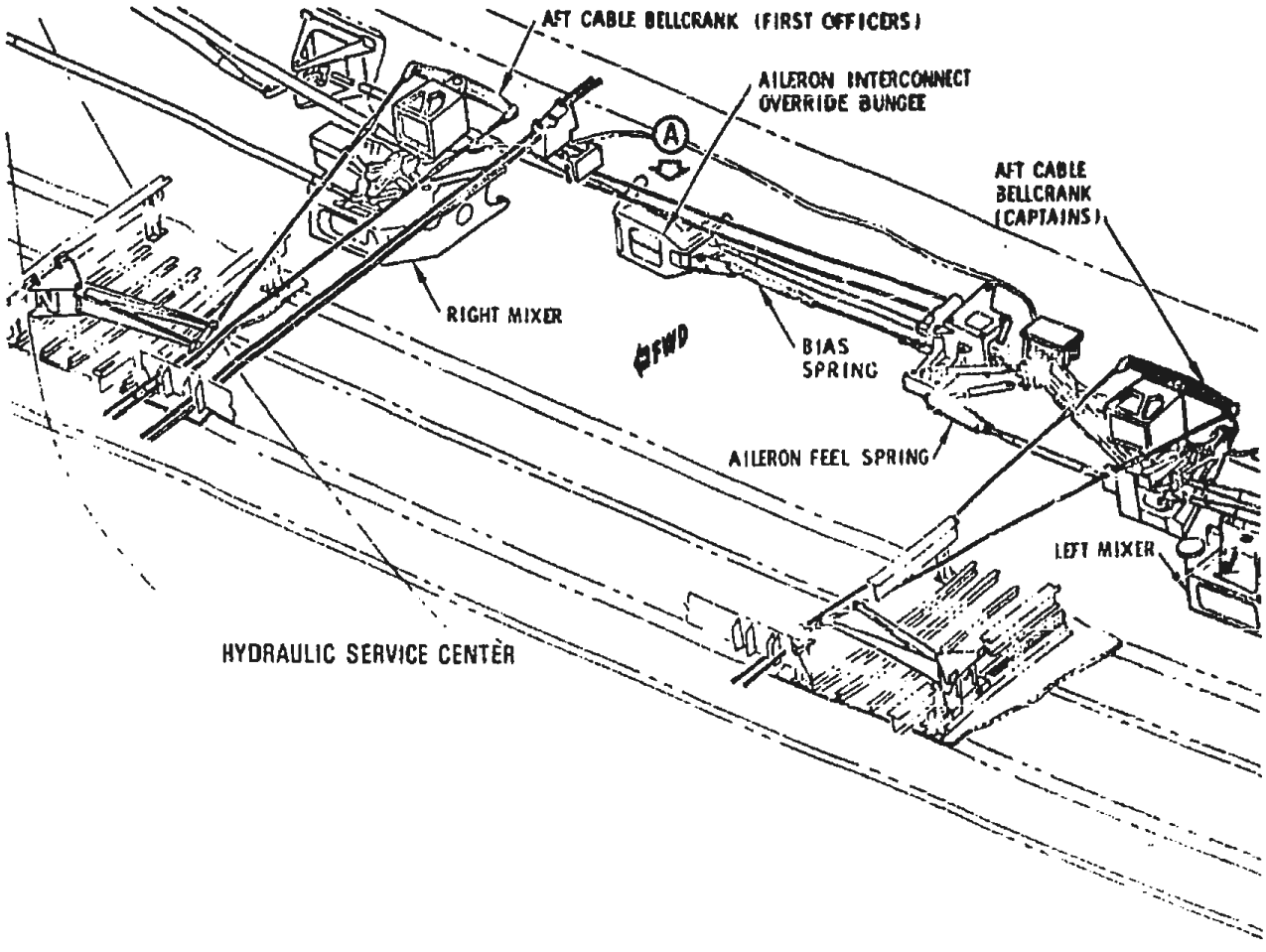


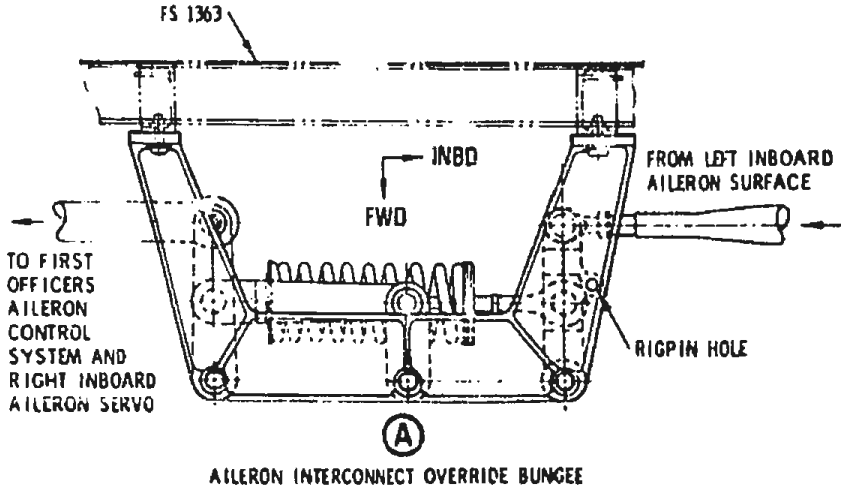
NOTE

ALI - AILERON LEFT NO. 1
ARI - AILERON RIGHT NO. 1

M1-0101-27-022

Aileron Control System Trim and Feel Bungee
Figure 15





MI-0101-27-020

R Aileron Control System Interconnect Override Bungee
R Figure 16

EFFECTIVITY: ALL

12. Inboard Aileron Bungee Cartridges

A. Description and Operation

Inboard aileron movement is transmitted by two pushrod linkage systems to the associated spoiler mixer and the outboard aileron servo. If either pushrod system jams, then the hydraulically operated inboard aileron could damage the pushrod system.

A bungee cartridge is installed in both pushrod systems of both inboard ailerons. The cartridges are installed near the inboard aileron servo, zones 550 and 650, with one end attached to the aileron surface (Ref. Fig. 17). One end of each bungee is adjustable for rigging the bungee length.

13. Outboard Aileron Servo Input Rod Assembly

A. Description and Operation

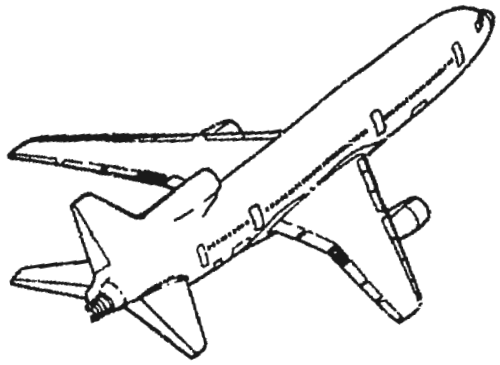
The outboard aileron servo input rod assembly incorporates a double-acting spring bungee. Each outboard aileron servo is slaved to its respective inboard aileron surface through a pushrod and cable system which includes an input rod assembly, zones 570 and 670 (Ref. Fig. 3). The spring bungee is installed to prevent damage to the outboard aileron control system if the outboard aileron servo jams. In addition, the outboard aileron control system also supplies roll inputs to the outboard spoiler selector which provides roll inputs to spoilers 5 and 6. If an outboard aileron servo jams, the spring bungee will allow spoilers 5 and 6 to receive roll command inputs from the inboard aileron and provide additional roll control.

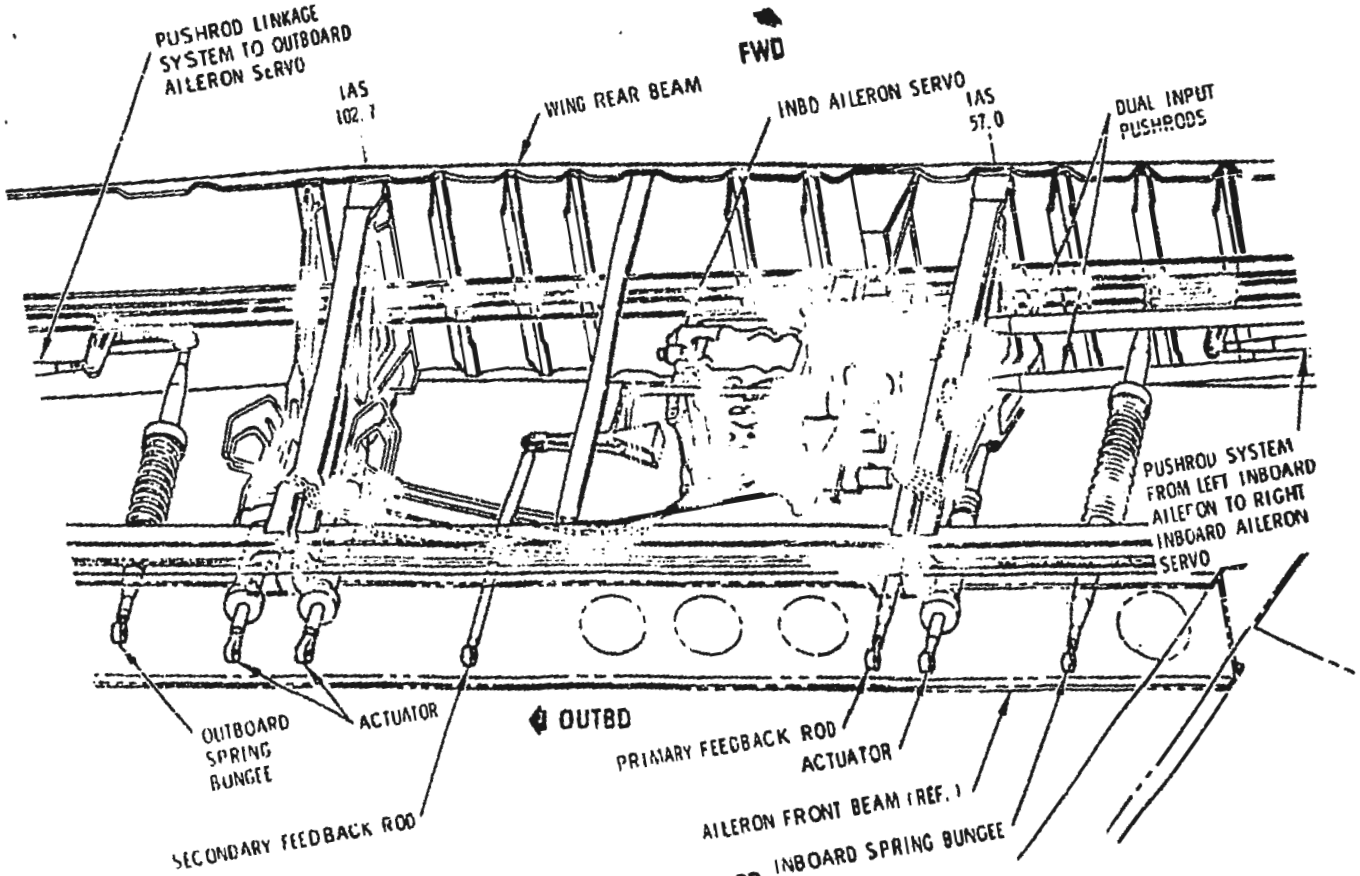
The input rod assembly is approximately 30 inches long. One end of the rod assembly contains a machined fork; the other end is provided with an adjustable rod end for rigging adjustment. The spring bungee will compress if the rod load exceed 70 pounds.

14. Inboard Aileron Servo Control Module

A. Description

The inboard aileron is controlled by a triple hydro-mechanical position servo and three actuators. The servo is located in the trailing edge of the wing just forward of the inboard aileron, zones 550 and 650 (Ref. Fig. 17). The left servo differs from the right in that the left servo contains the additional mechanism to receive autopilot





NOTE

LEFT WING SHOWN
RIGHT WING OPPOSITE

Inboard Aileron Servo Installation - Left Wing
Figure 17

EFFECTIVITY: ALL

R
R
001B

inputs. Both inboard aileron servos receive mechanical inputs from the Captains or First Officers control wheels, or, in the case of the left servo, electrical inputs from the autopilot, and positions the ailerons in response to these commands.

The servo system consists of a control valve module, three piston actuators, and dual external mechanical feedback linkages. The three actuators, each of which can control the aileron, operate in parallel and share the control surface load. The servo module is supplied by three independent hydraulic systems, thus assuring fail-safe operation of the aileron in the event of a hydraulic system failure. The left servo is supplied by systems A, B, and C; the right servo by systems B, C, and D.

Mechanical fail-safety of the control system is provided by dual servo input rods and cranks. Aileron command input motions are transmitted internally to a completely enclosed summing linkage which displace the three parallel power control valve spools. Surface movement is fed back to the summing linkage by dual feedback rods with a feedback input lever mounted on each side of the servo. The servo contains external stops that hydraulically limit control surface displacement to 20 degrees up and down from neutral by limiting input crank rotation.

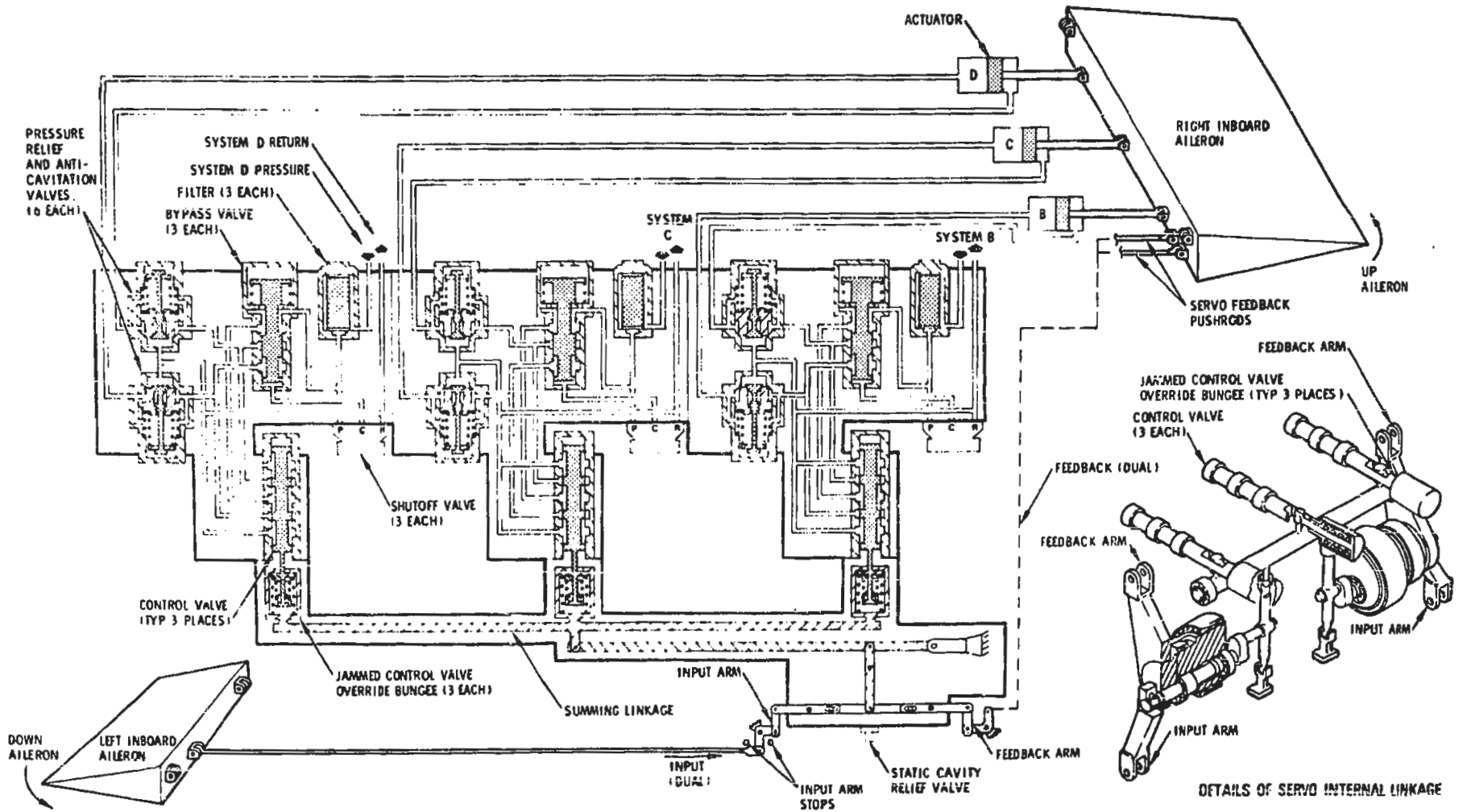
Both inboard aileron servos consist of three separate hydraulic manifolds, and one linkage manifold. The left inboard servo also includes two automode modules (Ref. Fig. 18 and 19).

Each of the three hydraulic manifolds on both servos contains a cleanable steel-mesh 25-micron absolute filter, a power control valve, a pressure-operated bypass and shutoff valve, two pressure relief and anti-cavitation valves, and a solenoid shutoff valve. A detail description of the servo components follows:

(1) Power Control Valve

The power control valve is a four-way spool selector valve that ports system flow to either the aileron actuator "up" line or "down" line in response to internal linkage displacement. Valve jam protection is provided by a caged spring in the control valve drive connection which allows each of the remaining control valves to be displaced independently of a jammed control valve.

(2) Bypass and Shutoff Valve



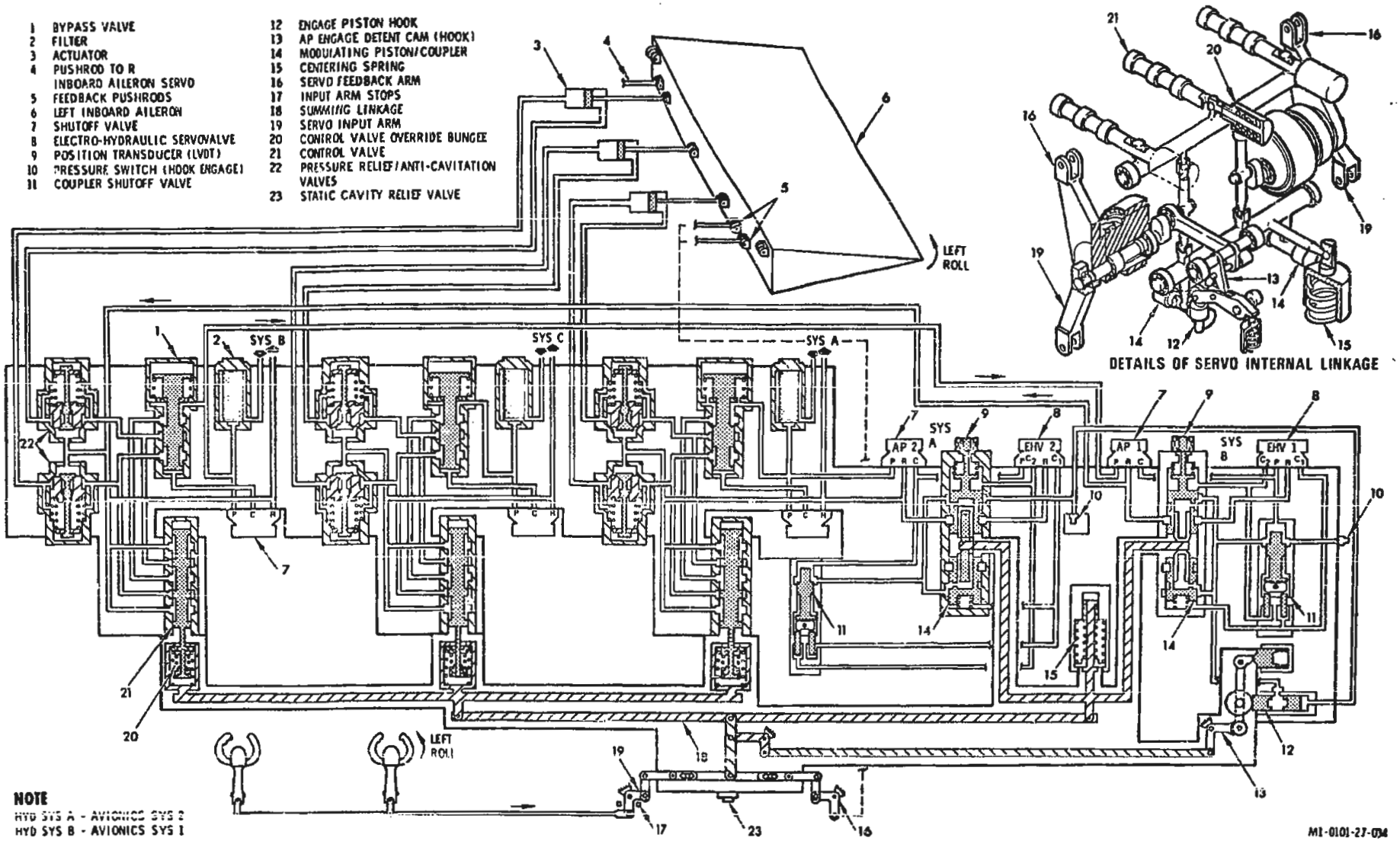
MI-0002-27-024

R
R

Right Inboard Aileron Servo Schematic
Figure 18

EFFECTIVITY: ALL

0018



DETAILS OF SERVO INTERNAL LINKAGE

R Left Inboard Aileron Servo Schematic
R Figure 19

EFFECTIVITY: ALL

The bypass and shutoff valve is installed to provide a means of shutting off the hydraulic supply to the power control valve. The two-position bypass and shutoff valve is installed in the pressure line between supply pressure and the power control valve and is connected to the actuating cylinder lines.

The normal position of the bypass and shutoff valve allows passage of system pressure to the power control valve spool and blocks the flow of fluid between the actuator cylinder ports. When the solenoid shutoff valve is energized, pressure is applied to one end of the bypass and shutoff valve spool, displacing the valve to the shutoff position. The shutoff position shuts off system supply pressure to the power control valve and interconnects the actuating cylinder ports, thus shutting down that system.

If system supply pressure falls below 450 psi, the bypass and shutoff valve spring automatically drives the valve to the shutoff position. Energizing system B and C solenoid shutoff valve on the left servo does not interrupt supply pressure to the automode components on the left servo.

(3) Pressure Relief and Anti-Cavitation Valve

A pressure relief and anti-cavitation valve is installed between each cylinder port and return port. The relief valve limits excessive cylinder pressure which might occur from abnormal external hinge moments. The relief valve unseats at 3700 psi and relieves excess pressure into the return line.

The anti-cavitation function of the assembly prevents negative pressure buildup (cavitation) in the actuating cylinder of a system that is shut down. Since the actuator of the shut down system is connected to the control surface, the actuator will be stroked with movement of the surface. Stroking an actuator with the oil supply shut off can draw air into the system across the actuating cylinder rod seals. The anti-cavitation valve opens when 2 to 5 psi differential pressure is produced across the anti-cavitation valve assembly and opens the affected (cavitating) cylinder port to system return, allowing return fluid to flow into the low pressure side of the cylinder.

(4) Solenoid Shutoff Valve

Three solenoid-operated, two-position, three-way hydraulic shutoff valves are plate-mounted to the servo

module, one for each channel. The left servo contains two additional solenoid shutoff valves on the automode modules which are covered under Automode Module.

The solenoid shutoff valve controls the operation of the bypass and shutoff valve. Energizing the solenoid shutoff valve hydraulically positions the bypass and shutoff valve to the shutoff position, thus shutting down that control system.

The solenoid shutoff valves are controlled from the PFCS MONITOR panel on the pilots overhead panel which contains two switchlights marked AILERON L INBD and R INBD (Ref. Fig. 6 and 7). Depressing a switchlight energizes all three solenoid valves on the associated inboard servo which will deactivate the servo and allow the aileron to seek the float position.

(5) Static Cavity Relief Valve

One static cavity relief valve is installed in the servo linkage manifold to protect the manifold against excessive return pressure buildup. The linkage manifold is common to all three control valves and is filled with fluid before installation.

Fluid pressure in the linkage manifold is a function of control valve spool lap leakage and will reflect approximate average of the three systems return pressure. The relief valve cracks at 250 psi with full flow at 300 psi. The relief valve is ported overboard.

Occasional fluid discharge from the relief valve may occur due to transient high return pressure spikes and can be considered normal. However, prolonged or persistent discharge is cause for further investigation.

(6) Automode Module (Left Inboard Aileron Servo Only)

There are two automode modules that are part of the left inboard aileron servo module (Ref. Fig. 19). These two automode modules operate in parallel and provide autopilot inputs into the roll system. Each automode module consists of a solenoid shutoff valve, pressure switch, electro-hydraulic servovalve, modulating piston/coupler, coupler shutoff valve, and position transducer. A single centering spring and autopilot engage piston assembly is common to both automode modules. Normally, both autopilot channels are active during the landing mode. In cruise, one channel is active and the second channel is on standby.

The autopilot is dualized to insure fail safe operation if a channel malfunctions. A description of the automode components follows:

(a) Solenoid Shutoff Valve

The solenoid shutoff valve is a two-position three-way valve that controls the hydraulic supply to the automode components. There is one shutoff valve on each of the two automode modules. The shutoff valve is energized when the roll channel of the Autopilot Flight Director System is engaged (Ref. 22-01-00). When energized, the solenoid shutoff valve supplies hydraulic pressure to the pressure switch, the engage piston, and the electo-hydraulic servovalve (EHV).

(b) Pressure Switch

The pressure switch senses that hydraulic pressure is being supplied to the automode components. The switch signals are fed to the autopilot roll computer and are used in the autopilot engage logic circuits.

(c) Autopilot Engage Piston

The autopilot engage piston is actuated when the autopilot is engaged and locks out the pilots manual inputs to the servo module. Two hydraulically separated locking pistons force a roller into a detent cam which is link connected to the pilots input control path, effectively locking it. The two locking pistons insure actuation of the engagement assembly if either or both of the autopilot channels are engaged.

In the event the autopilot malfunctions, the pilot can assume immediate control of the servo power control valves by applying enough force to the servo input lever, through his control system, to force the roller out of the engagement.

(d) Electro-Hydraulic Servovalve (EHV)

The EHV receives electrical roll position error inputs from the autopilot roll computer. The EHV converts these error input signals to proportionate hydraulic flows which are directed to the modulating piston/coupler.

(e) Modulating Piston/Coupler

The modulating piston/coupler receives hydraulic pressure differentials from the EHV valve which produces modulating piston stroking. The modulating piston output is applied to the internal summing linkage and positions the three power control valves.

The coupler function of the modulating piston hydraulically locks the modulating piston to its drive arm. The coupler is controlled by hydraulic signals from the coupler shutoff valve.

(f) Coupler Shutoff Valve

The coupler shutoff will automatically disengage the modulating piston coupler and disengage the autopilot engage piston if the modulating piston jams.

The coupler functions by comparing the modulating piston cylinder pressures and if the difference exceeds a preselected value, one of the two coupler shutoff valve pistons displaces the shutoff valve spool. Displacement of the shutoff valve spool depressurizes the modulating piston coupler and autopilot engage piston. Depressurizing the modulating piston coupler hydraulically uncouples the modulating piston from its drive arm, thus allowing the operable modulating piston to provide autopilot inputs.

A centering spring is connected to the common output arms of the two modulating pistons. The centering spring mechanically holds the automode end of the summing lever in neutral when both channels of the autopilot are shut off. With the autopilot off, the centering spring provides a hard point reference for the pilots manual inputs to react against.

(g) Position Transducer

The position transducer is coupled to the modulating piston and provides the autopilot roll computer with electrical feedback signals that are used to control modulating piston rate.

B. Operation

(1) Manual Operation

During normal operation of the inboard aileron servo with all three systems pressurized and active, the left servo module is supplied by hydraulic system A, B, and C; the right servo module by B, C, and D. To simplify the description of system operation, only system B of the left servo will be described in detail.

Normally all three servo channels are active and an input command displaces the three parallel acting power control valves to control the three actuators in unison. Figure 19 shows the left servo with all three servo channels and the two autopilot channels active.

Hydraulic system B fluid pressure (3000 psi nominal) is delivered to the servo module, filtered by a 25-micron filter and distributed to the various servo components. Fluid is supplied to the solenoid shutoff valve and to the spring chamber of the bypass and shutoff valve. Normally the solenoid shutoff valve is deenergized, shutting off flow at the pressure port (P) of the solenoid valve and connecting the solenoid valve cylinder port (C) to return (R). With the solenoid shutoff valve deenergized, the bypass and shutoff valve is positioned by system pressure in the spring chamber to the ON position as shown. In the ON position, the bypass and shutoff valve ports system pressure to the pressure port of the power control valve. The servo is now active and will respond to control valve displacement. System B fluid is also supplied to the solenoid shutoff valve of one of the autopilot control modules.

Operation of the manual servo is as follows: Counterclockwise rotation of either the Captains or First Officers control wheels (left roll) will, through a pushrod and linkage system, produce an up aileron input to the left servo and a down aileron input to the right servo. The input command displaces the three parallel power control valves through the internal linkages and opens the cylinder up-ports on the left servo to system pressure and the cylinder down-ports to system return; the right servo is ported opposite.

Hydraulic flow to the actuating cylinder is proportional to control valve displacement. The three actuators on each aileron respond to the load induced differential pressure and position the ailerons against the aerodynamic load.

Aileron displacement is mechanically fed back to the servo through the feedback arms and compared with the input command through the internal summing linkage.

The aileron feedback will null the control valves when the aileron reaches the commanded position. A right roll input is similar except all motions and hydraulic flows are reversed, causing the left aileron to position down and the right aileron to position up.

(2) Autopilot Operation

In cruise, only one autopilot channel is active; the second channel is on standby. During landing, both channels are active. However, either autopilot channel will provide full autopilot control of the roll system.

Roll position error signals from the roll autopilot system are fed to the electro-hydraulic servovalve (EHV) on the aileron servo. The EHV converts the error signal to proportionate hydraulic flows to the modulating piston. The modulating piston strokes against the centering spring and displaces the summing lever which pivots around the fixed fulcrum produced by the autopilot engage mechanism. Movement of the summing lever displaces the three power control valves which hydraulically position the aileron.

As the control surface moves out of its trimmed position in response to autopilot commands, the output of a surface position transducer increases and eventually balances the autopilot command signal with an equal and opposite signal. As the corrective maneuver returns the aircraft to the desired flight path, the initial position error command signal diminishes and the position transducer signal (which is now the larger of the two) takes effect as an opposite command signal to the EHV and returns the control surface to the original position.

The position transducer connected to the modulating piston controls the rate at which the servo force is applied to the surface. This transducer signal, which is produced by modulating piston stroking, dampens the original autopilot command signal. This dampened signal is reflected in the EHV and controls the stroke of the modulating piston.

15. Outboard Aileron Servo Control Module

A. Description

The outboard aileron servo is a hydro-mechanical position servo for positioning of the outboard ailerons. There are two identical servo packages; one servo package is installed

in the trailing edge of each wing just forward of the outboard aileron, zones 570 and 670 (Ref. Fig. 20). The outboard aileron servos receive mechanical positioning commands from the inboard aileron surfaces and positions the ailerons in response to these commands.

Each servo system consists of a dual control valve module, two unequal area actuators, and dual mechanical feedback linkages. The two actuators, each of which can control the aileron, operate in parallel and share the control surface load. The servo module is supplied by two independent hydraulic systems, thus assuring fail safe operation of the outboard aileron in the event of a hydraulic system failure. The left servo module is supplied by hydraulic systems A and B, the right by systems B and D.

Aileron command input motions are transmitted internally to a completely enclosed summing linkage which displaces the dual tandem power control valve (Ref. Fig. 21). Surface movement is fed back to the summing linkage by dual feedback rods, with a feedback lever mounted on each side of the module. The internal summing linkage includes a centering spring that will return the surface to the neutral position in the event of a disconnect in the servo input control linkage. Permanent external stops on the servo module limit input lever rotation which hydraulically limits control surface displacement to 20 degrees up and 20 degrees down from neutral.

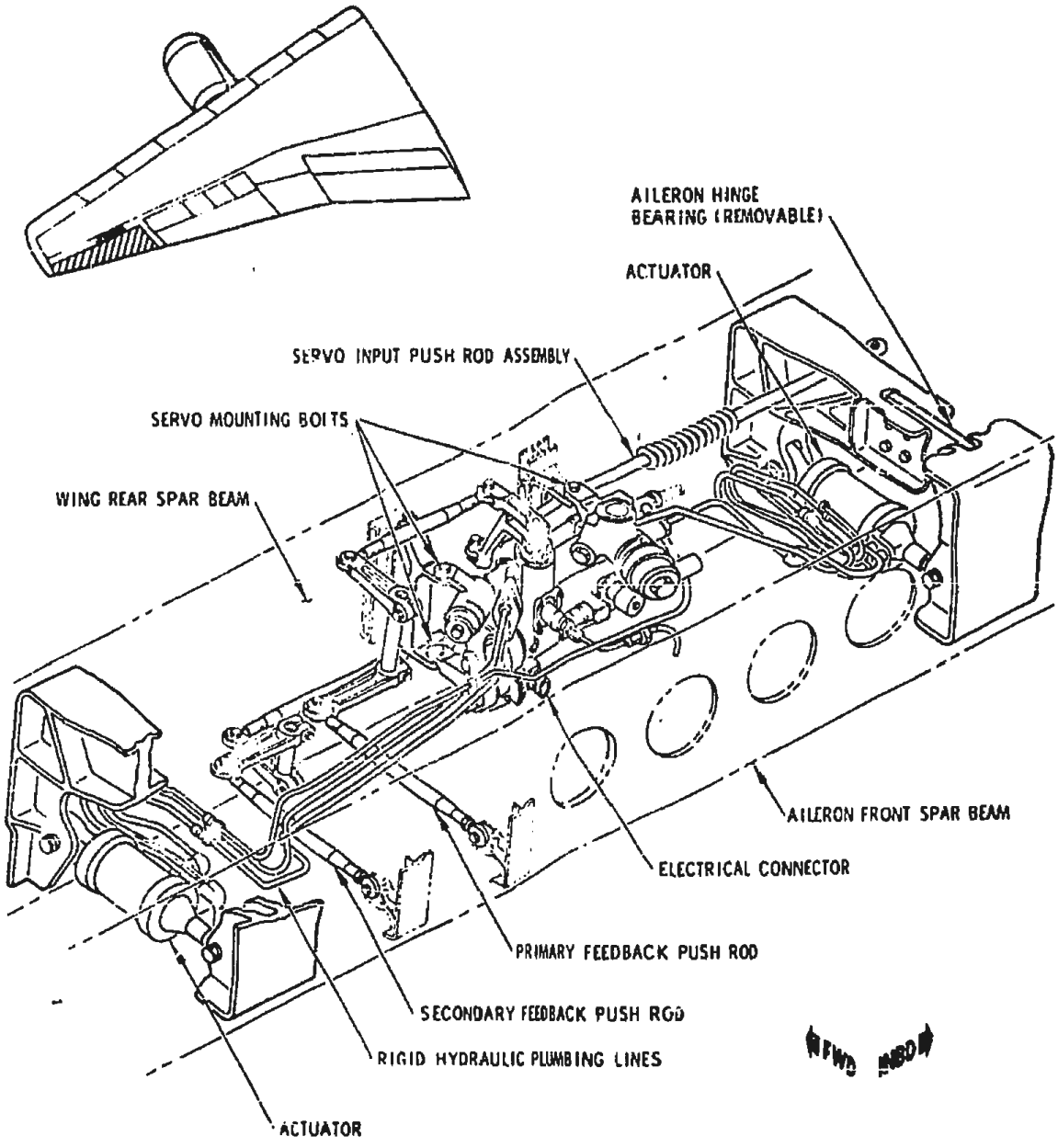
The aileron servo is composed of a dual control valve module. Each channel of the dual control valve module includes a cleanable steel-mesh 25 micron absolute filter, power control valve, bypass and shutoff valve, solenoid shutoff valve, and two relief valves. A detail description of the servo components follows:

(1) Power Control Valve

The power control valve consists of two four-way spools in tandem. The center land of each control valve controls supply pressure to either the actuator extend or retract line as commanded; independent return orifices are used for extend or retract flows compatible to the unequal area power actuators.

(2) Bypass and Shutoff Valve

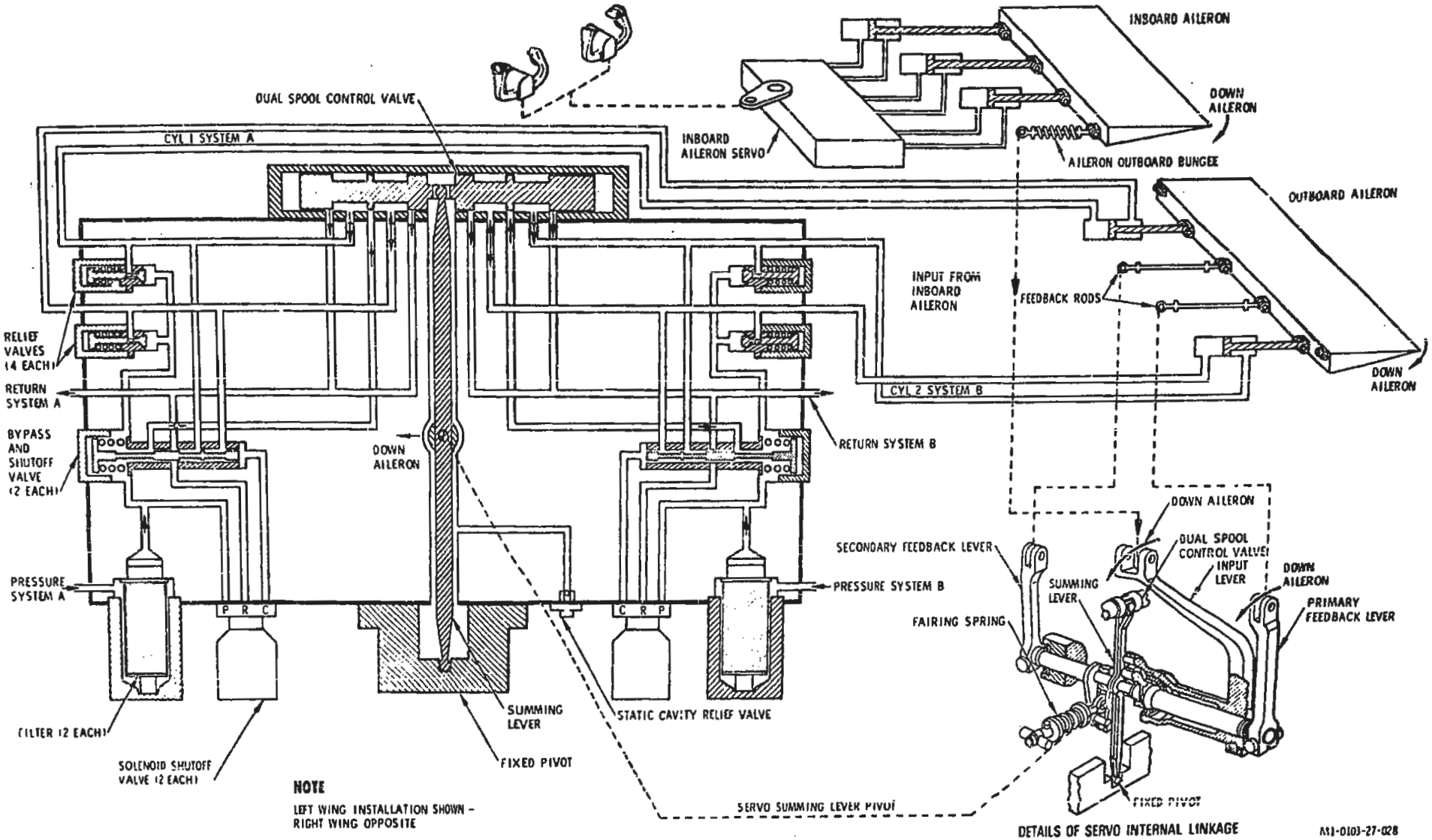
The bypass and shutoff valve provides a means for shutting off the hydraulic supply to the power control valve. There are two of these valve assemblies installed in the servo module, one for each system. The two-position hydraulically actuated valve is



NOTE
LEFT OUTBOARD SERVO SHOWN,
RIGHT OUTBOARD SERVO OPPOSITE

M1-0101-27-027

Outboard Aileron Servo Installation
Figure 20



R
R Outboard Aileron Servo Schematic
Figure 21

EFFECTIVITY: ALL

001B

installed in the pressure line between the filter and the power control valve and is connected to the actuating cylinder lines. The normal position of the shutoff valve allows passage of system pressure to the power control valve spool and blocks the flow of fluid between the actuating cylinder ports.

The bypass and shutoff valve is controlled by the solenoid shutoff valve. When the solenoid shutoff valve is energized, pressure is applied to one end of the bypass and shutoff valve. Actuation of the solenoid shutoff valve positions the bypass and shutoff valve to shut off system supply pressure to the power control valve and interconnect the cylinder ports to each other and return, thus shutting down that system. If system supply pressure falls below 450 psig, the bypass and shutoff valve spring will automatically drive the valve to the shutoff position.

(3) Solenoid Shutoff Valve

Two plate-mounted solenoid shutoff valves control the hydraulic actuation of the two bypass and shutoff valves. The solenoid shutoff valve is a two-position, three-way ball selector valve that is electrically controlled from the PFCS MONITOR panel on the pilots overhead panel (Ref. Fig. 6 and 7). The panel contains two switchlights marked AILERON L OUTBD and R OUTBD. Depressing one of the switchlights will energize both solenoid shutoff valves on the associated servo, deactivating the servo and causing the aileron to seek the float position.

(4) Relief Valve

Each hydraulic system has a pressure relief valve between each actuating cylinder line and supply pressure line to limit excessive cylinder pressure buildup which might occur from abnormal hinge moment. The valves are spring poppet assemblies. The relief valve cracks when cylinder pressure exceeds system pressure by 2 to 8 psi minimum and relieves excessive cylinder pressure into the system pressure line.

(5) Static Cavity Relief Valve

One static cavity relief valve is installed in the servo linkage manifold to protect the manifold against excessive return pressure buildup. The linkage manifold is common to both control valves and is filled with fluid before installation.

Fluid pressure in the linkage manifold is a function of control valve spool lap leakage and will reflect approximate average of both systems return pressure. The relief valve cracks at 250 psi with full flow at 300 psi. The relief valve is ported overboard.

Occasional fluid discharge from the relief valve may occur due to transient high return pressure spikes and can be considered normal. However, prolonged or persistent discharge is cause for further investigation.

B. Operation.

The outboard ailerons are slaved to the inboard ailerons and are active during all flight speeds. Normally, the outboard aileron operates with both hydraulic systems supplying the servo.

Assuming a left roll input has been applied by the Captain or First Officer, the operation of the outboard servos is as follows: Movement of the inboard aileron surfaces is transmitted by pushrod and cable systems to the input arm of the outboard servos. This manual command input is applied to the summing lever pivot and causes the summing lever to rotate around the fixed lower pivot.

Summing lever movement strokes the left dual control valve and opens the actuating cylinder up ports to system pressure and the cylinder down ports to system return; the right outboard aileron dual control valve is ported opposite. Hydraulic flow to the actuating cylinders is proportional to control valve displacement. The two actuators on each aileron respond to the load induced differential pressures and postion the left aileron up and the right aileron down against the aerodynamic load.

Aileron displacement is mechanically fed back to the servo through dual feedback links and compared with the input command through the internal summing linkage arrangement. The feedback nulls the dual control valves when the aileron reaches the commanded position. A right roll input is similar except all motions and hydraulic portings are reversed, causing the left aileron to position down and the right aileron to position up.

16. Solenoid Shutoff Valve

A. Description and Operation

The solenoid shutoff valve is a plate-mounted, electrically controlled, two-position, three-way hydraulic valve (Ref. Fig. 22) which contains a pressure supply port, a cylinder port, and a system return port. The valve functions to open the cylinder port to either pressure or to return. The valve is mounted to the aileron servo with four screws, and is sealed by a gasket-plate face seal. The valve consists of a double coil assembly, hydraulic filter, sleeve assembly, and a ball check valve assembly.

Twelve shutoff valves are used on the four aileron servos: two shutoff valves are used on each outboard servo; three are used on the right inboard servo, and five on the left inboard (master) servo.

Tenof the shutoff valves are used as pilot valves to control their respective bypass and shutoff valves, which controls the hydraulic supply to the servo power control valves. Two of the valves are used directly to control hydraulic flow to two electro-hydraulic servovalves on the autopilot module on the left inboard aileron servo.

Operation of the shutoff valve is controlled by energizing or deenergizing the solenoid. With the solenoid deenergized, a spring loaded plunger holds the ball on the pressure inlet seat, against system pressure. This opens the cylinder port to system return so that no hydraulic pressure can be applied to the cylinder port of the shutoff valve.

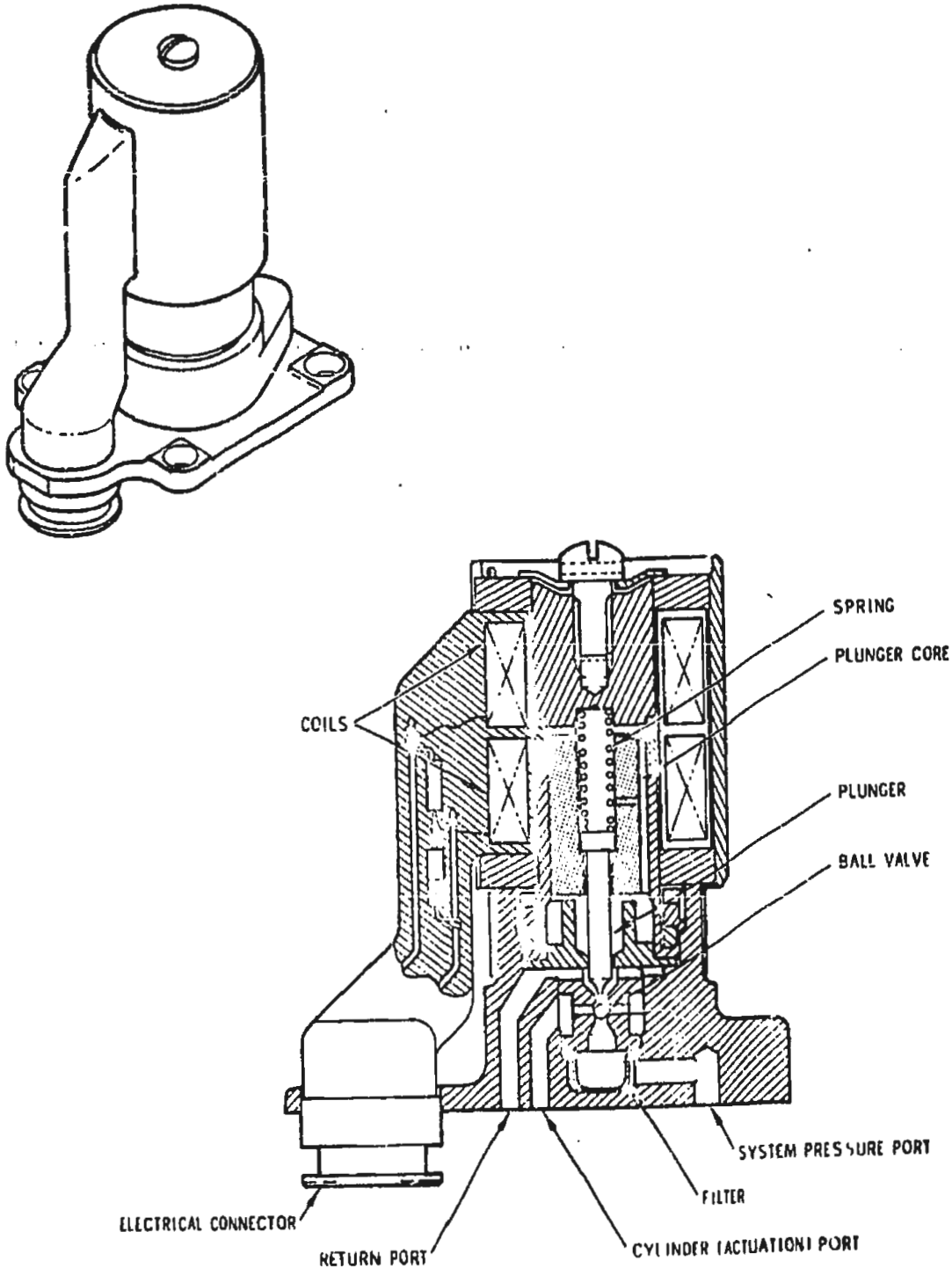
When the solenoid is energized by 28V dc, the double coil magnetic force on the plunger core and the system pressure on the ball overcome the plunger spring force to raise the plunger. System pressure then holds the ball against the return seat and opens the pressure port to the cylinder port.

Loss of solenoid electrical power will allow the spring loaded plunger to force the ball on the pressure inlet seat, thus shutting off hydraulic flow to the cylinder port of the shutoff valve.

17. Electro-Hydraulic Servovalve (EHV)

A. Description

The electro-hydraulic servovalve (EHV) is a four-way proportional valve that controls the flow of hydraulic fluid to and from a modulating piston actuator. The modulating piston is an integral part of the autopilot module on the left inboard aileron servo. The EHV is attached to the



HH 6468
MI-A00-27-062

Solenoid Shutoff Valve Schematic
Figure 22

aileron servos by four screws, and hydraulically sealed by plate type gasket face seals. Two EHV's are installed on the left inboard aileron servo.

The EHV is essentially a signal converter and a two-stage hydraulic amplifier. The EHV receives small electrical signals and converts them to large hydraulic output signals which are used to drive the modulating piston. The hydraulic flow developed by the EHV is proportional in magnitude and direction to the differential current applied to the EHV torque motor.

The EHV consists of a torque motor, a jet-pipe first stage nozzle with mechanical feedback, and a second stage four-way spool valve coupled to the first stage nozzle through a feedback spring (Ref. Fig. 23). A 25-micron filter, installed in the valve pressure manifold, insures contaminant free fluid supply to the valve.

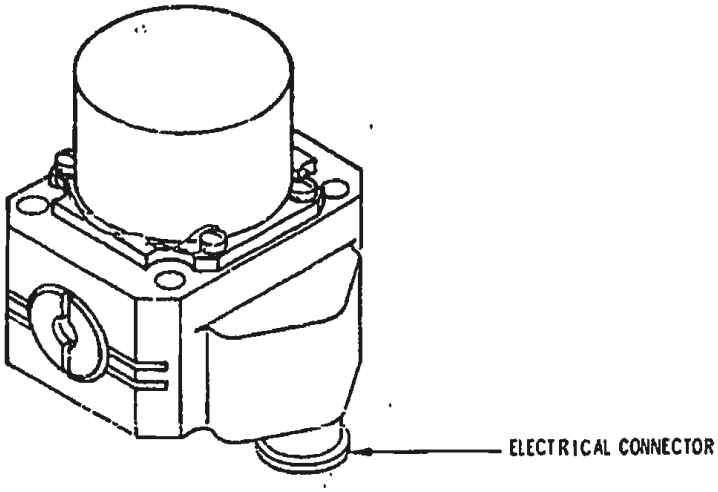
The torque motor is an electromagnetic device which consists of two pole shoes, two coils connected to the controlling computer through ships wiring, and an armature which is coupled to the first stage nozzle. The nozzle is held in the neutral (hydraulic null) position by a spring.

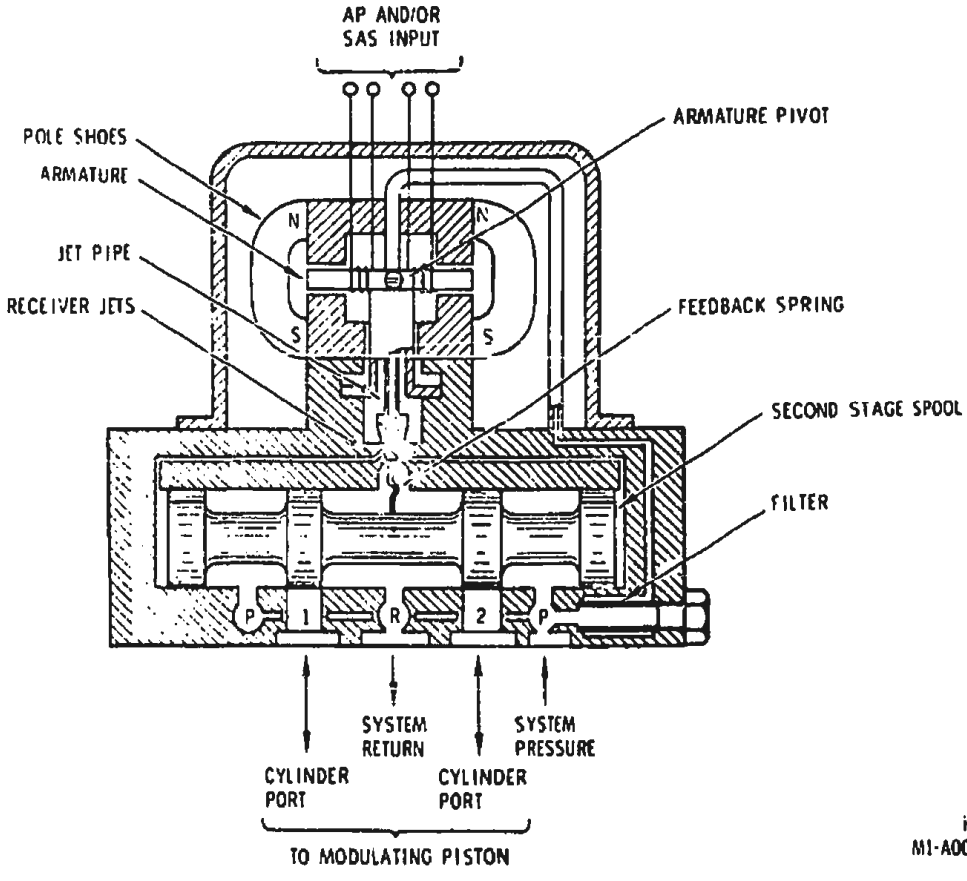
B. Operation

Hydraulic system pressure is supplied to the EHV where the fluid is filtered and ported to both pressure ports of the second stage spool valve and to the first stage nozzle. With a balanced electrical signal applied to the two coils of the torque motor, the nozzle is held in the neutral position. In this condition, the nozzle fluid-jet impinges equally on both second stage spool receiver jets, thus producing equal hydraulic pressures across the second stage spool, which maintain the second stage spool valve in the null position.

An autopilot electrical input command signal produces an unbalanced magnetic force in the torque motor and causes the armature and nozzle to rotate slightly. In this condition, the nozzle fluid-jet impinges unequally on the second stage spool receiver jets and produces a differential pressure across the second stage spool which displaces the spool.

Displacement of the second stage spool controls hydraulic flow and pressure to the modulating piston. The modulating piston is coupled to a position transducer (LVDT) which senses modulating piston displacement and provides the feedback signal to complete the servo positioning loop.





HH 5087
M1-A00-27-035

Electro-Hydraulic Servovalve (EHV)
Figure 23

Displacement of the second stage spool also applies a mechanical force through the feedback spring, which tends to return the nozzle towards the null position. The internal mechanical feedback mechanism stabilizes servovalve operation and provides for more accurate servovalve positioning.

18. Inboard Aileron Actuator

A. Description and Operation

Three independent actuators are used to position the inboard aileron. Each actuator is controlled by a separate power control valve, and each power control valve is supplied by an independent hydraulic supply system. The actuator is an equal area piston type (Ref. Fig. 24).

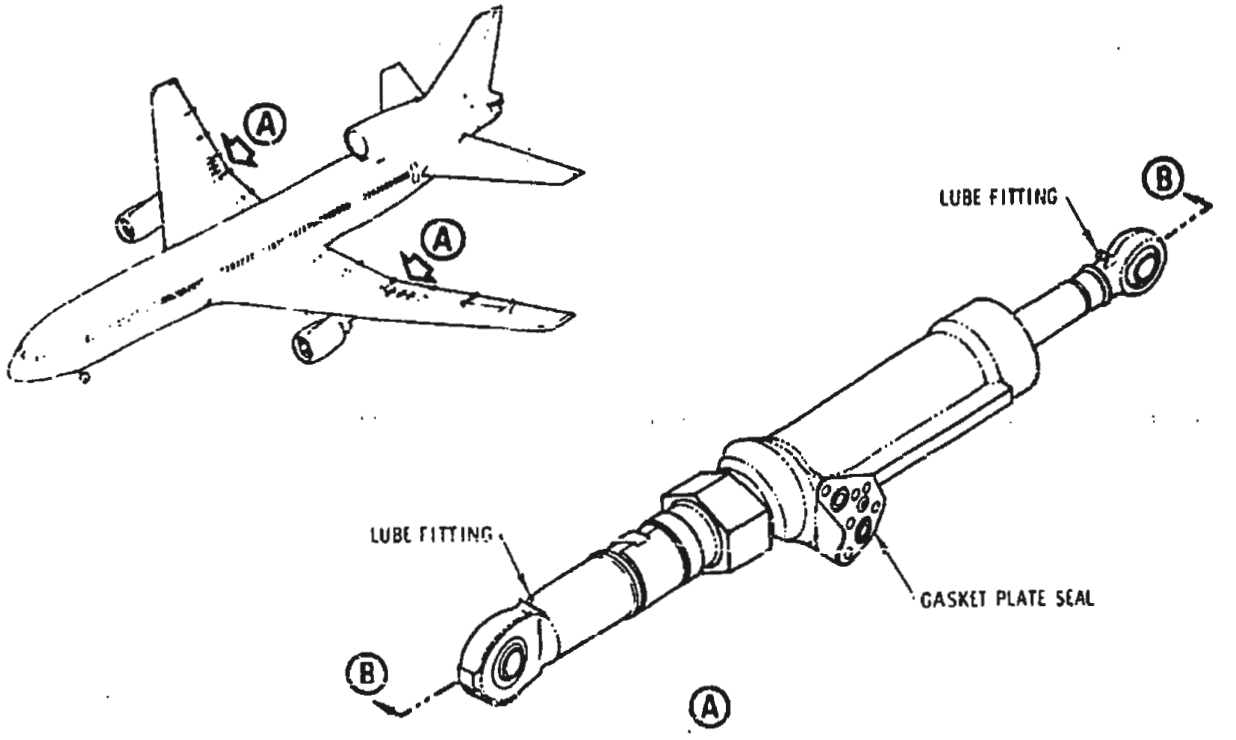
Gland inserts are used in the cylinder ends and contain the static and dynamic seals and the piston rod scraper ring. Hydraulic leakage is controlled by using dual static and dynamic seals. The cavity between the seals is plumbed to system return, thus the outer O-ring seal is subjected only to reservoir pressures. Both the cylinder attaching lug and the piston rod end contain self-aligning bearings which are lubricated by grease fittings. The three hydraulic lines are attached to the actuator by a plate-mounted manifold. The manifold is sealed by a gasket plate seal.

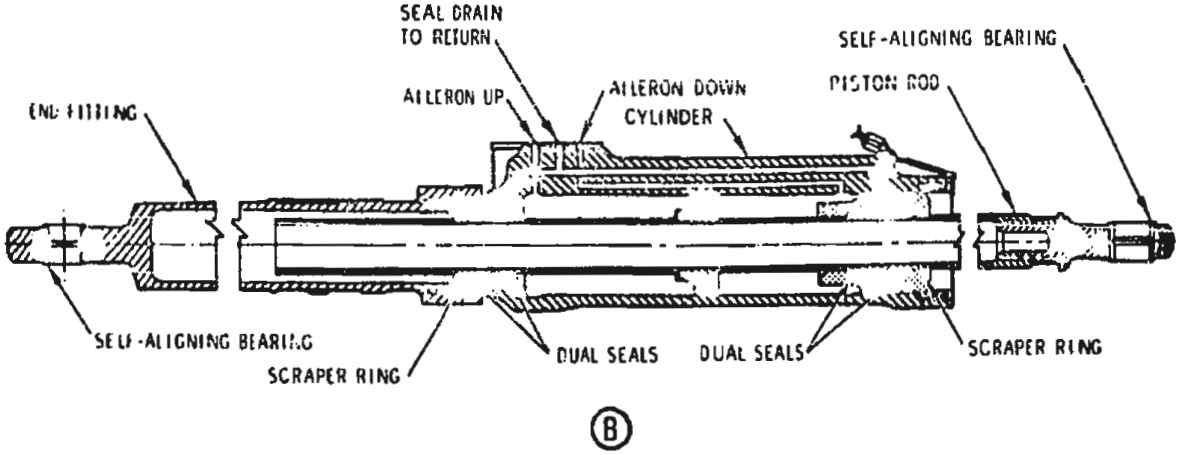
19. Outboard Aileron Actuator

A. Description and Operation

The outboard aileron is positioned by two independent actuators. Each actuator is controlled from a separate power control valve, and each power control valve is supplied by an independent hydraulic supply system. The actuator is an unequal area single ended type (Ref. Fig. 25).

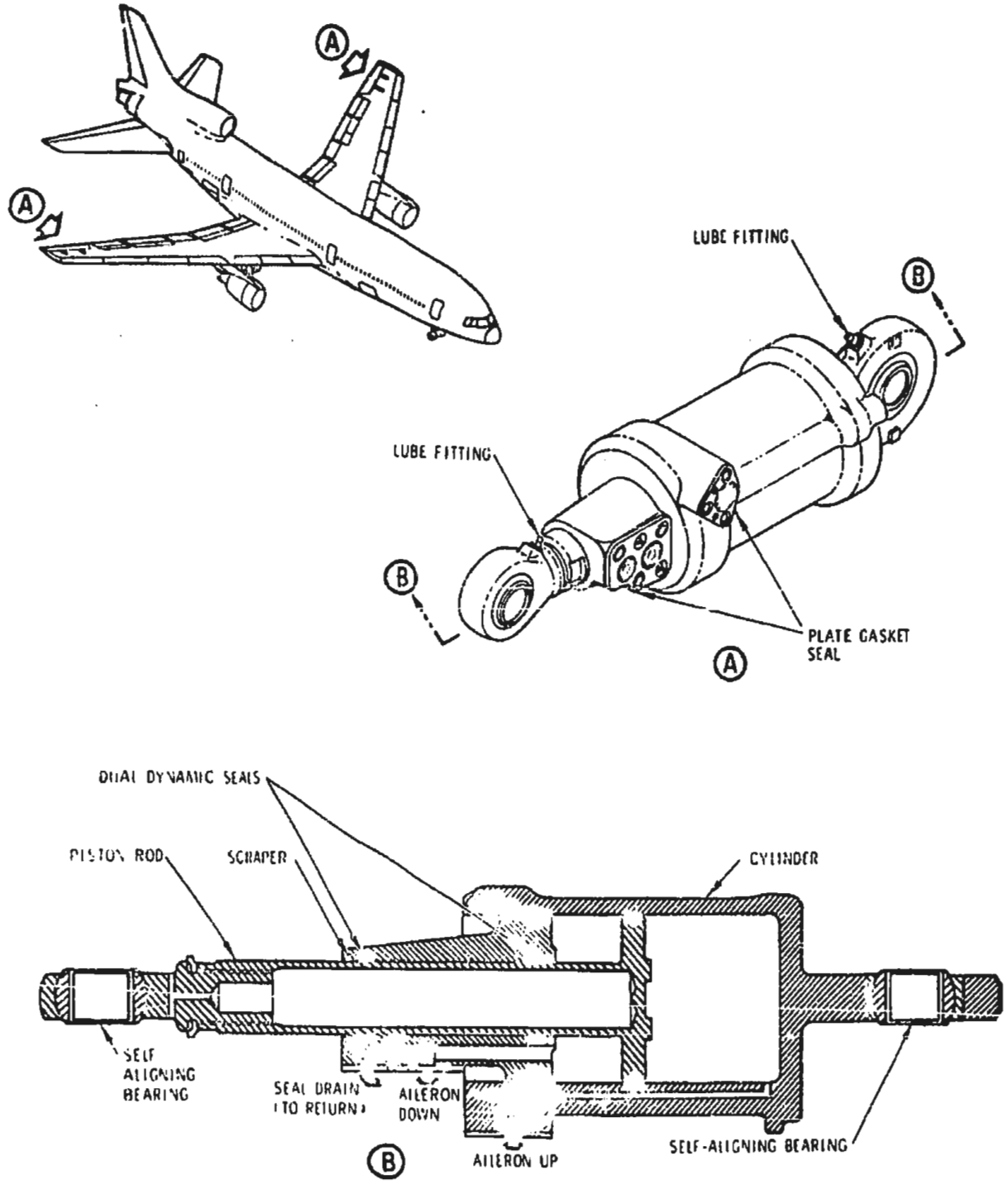
A gland insert is used in the piston rod end and contains the static and dynamic seals and the piston rod scraper ring. Dual dynamic seals are used to control hydraulic leakage. The cavity between the dual dynamic seals is plumbed to system return, thus the outer O-ring is exposed to reservoir pressures only. Both the cylinder attaching lug and the piston rod end contain self-aligning bearings which are lubricated by grease fittings. The three hydraulic lines are attached to the cylinder by two plate-mounted manifolds. The manifolds are sealed by gasket plate seals.





M1-0101-27-029

Inboard Aileron Actuator
Figure 24



MI-0101-27-030

Outboard Aileron Actuator
Figure 25

20. Outboard Aileron Damper

A. Description and Operation

Two dampers are installed on each outboard aileron to protect the aileron against possible surface flutter. The two dampers are located approximately mid-span of the aileron, zone 570 and 670. Each damper is mounted between machined clevis fittings on the wing rear spar and on the aileron forward spar (Ref. Fig. 26).

The damper is a fluid displacement hydraulic piston type with an integral reservoir. Reservoir fluid supply level is determined by viewing the reservoir piston indicator through a sight glass in the wall of the reservoir housing. Scribed indicator marks on the housing, marked FULL and REFILL, show when the reservoir should be recharged with hydraulic fluid.

The cylinder end of the damper contains two ports for filling the damper and charging the reservoir. The upper port contains a check valve and is used for filling; the lower port contains a threaded plug as is used for bleeding the damper during the filling procedure.

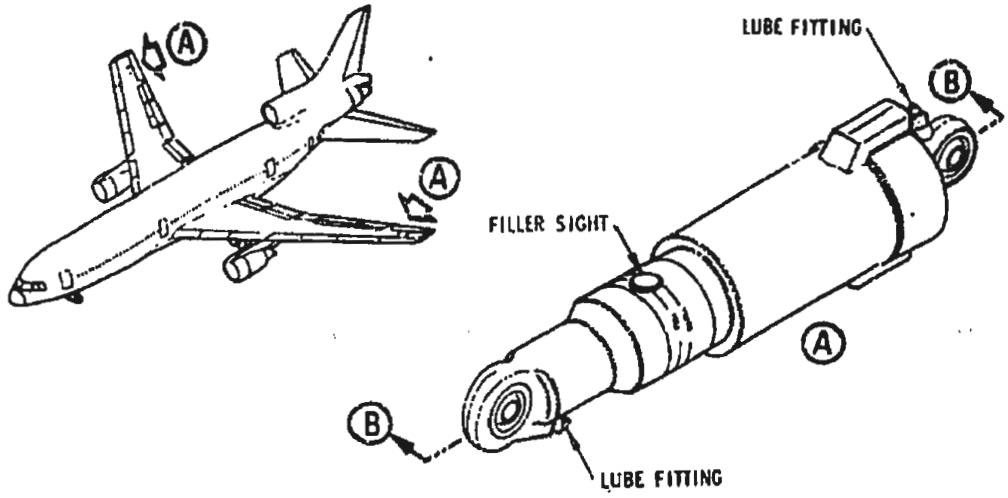
The damper provides a resistive force directly proportional to the velocity at which the damper piston rod is displaced in either direction. Hydraulic fluid is passed from one side of the piston to the other through the spool valve in the hollow piston rod. The spool valve is load sensitive and responds to damper pressures to produce essentially a lineal dampening curve. In addition, two relief valves are incorporated in the spool valve to allow flow between piston sides if the spool jams. The damper piston rod and the cylinder mounting lug contain self-aligning spherical bearings. The bearings are lubricated through threaded grease fittings.

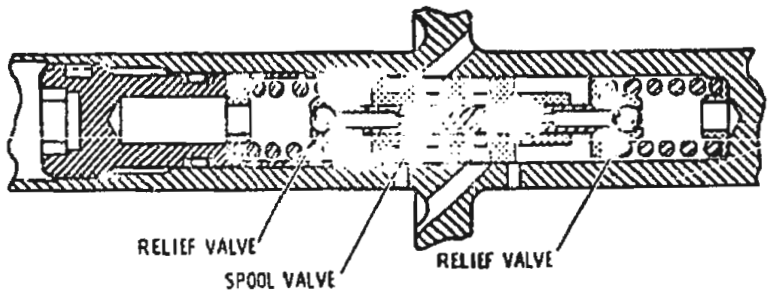
21. Inboard Aileron

A. Description

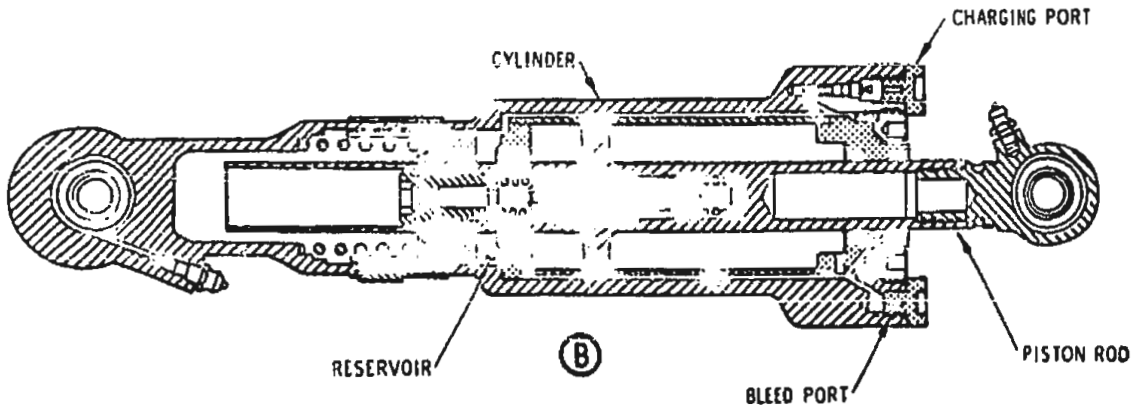
On aircraft 001-033, 036-999,
each inboard aileron is of aluminum alloy frame construction, consisting of leading and trailing edge spars, ribs, clad aluminum alloy box skin panels, and leading edge fairings. The trailing edge is of fiberglass construction.

On aircraft 034-035,
each of the inboard ailerons are fabricated from graphite-epoxy fabric and graphite-epoxy tape consisting of trailing edge spar, ribs and skin panels. Hinge and





SPOOL VALVE DETAIL



HH 6512
M1-0101-27-031

Outboard Aileron Damper
Figure 26

actuator fittings are made from aluminum forgings, rear spar from aluminum alloy and trailing edge from kevlar and nomex core. End fairings are made from fiber glass and leading edge shroud from aluminum.

The aileron is provided with two machined hinge fittings attached to the front spar (Ref. Fig. 27). These same two hinge fittings contain machined lugs on the lower ends for attachment of two of the three actuating cylinders. A third actuator fitting is located just outboard of the outboard hinge fitting. Four additional machined fittings are installed on the lower edge of the aileron front spar and provide for attaching two aileron servo feedback rods, a spoiler mixer input rod, and the outboard aileron servo input rod.

The aileron is a balanced surface. Weight and balance information is provided on a data placard located on the front spar inboard of the outboard hinge at aileron station 95. Access is through access panels 551AB, 551BB, and 651AB, 651BB.

Three threaded fittings are provided on the aileron upper surface for attaching an aileron support sling, for removing and installing the aileron.

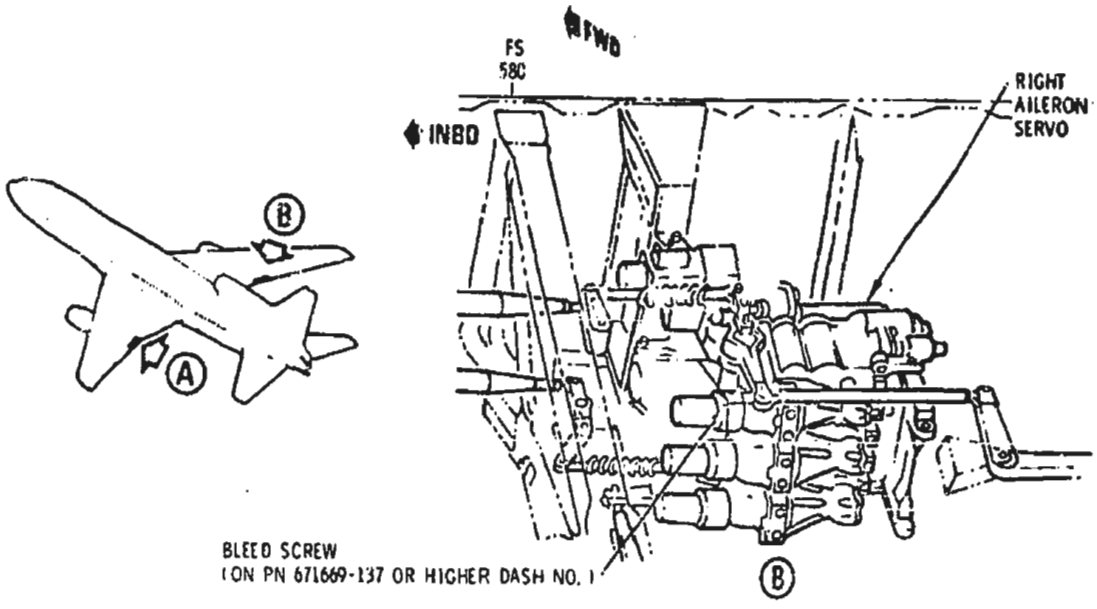
22. Outboard Aileron

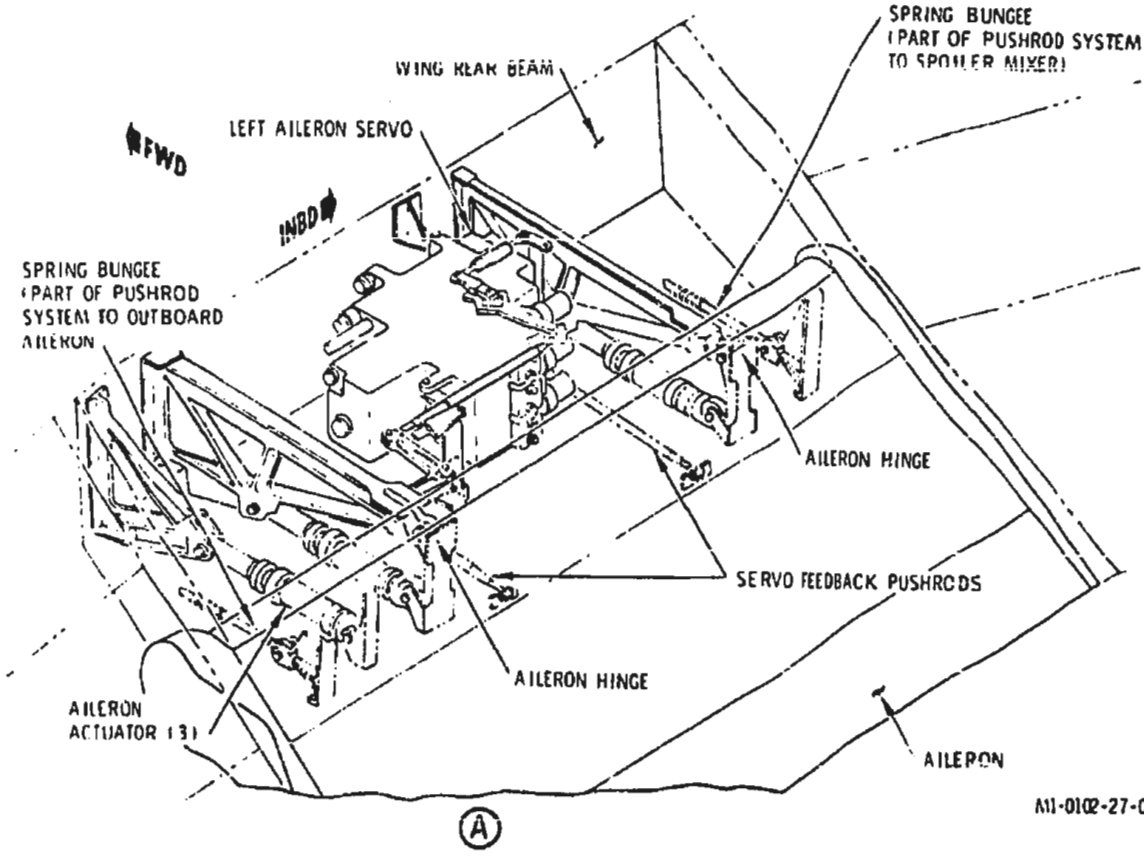
A. Description

Each of the outboard ailerons is of aluminum alloy frame construction, consisting of leading and trailing edge spars, ribs, clad aluminum alloy box skin panels, and leading edge fairings. The trailing edge is constructed of fiberglass. The outboard aileron is provided with four machined hinge fittings attached to the front spar (Ref. Fig. 28). The two inboard hinge fittings contain machined lugs on the lower ends for attachment of the two actuating cylinders.

Four additional machined fittings are installed on the lower edge of the aileron front spar and provide for attaching two flutter dampers and the two servo feedback pushrods. The two outboard fittings accept the flutter dampers; the two inboard fittings actuate the servo feedback pushrods.

The aileron is a balanced surface. Weight and balance information is provided on a data placard located on the front spar inboard of the second hinge (counting from inboard) at aileron station 83. Access is through access panels 571AB-1, 571AB-2, and 671AB-1, 671AB-2.





Inboard Aileron Installation
Figure 27

Three threaded fittings are provided on the aileron upper surface for attaching an aileron support sling, used for removing and installing the aileron.

23. Autopilot Limiter Switch Mechanism

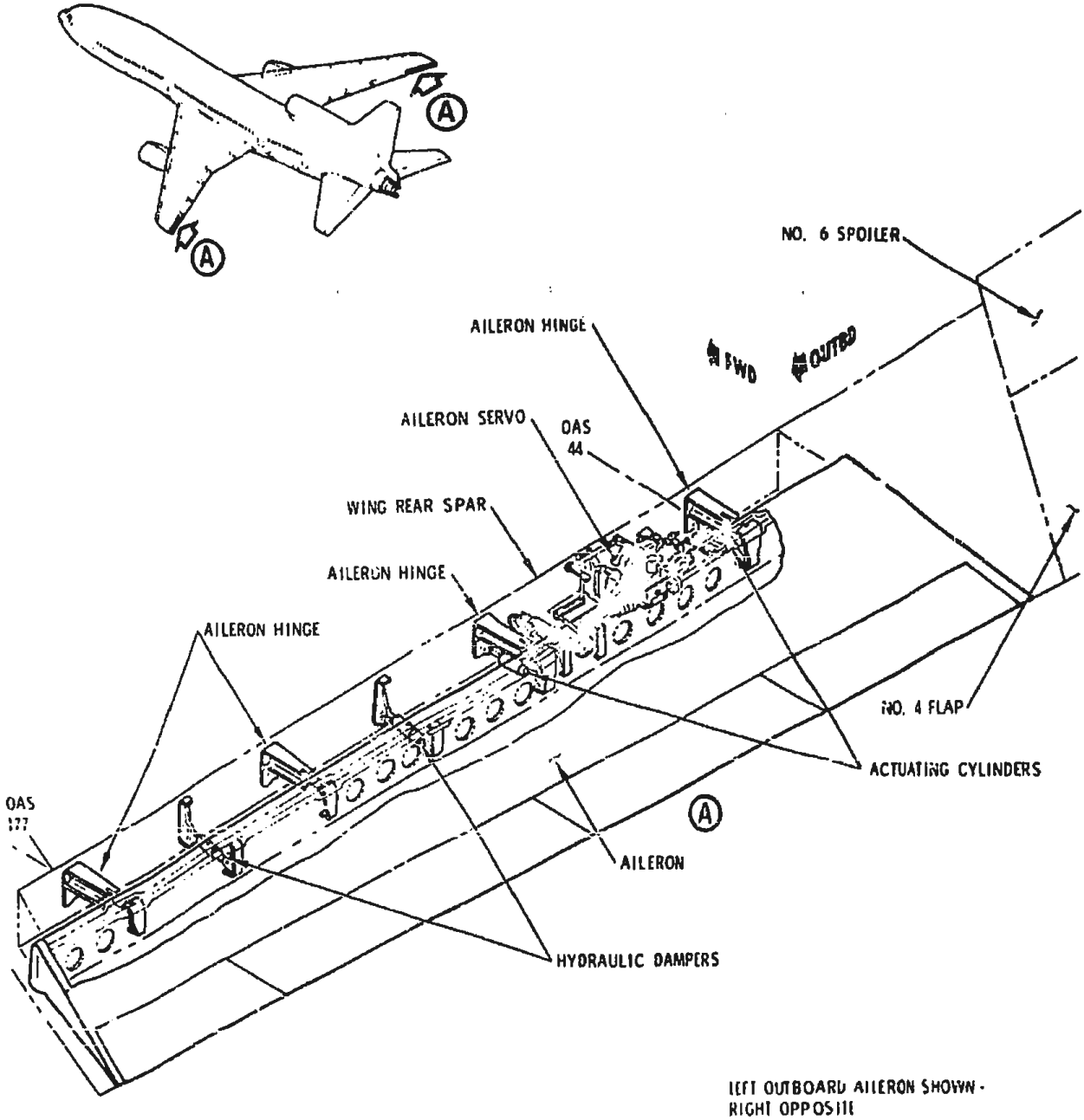
A. Description and Operation

The autopilot limiter switch mechanism is provided to limit the amount of aileron deflection the roll autopilot system can command during autopilot control. However, the autopilot limiter switches are inhibited during the control wheel steering (CWS) and autoland track modes of operation. The limit switches sense an aileron input command in excess of 13 degrees from trim and disengage the autopilot.

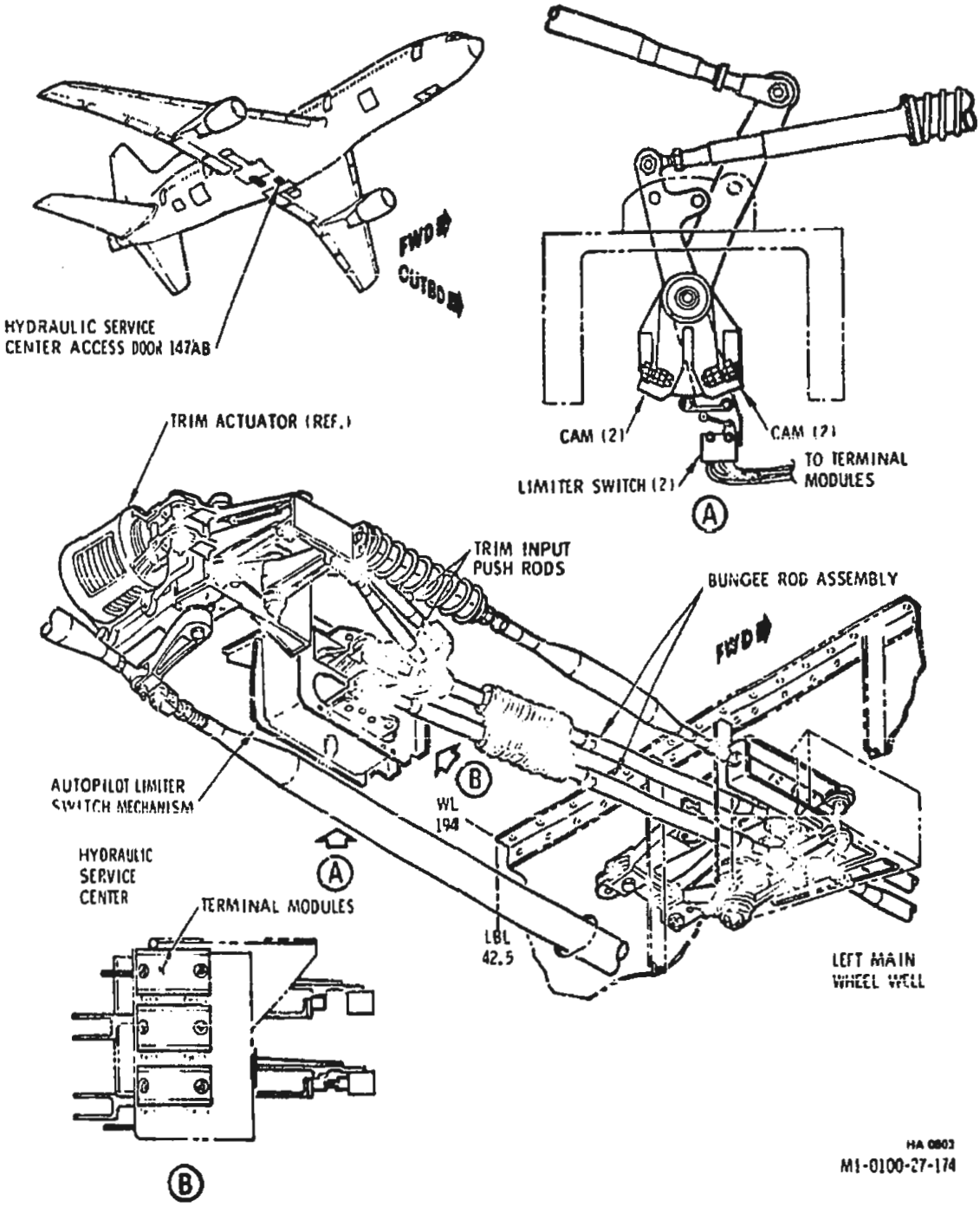
The switch mechanism is installed between and interconnected to the aileron trim actuator and the Captains aft cable bellcrank linkage. The switch mechanism is mounted to the ceiling in the hydraulic service center near the rear bulkhead, zone 147 (Ref. Fig. 29). The switch mechanism is a dual channel assembly consisting of two sets of arms (long and short), cams, cam followers, and microswitches, enclosed in a bracket assembly. Both sets of arms are mounted on a common axis by a bolt. Terminal modules are also mounted on the bracket assembly for the electrical interface.

The two shorter arm assemblies incorporate adjustable cams. A cam follower and two-pole double-throw microswitch are mounted on each of the two longer arm assemblies. The longer arms are positioned by manual aileron trim input commands. The shorter arms are positioned by left inboard aileron servo input commands. When the aileron deflection command by the autopilot system exceeds 13 degrees in either direction relative to trim, the resulting movement of the servo input pushrods will rotate the shorter arms with respect to the longer arms and actuate the switches.

The two switches used are cross-connected to the autopilot system channels so that either or both can signal the autopilot system. When actuated, the switches send autopilot authority limit signals (28V dc) to the autopilot system causing the system disengagement.



Outboard Aileron Installation
Figure 28



Autopilot Limiter Switch Mechanism
Figure 29

AILERON CONTROL SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a fault using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

Table 101

	FIGURE	TITLE
	101	COMPONENT LOCATOR INDEX
	102	COMPONENT LOCATOR DIAGRAM
	103	PFCS Roll Monitor Switchlight Indicates FAIL
R R	104	Aileron Switchlight Crosshatch Legends On; Spoiler Switchlight PUSH Legends May Be On
	105	Aileron Control Wheels Stiff or Notchy
	106	Outboard Aileron Inoperative, Inboard OK
	107	Aileron Controls Do Not Center

(Cont)
Table 101

FIGURE	TITLE
108	Aileron Trim Stiff or Notchy
109	FLT CONT PANELS Light On, Everything Else Normal
110	Aileron Trim Excessive

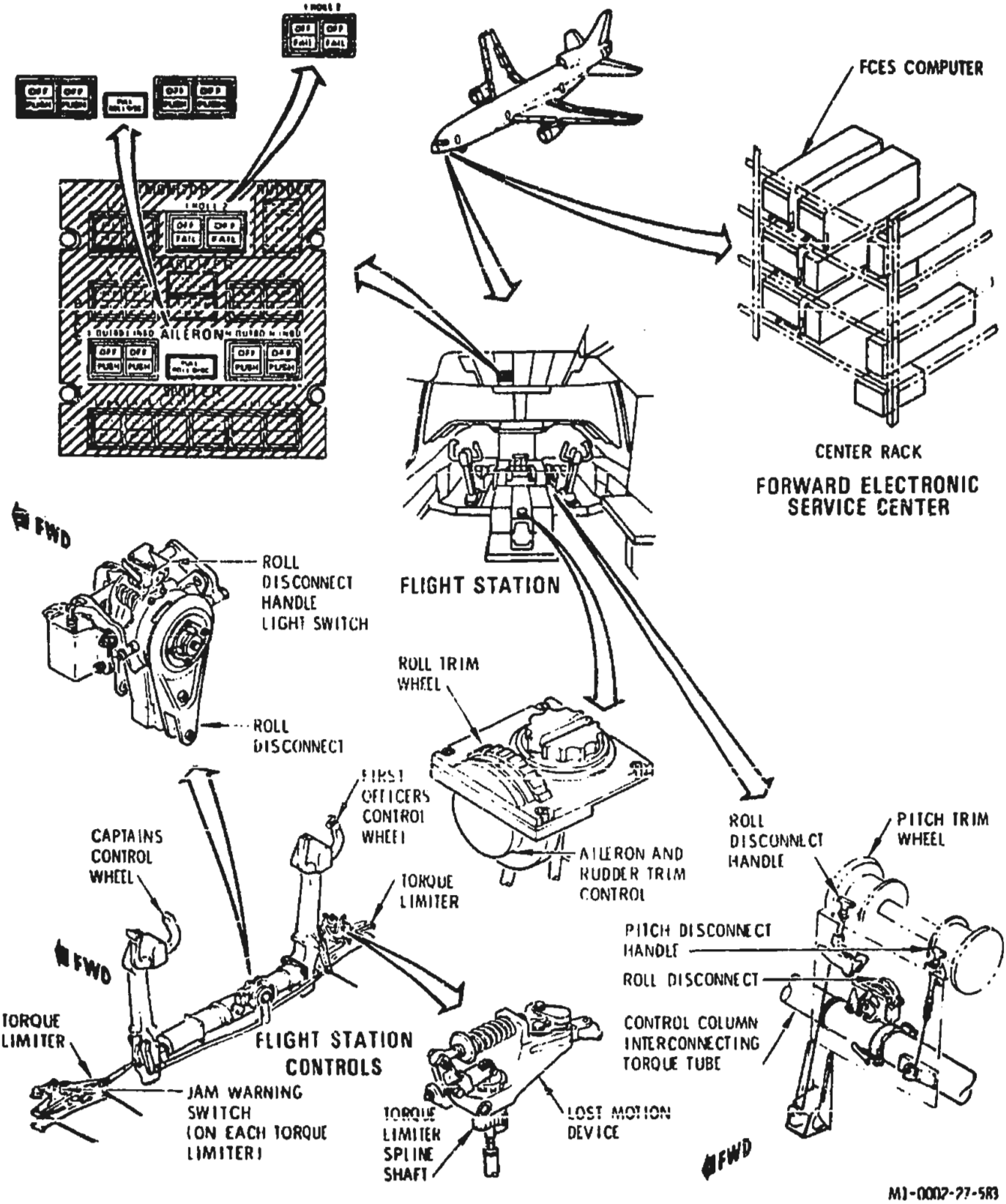
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACTUATOR, AILERON INBOARD	2	OUTBOARD WING TRAILING EDGE RIGHT & LEFT WING	27-11-23
ACTUATOR, AILERON OUTBOARD	2	INBOARD WING TRAILING EDGE RIGHT & LEFT WING	27-11-24
ACTUATOR, AILERON TRIM	1	HYDRAULIC SERVICE CENTER AFT WALL	27-12-05
DEVICE, LOST MOTION	1	HYDRAULIC SERVICE CENTER, AFT WALL	27-11-07
DISCONNECT, ROLL	1	FORWARD ELECTRICAL SERVICE CENTER	27-11-03
SERVO, AILERON INBOARD	1	INBOARD WING TRAILING EDGE, RIGHT & LEFT WING	27-11-17
SERVO, AILERON OUTBOARD	1	OUTBOARD WING TRAILING EDGE, RIGHT & LEFT WING	27-11-19
SWITCH MECHANISM, AUTOPILOT LIMITER	1	HYDRAULIC SERVICE CENTER, AFT WALL	27-11-38
WHEEL, ROLL TRIM	1	PILOT'S CENTER CONSOLE AFT OF THROTTLE QUADRANT	27-12-01

M1-0000-27-868

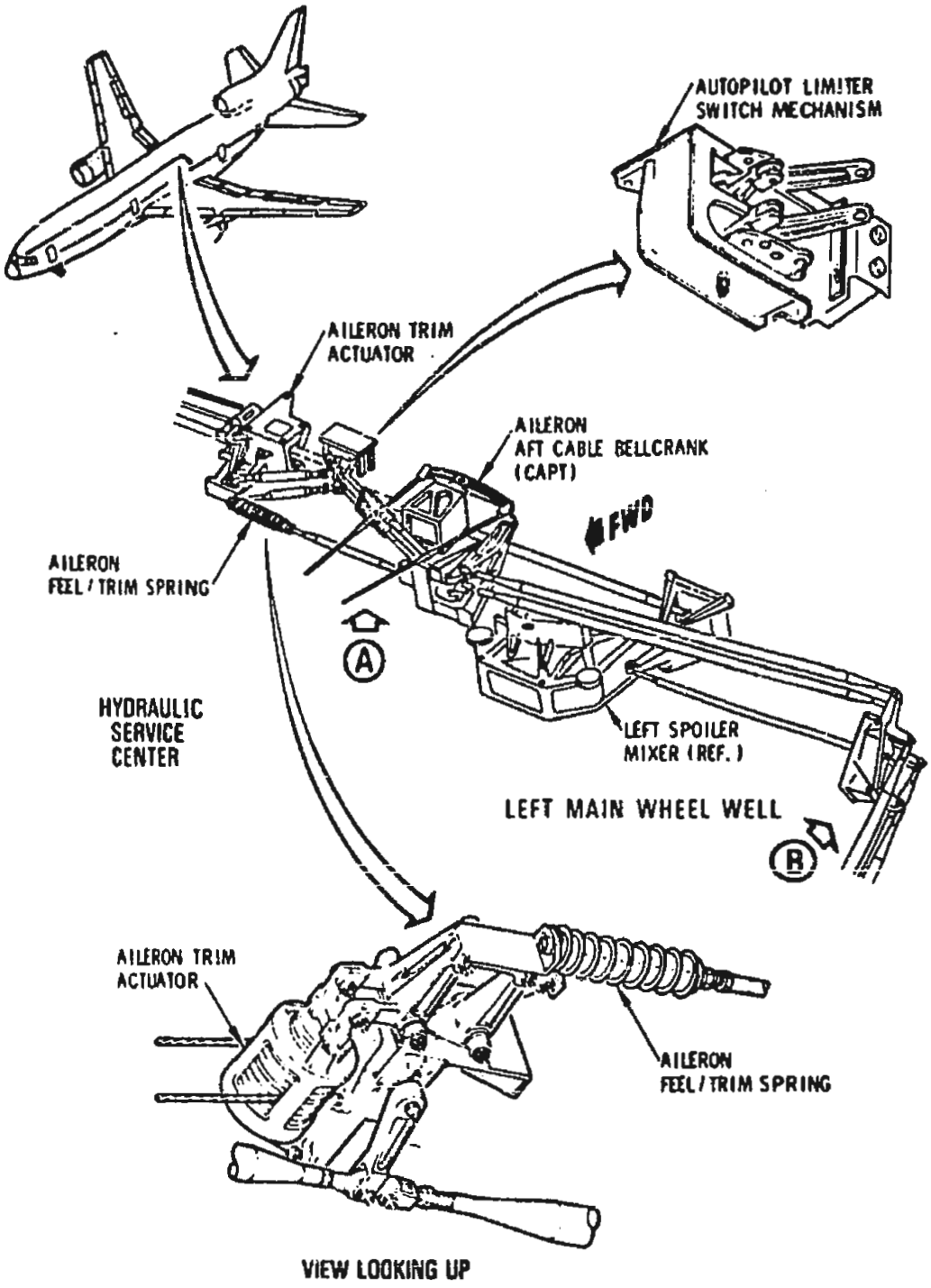
R Component Locator Index
R Figure 101

EFFECTIVITY: ALL

001B



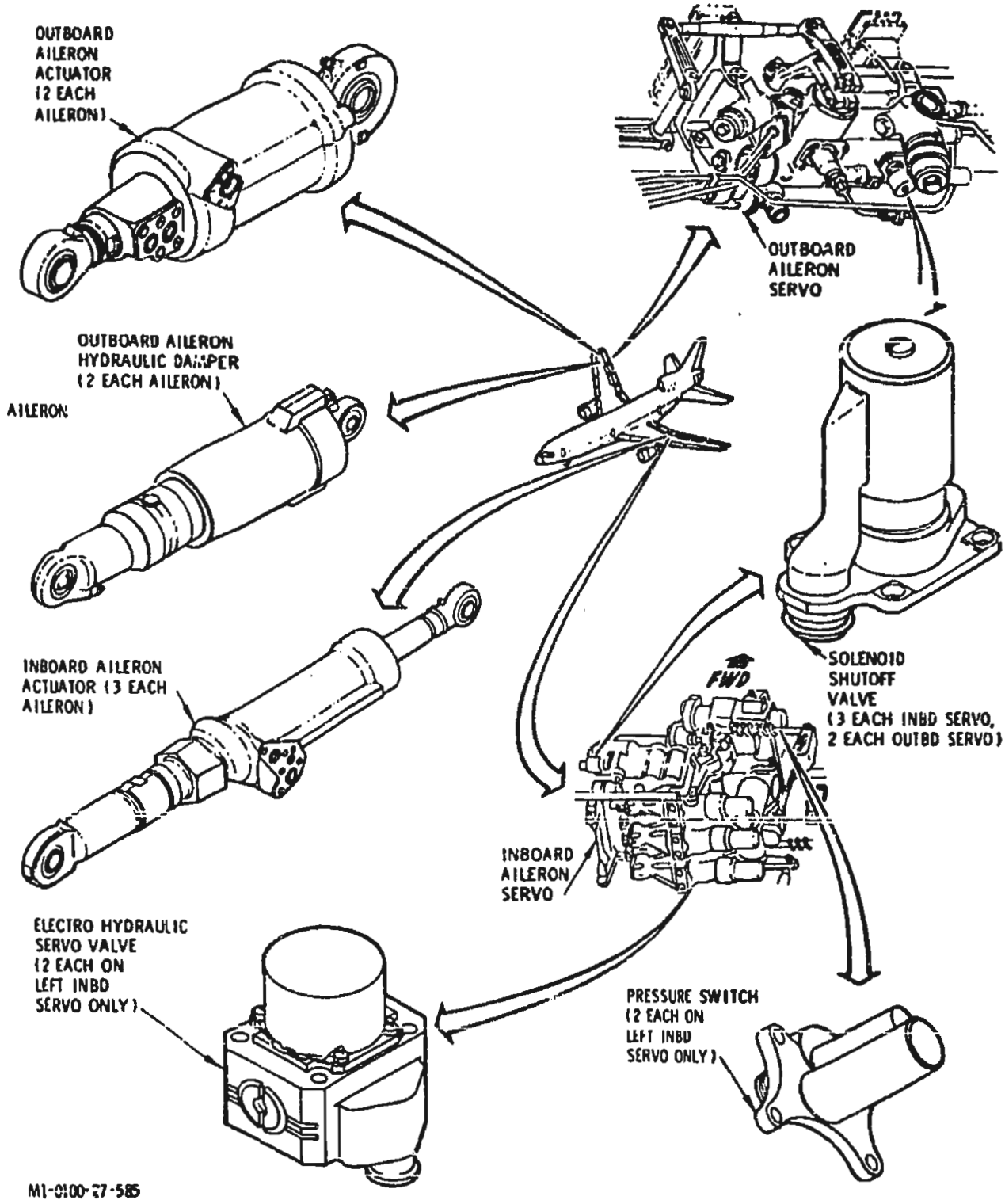
R Component Locator Diagram
R Figure 102 (Sheet 1)



Component Locator Diagram
Figure 102 (Sheet 2)

EFFECTIVITY: ALL

001B


OUTBOARD AILERON ACTUATOR (2 EACH AILERON)
OUTBOARD AILERON SERVO
OUTBOARD AILERON HYDRAULIC DAMPER (2 EACH AILERON)
AILERON
INBOARD AILERON ACTUATOR (3 EACH AILERON)
FWD
SOLENOID SHUTOFF VALVE (3 EACH INBD SERVO, 2 EACH OUTBD SERVO)
INBOARD AILERON SERVO
ELECTRO HYDRAULIC SERVO VALVE (2 EACH ON LEFT INBD SERVO ONLY)
PRESSURE SWITCH (2 EACH ON LEFT INBD SERVO ONLY)
M1-0100-27-585

R
R

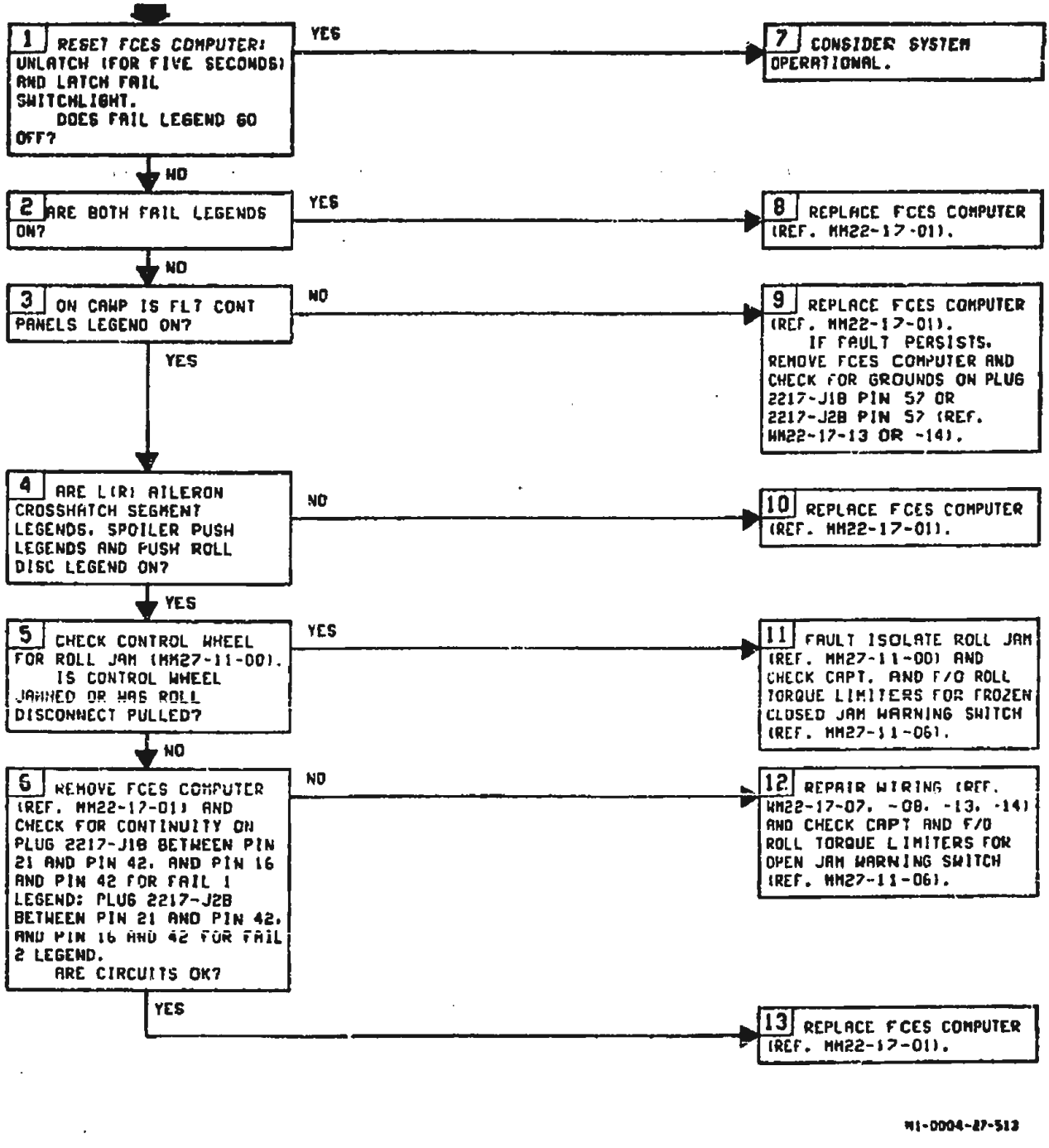
Component Locator Diagram
Figure 102 (Sheet 3)

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: CB1-B4, B5
CB2-F1
CB3-B2

PFCS MONITOR PANEL SWITCHLIGHT ROLL 1(2) FAIL LEGEND ON

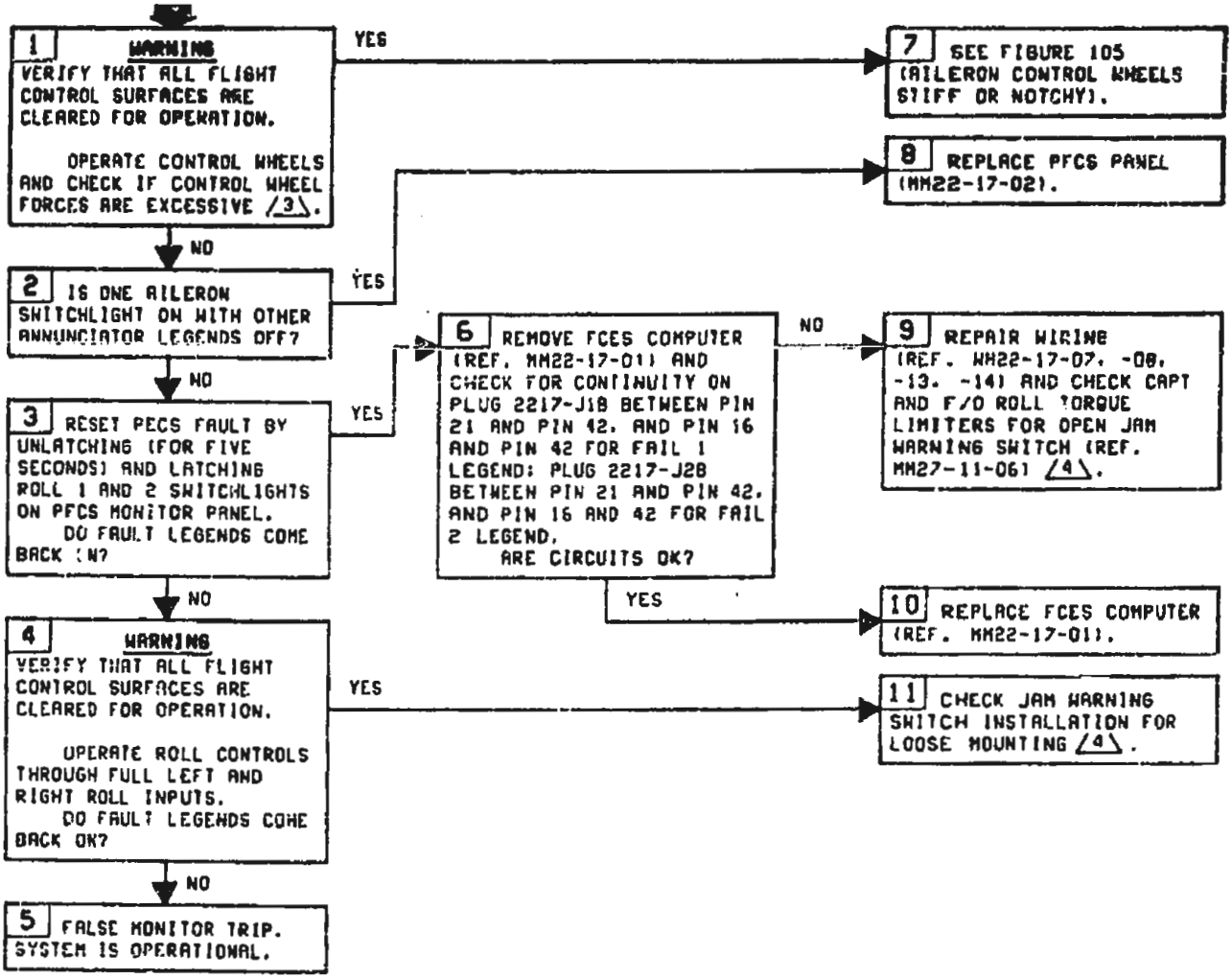

1 RESET FCES COMPUTER: UNLATCH (FOR FIVE SECONDS) AND LATCH FAIL SWITCHLIGHT. DOES FAIL LEGEND GO OFF?
YES
7 CONSIDER SYSTEM OPERATIONAL.
NO
2 ARE BOTH FAIL LEGENDS ON?
YES
8 REPLACE FCES COMPUTER (REF. MM22-17-01).
NO
3 ON CAWP IS FLT CONT PANELS LEGEND ON?
NO
9 REPLACE FCES COMPUTER (REF. MM22-17-01). IF FAULT PERSISTS, REMOVE FCES COMPUTER AND CHECK FOR GROUNDS ON PLUG 2217-J1B PIN 57 OR 2217-J2B PIN 57 (REF. MM22-17-13 OR -14).
YES
4 ARE L(R) AILERON CROSSHATCH SEGMENT LEGENDS, SPOILER PUSH LEGENDS AND PUSH ROLL DISC LEGEND ON?
NO
10 REPLACE FCES COMPUTER (REF. MM22-17-01).
YES
5 CHECK CONTROL WHEEL FOR ROLL JAM (MM27-11-00). IS CONTROL WHEEL JAMMED OR HAS ROLL DISCONNECT PULLED?
YES
11 FAULT ISOLATE ROLL JAM (REF. MM27-11-00) AND CHECK CAPT. AND F/O ROLL TORQUE LIMITERS FOR FROZEN CLOSED JAM WARNING SWITCH (REF. MM27-11-06).
NO
6 REMOVE FCES COMPUTER (REF. MM22-17-01) AND CHECK FOR CONTINUITY ON PLUG 2217-J1B BETWEEN PIN 21 AND PIN 42, AND PIN 16 AND PIN 42 FOR FAIL 1 LEGEND; PLUG 2217-J2B BETWEEN PIN 21 AND PIN 42, AND PIN 16 AND 42 FOR FAIL 2 LEGEND. ARE CIRCUITS OK?
NO
12 REPAIR WIRING (REF. MM22-17-07, -08, -13, -14) AND CHECK CAPT AND F/O ROLL TORQUE LIMITERS FOR OPEN JAM WARNING SWITCH (REF. MM27-11-06).
YES
13 REPLACE FCES COMPUTER (REF. MM22-17-01).

M1-0004-27-513

R PFCS ROLL MONITOR Switchlight Indicates FAIL
R Figure 103

AILERON SWITCHLIGHT CROSSHATCH LEGENDS ON AND SPOILER SWITCHLIGHT PUSH LEGENDS MAY BE ON (2)

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
HYDRAULIC POWER (MM29-11-00)
CB'S: CB1-B5 CB2-F1, J15, J16, J17, J18, J19, J20, J21, J22


1 WARNING
VERIFY THAT ALL FLIGHT CONTROL SURFACES ARE CLEARED FOR OPERATION.
OPERATE CONTROL WHEELS AND CHECK IF CONTROL WHEEL FORCES ARE EXCESSIVE (3).
YES
7 SEE FIGURE 105 (AILERON CONTROL WHEELS STIFF OR NOTCHY).
NO
2 IS ONE AILERON SWITCHLIGHT ON WITH OTHER ANNUNCIATOR LEGENDS OFF?
YES
8 REPLACE PFCS PANEL (MM22-17-02).
NO
3 RESET PFCS FAULT BY UNLATCHING (FOR FIVE SECONDS) AND LATCHING ROLL 1 AND 2 SWITCHLIGHTS ON PFCS MONITOR PANEL.
DO FAULT LEGENDS COME BACK ON?
YES
6 REMOVE FCES COMPUTER (REF. MM22-17-01) AND CHECK FOR CONTINUITY ON PLUG 2217-J18 BETWEEN PIN 21 AND PIN 42, AND PIN 16 AND PIN 42 FOR FAIL 1 LEGEND; PLUG 2217-J28 BETWEEN PIN 21 AND PIN 42, AND PIN 16 AND 42 FOR FAIL 2 LEGEND.
ARE CIRCUITS OK?
NO
9 REPAIR WIRING (REF. MM22-17-07, -08, -13, -14) AND CHECK CAPT AND F/O ROLL TORQUE LIMITERS FOR OPEN JAM WARNING SWITCH (REF. MM27-11-06) (4).
YES
10 REPLACE FCES COMPUTER (REF. MM22-17-01).
NO
4 WARNING
VERIFY THAT ALL FLIGHT CONTROL SURFACES ARE CLEARED FOR OPERATION.
OPERATE ROLL CONTROLS THROUGH FULL LEFT AND RIGHT ROLL INPUTS.
DO FAULT LEGENDS COME BACK ON?
YES
11 CHECK JAM WARNING SWITCH INSTALLATION FOR LOOSE MOUNTING (4).
NO
5 FALSE MONITOR TRIP. SYSTEM IS OPERATIONAL.

NOTE

1 POSSIBLE FAULTS:
- A JAM IN CAPTAINS OR FIRST OFFICERS CONTROL PATH.
- B FAULTY JAM WARNING SWITCH MOUNTING.
- C FAILURE IN FCES COMPUTER ROLL MONITOR.

(2) THE FOLLOWING SWITCHLIGHT LEGENDS COME ON FOR ROLL CONTROL JAM:
- A CAPTAINS CONTROL PATH JAM -
  AILERON - L OUTBD, L INBD
  SPOILER - L5 & 6, L & R4
- B FIRST OFFICERS CONTROL PATH JAM -
  AILERON - R OUTBD, R INBD
  SPOILER - L & R2, L & R3, R5 & 6

(3) NORMAL FORCE TO OPERATE ROLL CONTROL WHEEL IS APPROXIMATELY 4 TO 20 POUNDS AT WHEEL RIM. IN A JAM CONDITION, IT REQUIRES APPROXIMATELY 40 POUNDS AT WHEEL RIM TO "BRAKE OUT" TORQUE LIMITER AND ACTUATE JAM WARNING SWITCH.

(4) FOR ACCESS TO JAM WARNING SWITCHES, REMOVE FLOOR PANEL JUST OUTBOARD OF CAPTAINS AND FIRST OFFICERS CONTROL COLUMN (REF. 27-11-06, FIG. 401).

M1-0003-27-514

R Aileron Switchlight Crosshatch Legend on; Spoiler Switchlight PUSH
R Legends May Be On
R Figure 104

AILERON CONTROL WHEELS STIFF OR NOTCHY /1\ /2\

PREREQUISITES
HYDRAULIC POWER (MM29-11-00)

1 WHILE CYCLING CONTROL WHEELS, HAVE SECOND MAN VIEW BOTH CAPTAINS AND FIRST OFFICERS TORQUE LIMITER FROM FORWARD ELECTRONIC SERVICE CENTER.
IS TORQUE LIMITER CAM CONTACTING FLOOR BEAM WEB OR HI-TIGUE NUT ON FLOOR BEAM JUST AFT OF TORQUE LIMITER?

YES → **4** REMOVE INTERFERENCE IN ACCORDANCE WITH SB 27-133.

NO ↓

2 WITH HYDRO OFF, MANUALLY POSITION BOTH INBOARD AILERONS TO NEUTRAL AND INSTALL AILERON SUPPORT TOOL BF90 (REF. MM27-11-00, FIG. 513). PULL UP AND LOCK ROLL DISC HANDLE. CHECK BOTH CONTROL WHEELS TO ISOLATE FAULTY CONTROL PATH. DISCONNECT PUSHROD BETWEEN CONTROL COLUMN AND TORQUE LIMITER ON FAULTY CONTROL PATH.
IS CONTROL WHEEL STILL STIFF OR NOTCHY?

YES → **5** CHECK CONTROL COLUMN COMPONENTS FOR FREEDOM OF MOVEMENT OR INDICATIONS OF WEAR. REPAIR AS REQUIRED. IF CONTROL COLUMN CANNOT BE REPAIRED, REPLACE CONTROL COLUMN (MM27-41-01).

NO ↓

3 RECONNECT PUSHROD TO CONTROL COLUMN. DISCONNECT AFT CABLE BELLCRANK OUTPUT PUSHROD(S) IN ASSOCIATED MAIN WHEEL WELL TO ISOLATE CABLE SYSTEM (MM27-11-00, FIG. 503).
IS CONTROL WHEEL STILL STIFF OR NOTCHY?

YES → **6** CHECK FOLLOWING FUSELAGE CONTROL COMPONENTS ON FREEDOM OF OPERATION OR DAMAGE:
- TORQUE LIMITER
- CABLE LOOP
- IDLER BELLCRANKS
- AFT CABLE BELLCRANK
- FEEL/TRIM BUNGEE IF PROBLEM IN CAPTAINS CONTROL PATH.
- ROLL DISCONNECT IF PROBLEM IN FIRST OFFICERS CONTROL PATH.

REPAIR OR REPLACE COMPONENTS AS NECESSARY.

NO ↓

TO SHEET 2

NOTE

/1\ VERIFY THAT AUTOPILOT IS NOT ENGAGED

/2\ NORMAL CONTROL WHEEL FORCES ARE SHOWN IN TABLE BELOW

CONTROL WHEEL FORCES (0° TRIM)

CONTROL WHEEL POSITION	DEGREES (APPROX)	MAX TANGENTIAL FORCE
BREAKAWAY	0°	2.5 LBS
1/2 WHEEL TRAVEL	45°	17 LBS
FULL TRAVEL	80°	27.4 LBS

3 NORMAL AILERON SYSTEM FORCES ARE AS FOLLOWS:

AILERON INPUT SYSTEM FORCE TO THE LEFT INBOARD AILERON SERVO: 15 LB MAX, 2 TO 3 LB TYP

FROM FEEL SPRING TO LEFT AILERON SERVO: 5 LB MAX

LEFT AILERON SERVO TO RIGHT AILERON SERVO (CROSS SHIP DRIVE): APPROX 10 LB

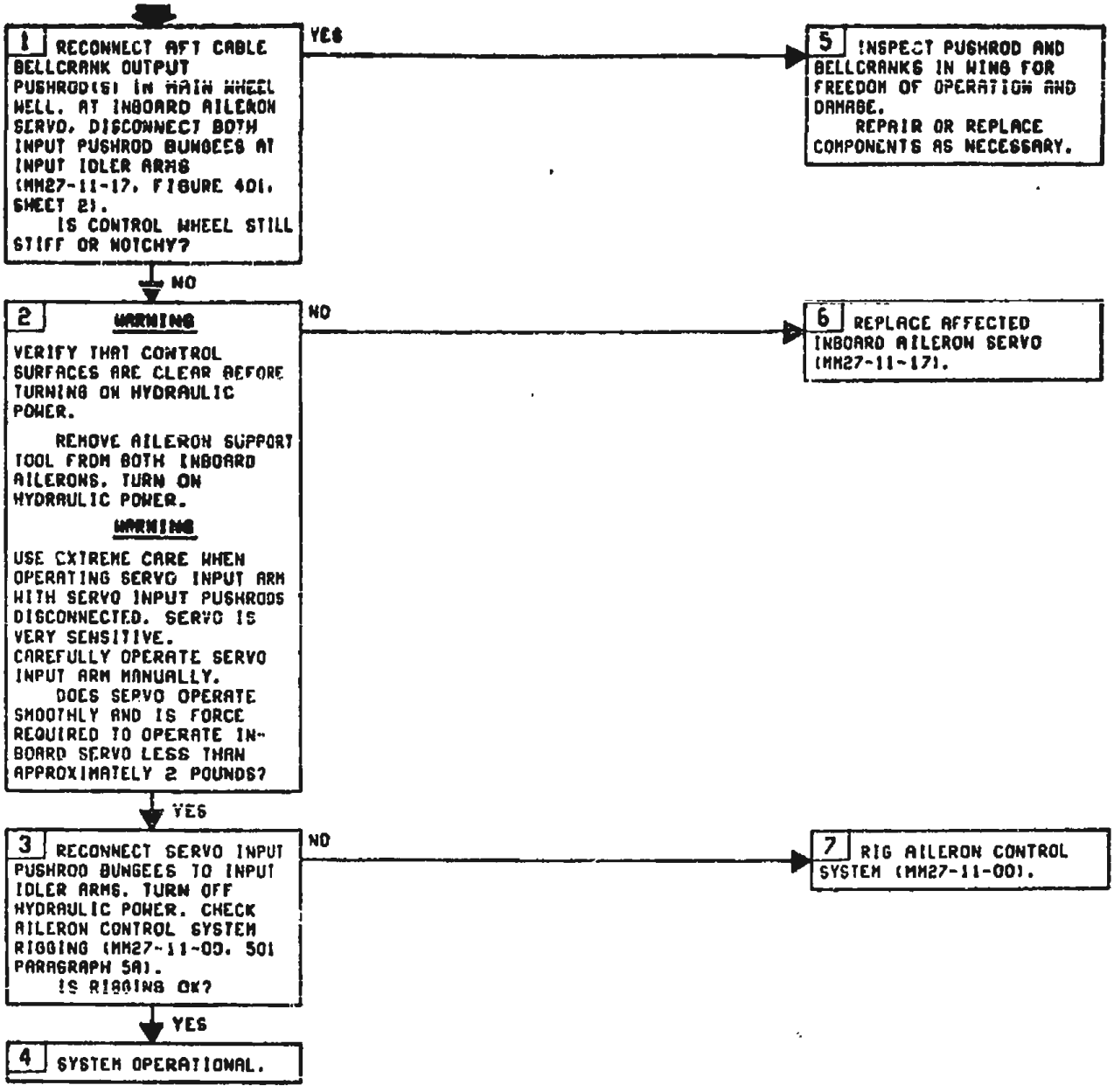
M1-0001-27-1241

CR
CR

Aileron Control Wheels Stiff or Notchy
Figure 105 (Sheet 1)

PREREQUISITES
HYDRAULIC POWER (MM29-11-00)

FROM SHEET 1


1 RECONNECT AFT CABLE BELLCRANK OUTPUT PUSHROD(S) IN MAIN WHEEL WELL. AT INBOARD AILERON SERVO, DISCONNECT BOTH INPUT PUSHROD BUNGEES AT INPUT IDLER ARMS (MM27-11-17, FIGURE 401, SHEET 2).
IS CONTROL WHEEL STILL STIFF OR NOTCHY?
YES
5 INSPECT PUSHROD AND BELLCRANKS IN WING FOR FREEDOM OF OPERATION AND DAMAGE.
REPAIR OR REPLACE COMPONENTS AS NECESSARY.
NO
2 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC POWER.
REMOVE AILERON SUPPORT TOOL FROM BOTH INBOARD AILERONS. TURN ON HYDRAULIC POWER.
WARNING
USE EXTREME CARE WHEN OPERATING SERVO INPUT ARM WITH SERVO INPUT PUSHRODS DISCONNECTED. SERVO IS VERY SENSITIVE. CAREFULLY OPERATE SERVO INPUT ARM MANUALLY.
DOES SERVO OPERATE SMOOTHLY AND IS FORCE REQUIRED TO OPERATE INBOARD SERVO LESS THAN APPROXIMATELY 2 POUNDS?
NO
6 REPLACE AFFECTED INBOARD AILERON SERVO (MM27-11-17).
YES
3 RECONNECT SERVO INPUT PUSHROD BUNGEES TO INPUT IDLER ARMS. TURN OFF HYDRAULIC POWER. CHECK AILERON CONTROL SYSTEM RIGGING (MM27-11-00, 501 PARAGRAPH 5A).
IS RIGGING OK?
NO
7 RIG AILERON CONTROL SYSTEM (MM27-11-00).
YES
4 SYSTEM OPERATIONAL.

A1-0000-27-1056

R Aileron Control Wheels Stiff or Notchy
R Figure 105 (Sheet 2)

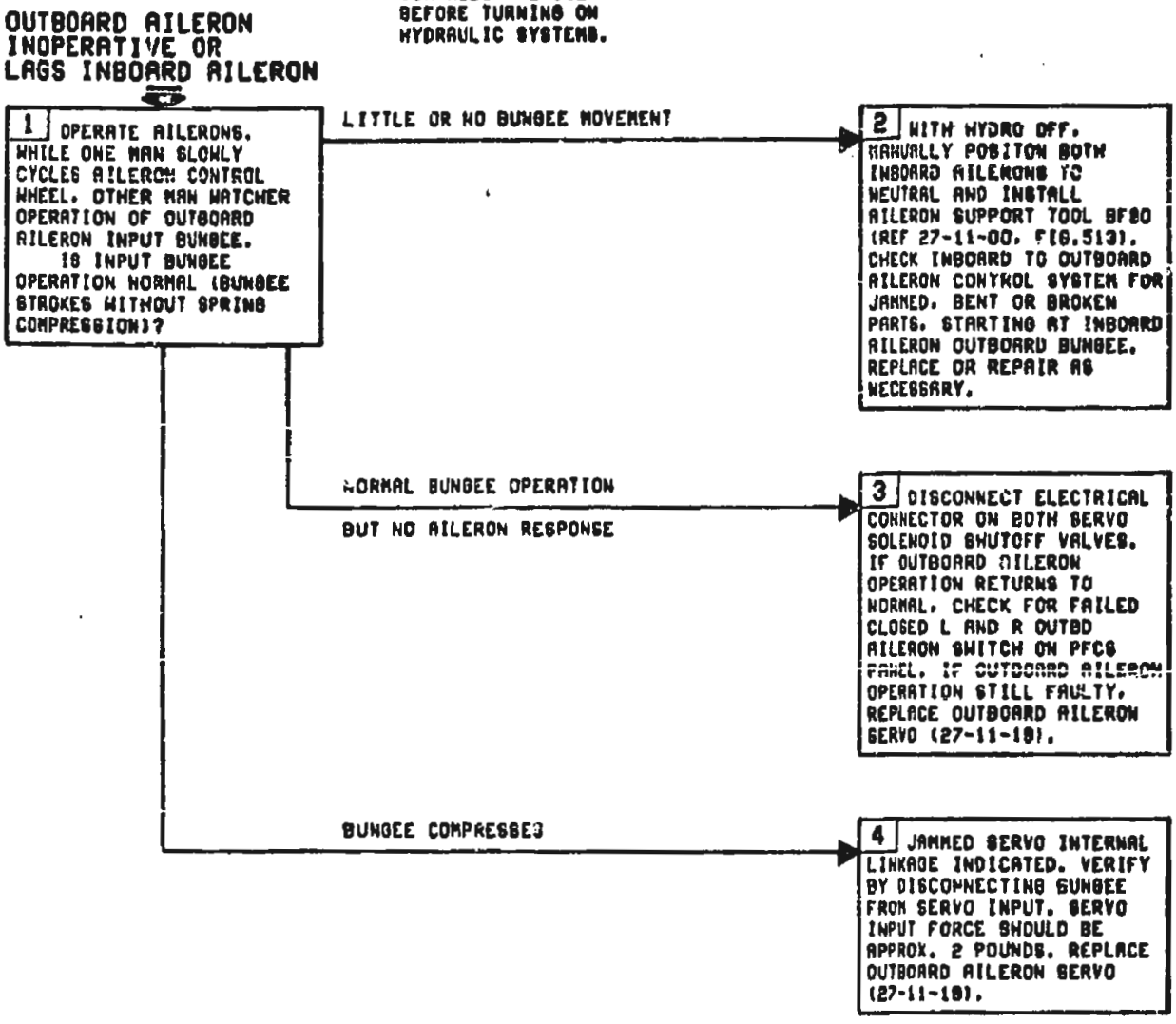
EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (24-41-00)
HYD POWER, SYS A, B, D (29-11-00)
CB'S: C92-J19, J20, J21, J22.

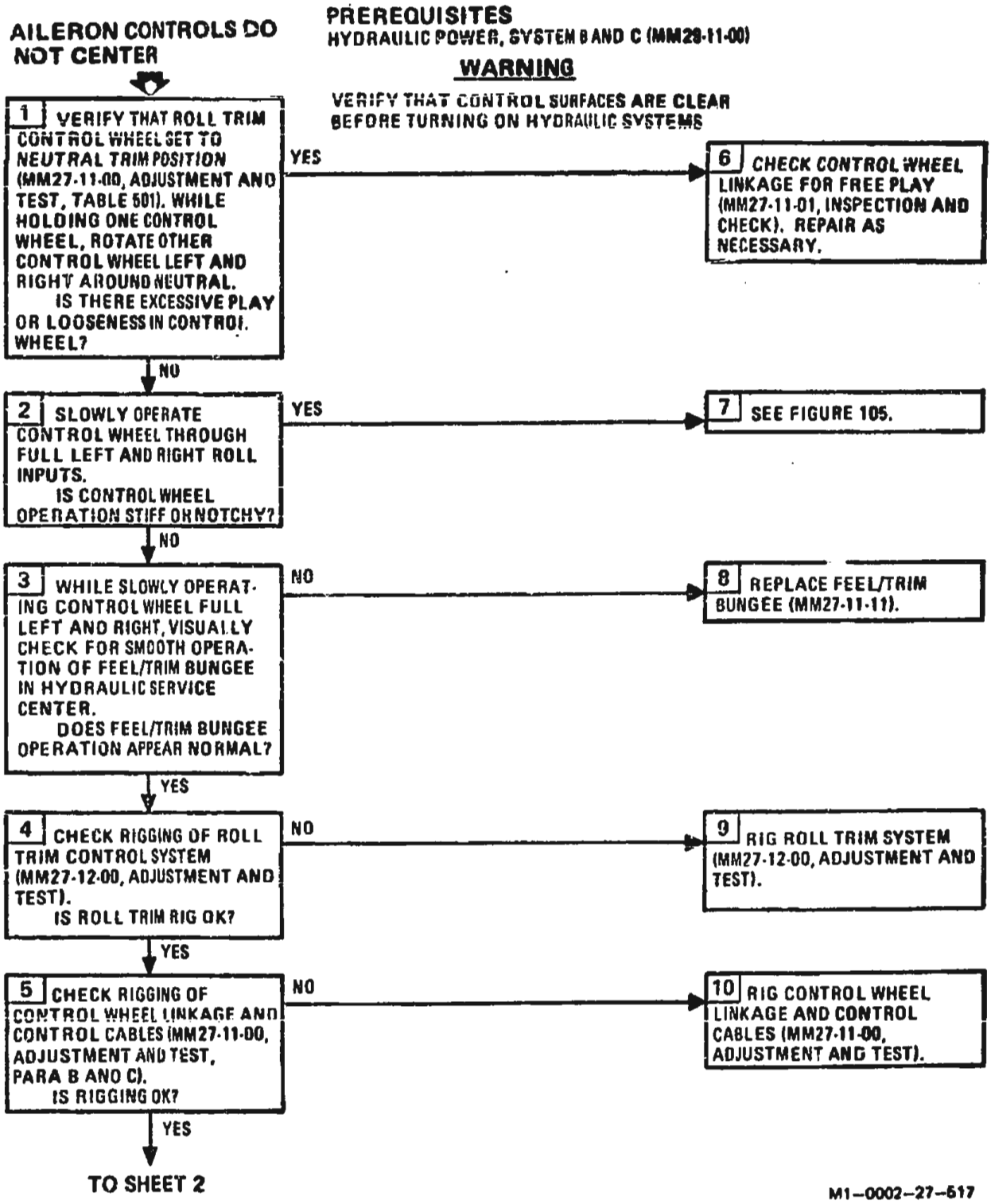
WARNING

VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS.


OUTBOARD AILERON INOPERATIVE OR LAGS INBOARD AILERON
1 OPERATE AILERONS. WHILE ONE MAN SLOWLY CYCLES AILERON CONTROL WHEEL, OTHER MAN WATCHES OPERATION OF OUTBOARD AILERON INPUT BUNGEE. IS INPUT BUNGEE OPERATION NORMAL (BUNGEE STROKES WITHOUT SPRING COMPRESSION)?
LITTLE OR NO BUNGEE MOVEMENT
2 WITH HYDRO OFF, MANUALLY POSITON BOTH INBOARD AILERONS TO NEUTRAL AND INSTALL AILERON SUPPORT TOOL BF80 (REF 27-11-00, FIG.513). CHECK INBOARD TO OUTBOARD AILERON CONTROL SYSTEM FOR JAMMED, BENT OR BROKEN PARTS, STARTING AT INBOARD AILERON OUTBOARD BUNGEE. REPLACE OR REPAIR AS NECESSARY.
NORMAL BUNGEE OPERATION
BUT NO AILERON RESPONSE
3 DISCONNECT ELECTRICAL CONNECTOR ON BOTH SERVO SOLENOID SHUTOFF VALVES. IF OUTBOARD AILERON OPERATION RETURNS TO NORMAL, CHECK FOR FAILED CLOSED L AND R OUTBD AILERON SWITCH ON PFCS PANEL. IF OUTBOARD AILERON OPERATION STILL FAULTY, REPLACE OUTBOARD AILERON SERVO (27-11-18).
BUNGEE COMPRESSED
4 JAMMED SERVO INTERNAL LINKAGE INDICATED. VERIFY BY DISCONNECTING BUNGEE FROM SERVO INPUT. SERVO INPUT FORCE SHOULD BE APPROX. 2 POUNDS. REPLACE OUTBOARD AILERON SERVO (27-11-18).

RI-0004-27-516

Outboard Ailerons Inoperative, Inboard Ok
Figure 106

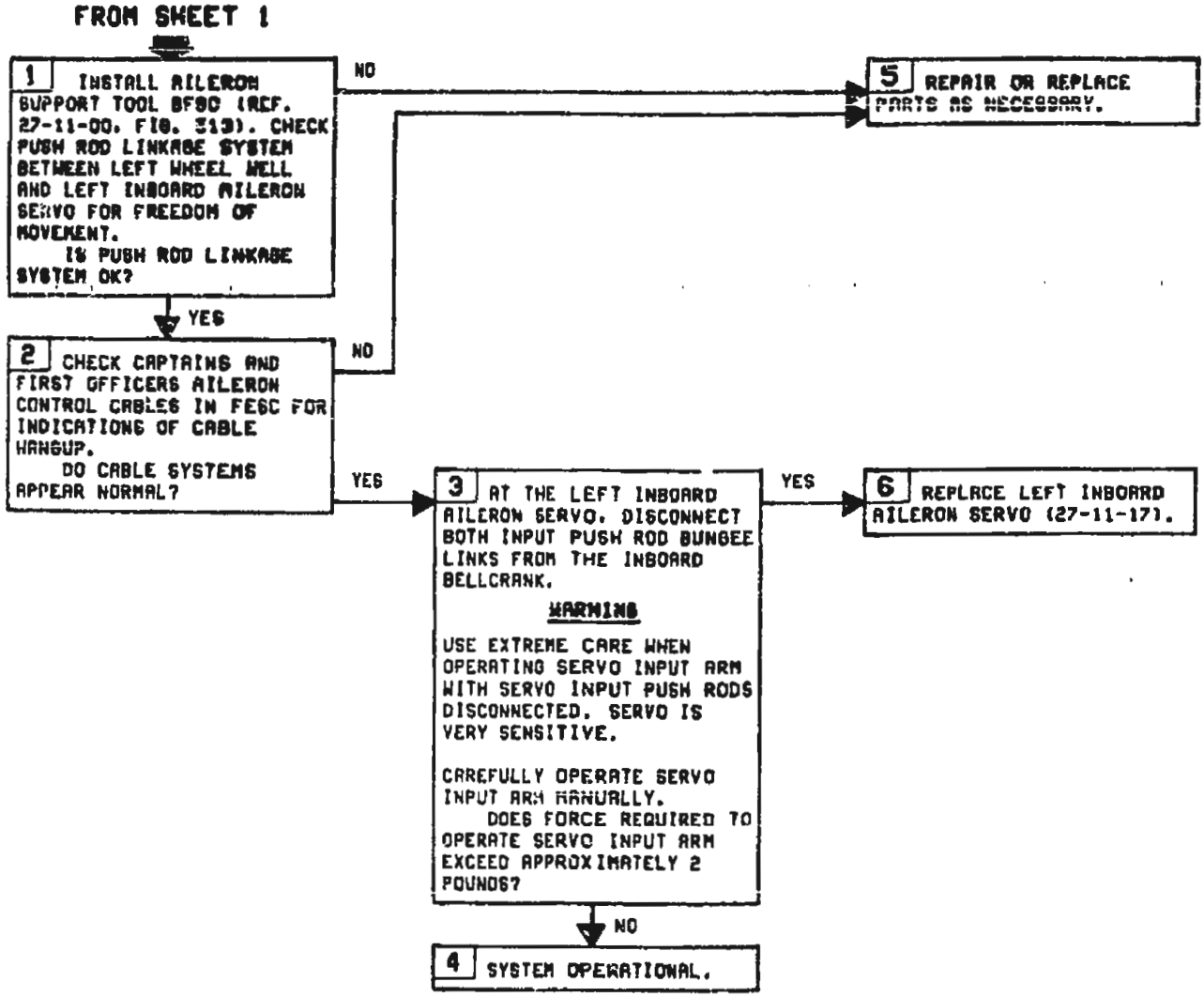

AILERON CONTROLS DO NOT CENTER
PREREQUISITES
HYDRAULIC POWER, SYSTEM B AND C (MM29-11-00)
WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS
1 VERIFY THAT ROLL TRIM CONTROL WHEEL SET TO NEUTRAL TRIM POSITION (MM27-11-00, ADJUSTMENT AND TEST, TABLE 501). WHILE HOLDING ONE CONTROL WHEEL, ROTATE OTHER CONTROL WHEEL LEFT AND RIGHT AROUND NEUTRAL. IS THERE EXCESSIVE PLAY OR LOOSENESS IN CONTROL WHEEL?
YES
6 CHECK CONTROL WHEEL LINKAGE FOR FREE PLAY (MM27-11-01, INSPECTION AND CHECK). REPAIR AS NECESSARY.
NO
2 SLOWLY OPERATE CONTROL WHEEL THROUGH FULL LEFT AND RIGHT ROLL INPUTS. IS CONTROL WHEEL OPERATION STIFF OR NOTCHY?
YES
7 SEE FIGURE 105.
NO
3 WHILE SLOWLY OPERATING CONTROL WHEEL FULL LEFT AND RIGHT, VISUALLY CHECK FOR SMOOTH OPERATION OF FEEL/TRIM BUNGEE IN HYDRAULIC SERVICE CENTER. DOES FEEL/TRIM BUNGEE OPERATION APPEAR NORMAL?
NO
8 REPLACE FEEL/TRIM BUNGEE (MM27-11-11).
YES
4 CHECK RIGGING OF ROLL TRIM CONTROL SYSTEM (MM27-12-00, ADJUSTMENT AND TEST). IS ROLL TRIM RIG OK?
NO
9 RIG ROLL TRIM SYSTEM (MM27-12-00, ADJUSTMENT AND TEST).
YES
5 CHECK RIGGING OF CONTROL WHEEL LINKAGE AND CONTROL CABLES (MM27-11-00, ADJUSTMENT AND TEST, PARA B AND C). IS RIGGING OK?
NO
10 RIG CONTROL WHEEL LINKAGE AND CONTROL CABLES (MM27-11-00, ADJUSTMENT AND TEST).
YES
TO SHEET 2
M1-0002-27-617

R Aileron Controls Do Not Center
R Figure 107 (Sheet 1)

EFFECTIVITY: ALL

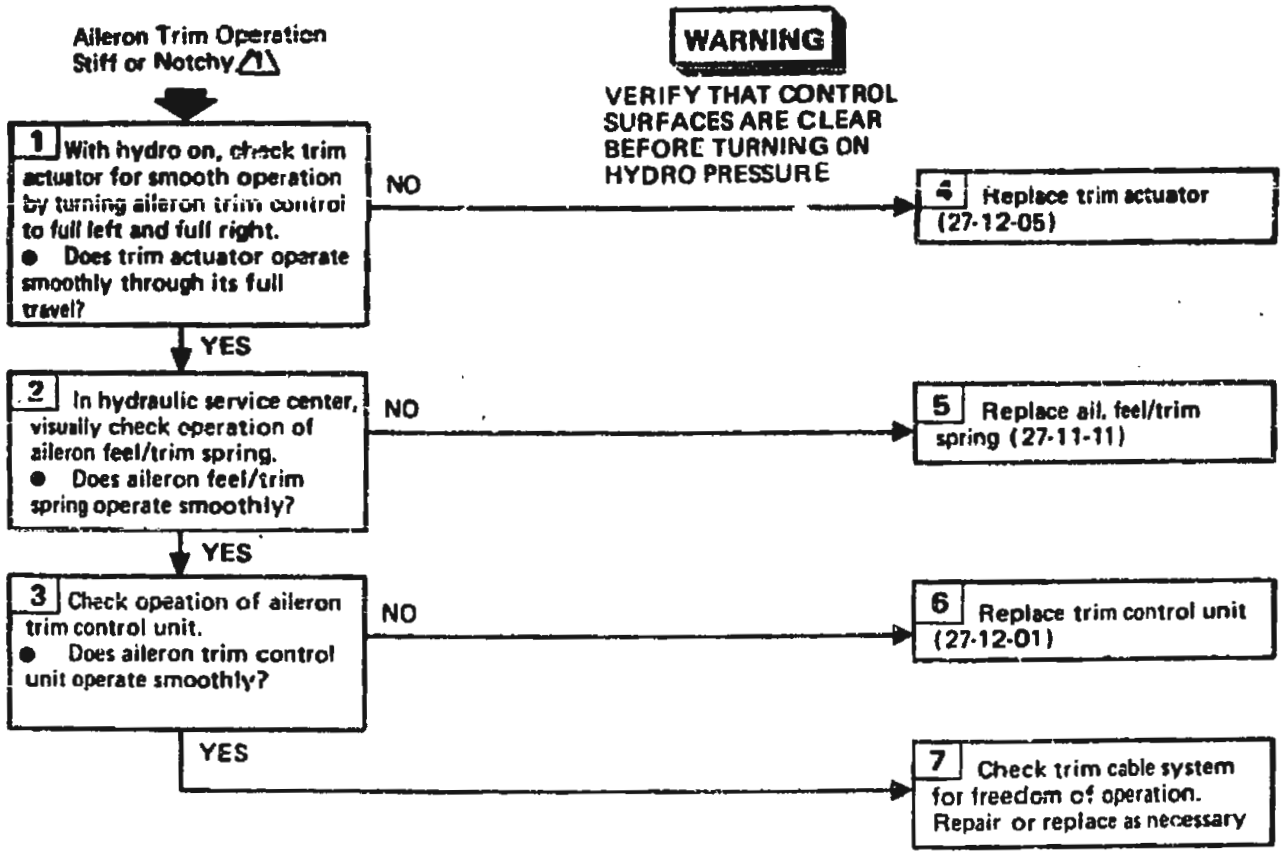
001B

PREREQUISITES
SEE SHEET 1


FROM SHEET 1
1 INSTALL AILERON SUPPORT TOOL BF9C (REF. 27-11-00, FIG. 313). CHECK PUSH ROD LINKAGE SYSTEM BETWEEN LEFT WHEEL WELL AND LEFT INBOARD AILERON SERVO FOR FREEDOM OF MOVEMENT.
IS PUSH ROD LINKAGE SYSTEM OK?
NO
5 REPAIR OR REPLACE PARTS AS NECESSARY.
YES
2 CHECK CAPTAINS AND FIRST OFFICERS AILERON CONTROL CABLES IN FEGC FOR INDICATIONS OF CABLE HANGUP.
DO CABLE SYSTEMS APPEAR NORMAL?
NO
YES
3 AT THE LEFT INBOARD AILERON SERVO, DISCONNECT BOTH INPUT PUSH ROD BUNGEE LINKS FROM THE INBOARD BELLCRANK.
WARNING
USE EXTREME CARE WHEN OPERATING SERVO INPUT ARM WITH SERVO INPUT PUSH RODS DISCONNECTED. SERVO IS VERY SENSITIVE.
CAREFULLY OPERATE SERVO INPUT ARM MANUALLY.
DOES FORCE REQUIRED TO OPERATE SERVO INPUT ARM EXCEED APPROXIMATELY 2 POUNDS?
YES
6 REPLACE LEFT INBOARD AILERON SERVO (27-11-17).
NO
4 SYSTEM OPERATIONAL.

M1-0002-27-280

Aileron Controls Do Not Center
Figure 107 (Sheet 2)


Aileron Trim Operation Stiff or Notchy ⚠1
WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE
1 With hydro on, check trim actuator for smooth operation by turning aileron trim control to full left and full right.
● Does trim actuator operate smoothly through its full travel?
NO
4 Replace trim actuator (27-12-05)
YES
2 In hydraulic service center, visually check operation of aileron feel/trim spring.
● Does aileron feel/trim spring operate smoothly?
NO
5 Replace ail. feel/trim spring (27-11-11)
YES
3 Check opeation of aileron trim control unit.
● Does aileron trim control unit operate smoothly?
NO
6 Replace trim control unit (27-12-01)
YES
7 Check trim cable system for freedom of operation. Repair or replace as necessary

⚠1 **NOTE**
Breakout force at trim control unit is 2.75 lbs max.

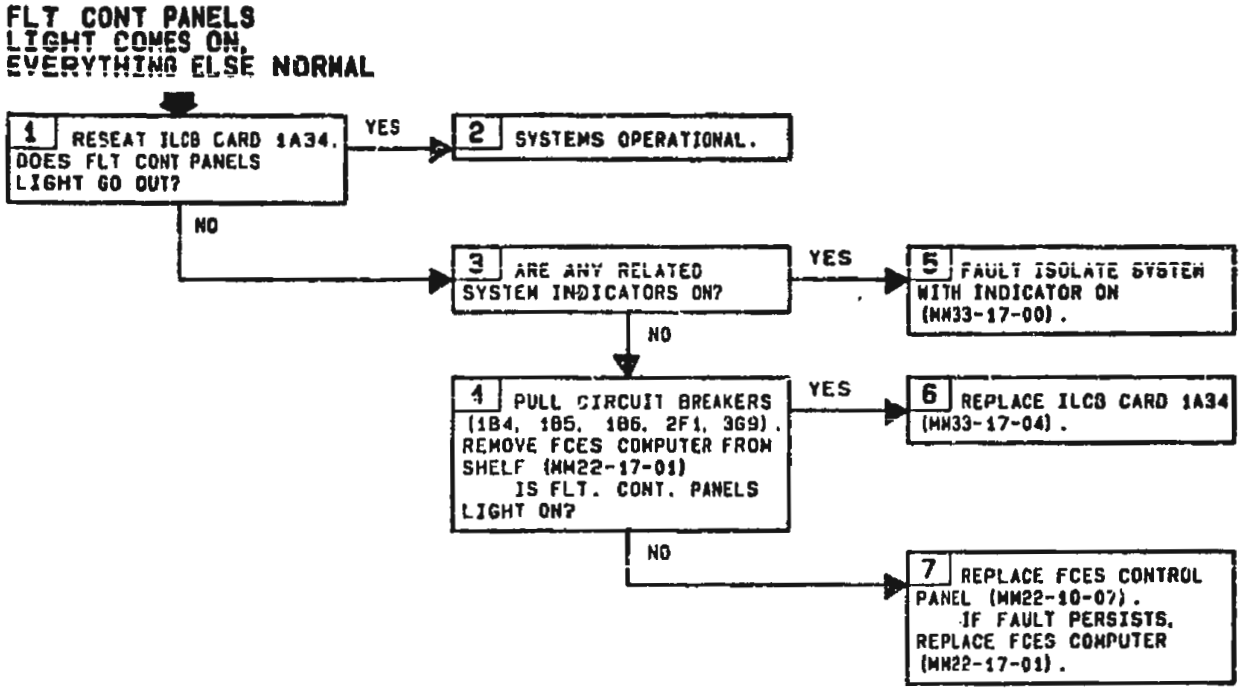
PREREQUISITES
Hyd Power (Sys B) (29-11-00)

M1-0101-27-519

Aileron Trim Stiff or Notchy
Figure 108

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: CB3-68

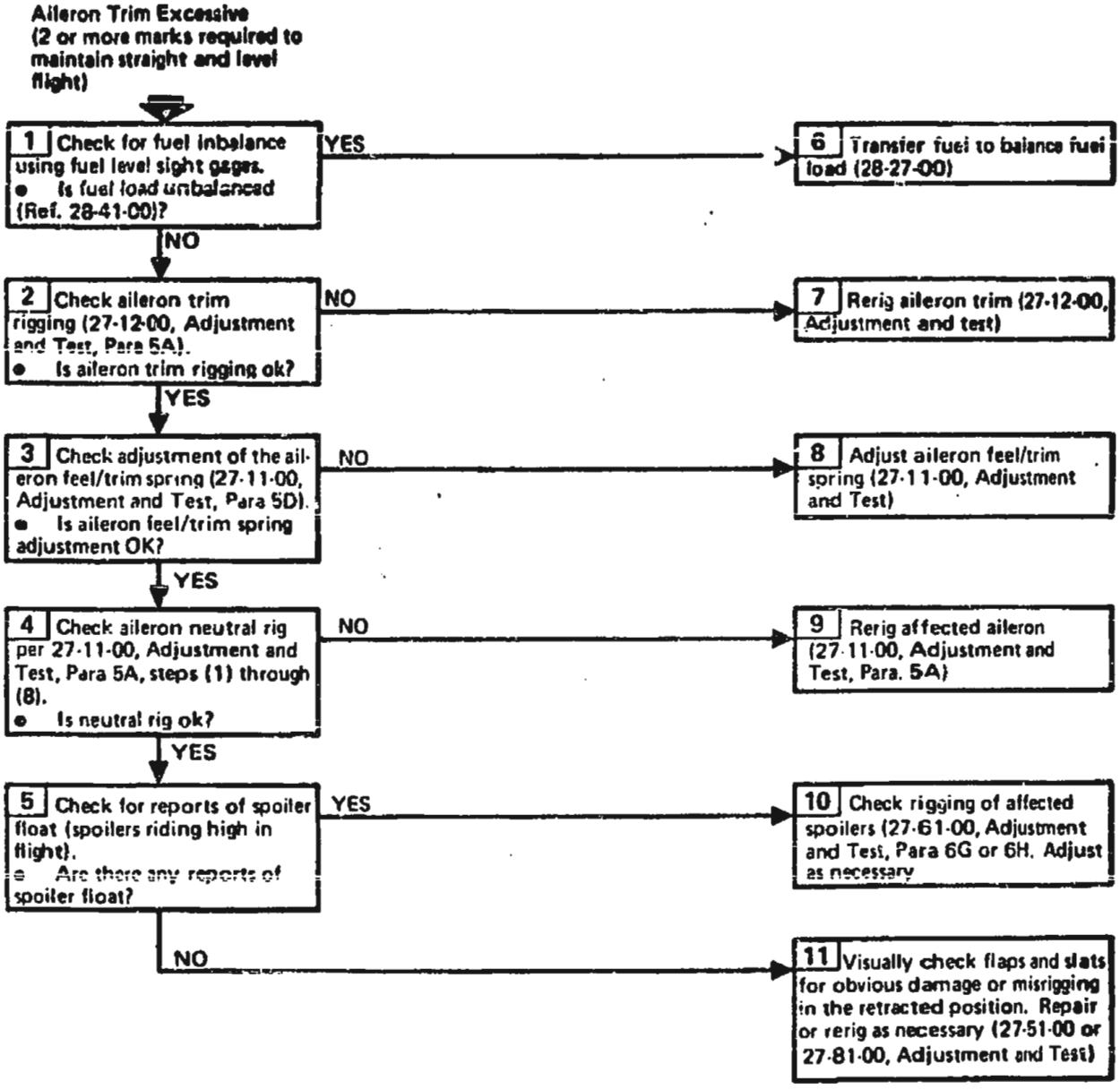

FLT CONT PANELS
LIGHT COMES ON,
EVERYTHING ELSE NORMAL
1 RESEAT ILCS CARD 1A34. DOES FLT CONT PANELS LIGHT GO OUT?
YES
2 SYSTEMS OPERATIONAL.
NO
3 ARE ANY RELATED SYSTEM INDICATORS ON?
YES
5 FAULT ISOLATE SYSTEM WITH INDICATOR ON (MM33-17-00).
NO
4 PULL CIRCUIT BREAKERS (1B4, 1B5, 1B6, 2F1, 3G9). REMOVE FCES COMPUTER FROM SHELF (MM22-17-01) IS FLT. CONT. PANELS LIGHT ON?
YES
6 REPLACE ILCS CARD 1A34 (MM33-17-04).
NO
7 REPLACE FCES CONTROL PANEL (MM22-10-07). IF FAULT PERSISTS, REPLACE FCES COMPUTER (MM22-17-01).

NOTE

ILCS PROBLEMS MAY BE CAUSED BY DIRTY CONTACTS ON ILCS CONNECTORS. KEEP CONTACTS CLEAN.

M1-0003-27-849

R FLT CONT PANELS Light On, Everything Else Normal
R Figure 109


Aileron Trim Excessive
(2 or more marks required to maintain straight and level flight)
1 Check for fuel inbalance using fuel level sight gages.
• Is fuel load unbalanced (Ref. 28-41-00)?
YES
6 Transfer fuel to balance fuel load (28-27-00)
NO
2 Check aileron trim rigging (27-12-00, Adjustment and Test, Para 5A).
• Is aileron trim rigging ok?
NO
7 Rerig aileron trim (27-12-00, Adjustment and test)
YES
3 Check adjustment of the aileron feel/trim spring (27-11-00, Adjustment and Test, Para 5D).
• Is aileron feel/trim spring adjustment OK?
NO
8 Adjust aileron feel/trim spring (27-11-00, Adjustment and Test)
YES
4 Check aileron neutral rig per 27-11-00, Adjustment and Test, Para 5A, steps (1) through (8).
• Is neutral rig ok?
NO
9 Rerig affected aileron (27-11-00, Adjustment and Test, Para. 5A)
YES
5 Check for reports of spoiler float (spoilers riding high in flight).
• Are there any reports of spoiler float?
YES
10 Check rigging of affected spoilers (27-61-00, Adjustment and Test, Para 6G or 6H. Adjust as necessary
NO
11 Visually check flaps and slats for obvious damage or misrigging in the retracted position. Repair or rerig as necessary (27-51-00 or 27-81-00, Adjustment and Test)

M1-0101-27-059

Aileron Trim Excessive
Figure 110

R EFFECTIVITY: ALL
R
001B

R # AILERON CONTROL SYSTEM - MAINTENANCE PRACTICES

R 1. General

R This procedure can be used to check or reestablish the neutral
R rigpin position of the inboard aileron and/or replace the
R inboard aileron neutral indicator (red dot) on flap torque box.

R 2. Equipment and Materials

R Inclinometer

R Paint, Red, LAC 1075A

R 3. Referenced Procedures

R	8-11-00	Leveling, Plumb Bob - Maintenance Practices
R	8-12-00	Leveling, Spirit Level - Maintenance Practices
R	8-13-00	Leveling, Engineers Transit - Maintenance Practices
R	20-51-08	Touch Up Requirements for Finishes - Maintenance Practices
R	27-11-00	Aileron Control System - Adjustment and Test
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 4. Maintenance Practices

R A. Index Point Location Verification

R (1) Park aircraft where it is level within ±1.5 degrees
R laterally and ±4 degrees longitudinally (Ref. 8-11-00,
R 8-12-00, or 8-13-00).

R NOTE: It is not necessary to jack or otherwise level
R aircraft if aircraft is within 1.5 degrees of
R level laterally and within 4 degrees of level
R longitudinally.

R Any method provided by Maintenance Manual
R Chapter 8 may be used to measure aircraft
R attitude. An acceptable alternate procedure is
R to measure deviation from level of hydraulic

R service center fore and aft floor supports using
R an inclinometer.

R (2) Record, as dimension "A", the deviation of aircraft
R from longitudinal level. For this procedure consider
R nose high as positive and nose low as negative.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM.

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC
R PRESSURE.

R (3) If roll trim system is not in rigpin position (Ref.
R 27-11-00), turn on hydraulic system B (Ref. 29-11-00).

R (4) Adjust roll trim wheel to system rigpin position (Ref.
R 27-11-00).

R (5) Turn off hydraulic systems A, B and C (left inboard
R aileron) or systems B, C and D (right inboard aileron).

R (6) Tag Flight Engineer/Second Officers hydraulic system
R panel, zone 215, and the hydraulic service center
R panel, zone 147, against operation.

R WARNING: VERIFY HYDRAULIC POWER IS OFF AND HYDRAULIC
R CONTROL PANELS ARE TAGGED AGAINST OPERATION PRIOR
R TO THE FOLLOWING STEPS.

R (7) Prop inboard aileron to approximately the faired
R position. Aileron will be slightly trailing edge down.

R NOTE: No measurements are required for Step 4A(7).

R (8) Locate inclinometer on inboard aileron with long
R dimension of inclinometer base extending along inboard
R end of aileron at 12 to 21 inches forward of trailing
R edge.

R (9) Record inclinometer reading as dimension "B".

R (10) On aircraft without SB27-162,
R add dimensions "A" and "B". If "A" plus "B" equals
R less than 3±0.5 degrees, adjust aileron prop to move
R trailing edge down to make sum of "A" plus "B" equal
R 8±0.5 degrees. If "A" plus "B" equals more than 8±0.5
R degrees, adjust prop to move trailing edge up to make
R sum of "A" plus "B" equal 8±0.5 degrees.

R (10) On aircraft with SB27-162,
R add dimensions "A" and "B". If "A" plus "B" equals
R less than 6.5±0.5 degrees, adjust aileron prop to move
R trailing edge down to make sum of "A" plus "B" equal
R 6.5±0.5 degrees. If "A" plus "B" equals more than
R 6.5±0.5 degrees, adjust prop to move trailing edge up
R to make sum of "A" plus "B" equal 6.5±0.5 degrees.

R (11) On aircraft without SB27-162,
R verify location of neutral index mark. Index mark
R should be in line with aileron lower surface trailing
R edge on outboard face of torque box No. 3, midway
R between two fasteners. Remove aileron prop.

R (11) On aircraft with SB27-162,
R verify location of neutral index mark as follows:

R (a) Add pencil mark to torque box No. 3 outboard face
R at aileron lower surface trailing edge.

R (b) Measure forward from pencil mark along outboard
R face of torque box No. 3 fairing in line with
R aileron lower surface 9.38 inches and add pencil
R mark to torque box fairing.

R (c) Remove aileron prop and allow aileron to droop
R full down.

R (d) Index mark should be 1.06 inches up from forward
R pencil mark.

R NOTE: Vertical measurement should be parallel
R with adjacent vertical row of rivets.

R (12) If neutral index mark is absent, add impression 0.06
R inch diameter; 0.03 to 0.05 inch deep. Fill depression
R with red paint LAC 1075A (Ref. 20-51-08).

R (13) Remove tags from hydraulic control panels in flight
R station and hydraulic service center.

AILERON CONTROL SYSTEM - ADJUSTMENT AND TEST

1. Adjustment/Test

These procedures must be used to perform the operational tests (Ref. Par. 4) and a rigging check and adjustment (Ref. Par. 5) of the aileron control system.

NOTE: During operation of the roll control system, a "bump" may be felt at the control wheel. The conditions to cause this are:

A. Flaps 4 degrees or more.

B. Speedbrake lever full aft.

C. Control wheels rotated full left or right.

R The "bump" is normal and is caused by the spoiler mixer
R output linkage going overcenter. The conditions to cause the "bump" are normally experienced only during ground test procedures.

2. Equipment and Materials

Lockclad Cable Tensiometer, Pacific Scientific PN 1601009, or equivalent

Aileron Support Tool, BF90, or equivalent

Rig Pin Kit - Wing Control Surface, B735, or equivalent

Rig pin kit includes the following 5/16-inch diameter pins [except for R6A which is a stepped pin (5/16 and 3/16 inch diameter and R6B (1/4 inch diameter) used to pin the spoiler selector]:

RIG PIN IDENT.	GRIP LENGTH (INCHES)	COLOR
R2	2	Red
R3	3	Green
R4	4	Yellow
R5	5	Brown

RIG PIN IDENT.	GRIP LENGTH (INCHES)	COLOR
R6	6	Orange
R6A	6	
R6B	6	
R7	7	Black
R12	12.5	Clear

3. Referenced Prccedures

6-40-00	Exterior Access Doors and Panels
6-50-00	Interior Access Doors and Panels
22-01-00	Autopilot Flight Director System - Adjustment and Test
22-12-00	APFDS Modes of Operation - Maintenance Practices
22-12-23	Autopilot CWS/CMD Mode - Fault Isolation
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Fault Isolation
R 27-11-00	Aileron Control System - Maintenance Practices
27-11-19	Servo Control Module - Outboard Aileron - Removal and Istallation
27-12-00	Aileron Control System - Adjustment and Test
27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Tests

The following operational tests are provided:

Aileron Control System Test (Para. 4A)

Aileron Servo Shutoff Valve Test (Para. 4B)

Aileron Servo Hydraulic Integrity Test (Para. 4C)

Left Inboard Aileron Servo Autopilot Test (Para. 4D)

CAUTION: RAPID CYCLING OF OUTBOARD AILERONS CAN DAMAGE THE OUTBOARD AILERON DAMPER SEALS. CYCLE AILERONS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

4A. Aileron Control System Test

This test is performed to verify normal operation of the aileron control system. If an electrical fault is noted during test, refer to 27-11-00, Fault Isolation section for appropriate fault isolation diagram. If a mechanical problem is noted during test, refer to 27-11-00, Paragraph 5, for affected rigging check and adjustment procedures.

(1) Verify the following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1, zone 210:

FCES COMPUTERS - DC (B4), and AC & L AOA (B5)

SURF POS IND (J23)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

AILERON SERVO -

C INBD L&R (J19)

A INBD & OUT BD L (J20)

B INBD & OUT BD L&R (J21)

D INBD & OUT BD R (J22)

IND LT - PILOTS (J2)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215: IND LT - PFCS ADS/DH (G8).

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Pressurize hydraulic systems A, B, C, and D (Ref. 29-11-00).

(4) Verify all four AILERON switchlights on the PFCS panel are depressed and latched (flush with panel).

(5) Verify none of the crosshatched or OFF lights on the AILERON switchlights are on.

(6) Verify the PULL ROLL DISC light on the PFCS panel is off.

(7) Set roll trim to zero to position ailerons to neutral.

NOTE: If aircraft contains roll trim bias (Ref. roll trim bias decal on underside of L.G. emergency handle door), set roll trim wheel to specified LWD setting to position ailerons to neutral (Ref. Roll Trim Bias Table 501).

(8) Rotate captains control wheel full left and hold. Verify the following:

(a) Both left ailerons position full up (use surface position indicator).

(b) Both right ailerons position full down.

(c) Aileron controls operate smoothly throughout control range.

(d) Aileron pointers on surface position indicator follows control wheel movement. (Depress OUTBD AIL PUSH switch on surface position indicator to read outboard ailerons.)

(9) Allow control wheel to return towards neutral. Controls should position smoothly to approximately neutral position.

(10) Rotate Captains control wheel full right and hold. Verify the following:

(a) Both right ailerons position full up.

(b) Both left ailerons position full down.

(c) Aileron pointers on surface position indicator follows control wheel movement.

(11) Allow control wheel to return towards neutral. Controls should position smoothly to approximately neutral position.

(12) Pull up and lock ROLL DISC handle on center console. Verify handle lights come on.

(13) Rotate Captains control wheel left and right. Verify the following:

(a) First Officers control wheel follows Captains wheel.

(b) All four ailerons respond to control wheel movement.

(14) Rotate First Officers control wheel left and right. Verify the following:

(a) No lost motion in First Officers control wheel inputs.

(b) Captains wheel remains at neutral.

(c) Only right wing ailerons respond to control wheel movement.

(15) Release ROLL DISC handle and allow handle to retract against console. Verify handle lights go off.

(16) Verify control wheels are coupled: rotate First Officers control wheel, Captains control wheel must follow.

(17) Turn off hydraulic power if no longer required (Ref. 29-11-00)

(18) Turn off electrical power if no longer required (Ref. 24-41-00).

4B. Aileron Servo Shutoff Valve Test

This test is performed to verify proper operation of servo shutoff valves and servo actuation channels. If a shutoff valve does not function to turn on or turn off the aileron
R servo in response to the following steps, replace the
R inoperative shutoff valve.

(1) Verify the following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1:

FCES COMPUTERS - DC (B4) and AC & L AOA (B5)

SURF POS IND (J23).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2:

R AILERON SERVO -

R C INBD L&R (J19)

R A INBD & OUT BD L J(J20)

R B INBD & OUT BD L&R (J21)

R D INBD & OUT BD R (J22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3: IND LT - PFCS ADS/DH (G8).

(2) Turn on electrical power (Ref. 24-41-00).

(3) Verify all four AILERON switchlights on PFCS panel are in the normal position (flush with panel).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR

SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Pressurize hydraulic systems A, B, C, and D (Ref. 29-11-00).

NOTE: Reset FLT CONT PANELS light after each operation by depressing the RESET on pilots caution and warning panel. FLT CONT PANELS light may come on each time the circuit breakers are opened or closed. The FLT CONT PANELS light will flash for approximately 10 seconds and then stay on.

(5) Check left outboard aileron as follows:

(a) Release (out) the AILERON L OUTBD switchlight on PFCS panel to deactivate servo. The switchlight OFF light must come on, FLT CONT PANELS light must come on, and left outboard aileron must droop to full down.

NOTE: Use surface position indicator to verify surface position. Depress OUTBD AIL PUSH switch on surface position indicator to read outboard ailerons.

(b) Rotate Captains control wheel left and right. Verify the left outboard aileron is inactive. Center control wheel.

(c) Open AILERON SERVO A circuit breaker to deenergize channel A shutoff valve and activate A servos. Left outboard aileron will move to neutral. (System A hydraulic system supplies both left ailerons.)

(d) Rotate Captains control wheel left and right. Verify left outboard aileron follows left inboard aileron movement.

(e) Close the AILERON SERVO A circuit breaker. Open AILERON SERVO B circuit breaker. (System B hydraulic system supplies all four ailerons.)

(f) Rotate Captains control wheel left and right. Verify left outboard aileron follows left inboard aileron movement. Center control wheel.

(g) Depress (in) AILERON L OUTBD switchlight. The switchlight OFF light must go off. The left outboard aileron will remain faired.

(h) Close AILERON SERVO B (J21) circuit breaker.

(6) Check left inboard aileron as follows:

C NOTE: On aircraft with PFCS panel LCC PN672304-101 the
C AILERON SERVO A circuit breaker controls the
C aileron left inboard Servo B shutoff valve; the
C B circuit breaker controls the A shutoff valve.

C On aircraft with PFCS panel LCC PN672304-103
C (MOD 7) (or higher dash number) the A circuit
C breaker controls the servo A shutoff valve and
C the B circuit breaker controls the B shutoff
C valve.

(a) Release AILERON L INBD switchlight on PFCS panel. The switchlight OFF light must come on, the FLT CONT PANELS light must come on, and left inboard
R aileron must droop down, followed by left outboard
R aileron.

NOTE: The control wheels will turn approximately half travel right roll. DO NOT HOLD.

(b) Rotate Captains control wheel first to right and then to left sufficiently to verify left inboard aileron is inactive. (It is not necessary to exert enough force to override Captains torque limiter.)

(c) Open AILERON SERVO A circuit breaker. The left inboard aileron will move to neutral and control wheel will center.

(d) Rotate Captains control wheel left and right. Verify left inboard aileron follows control wheel movement.

(e) Close AILERON SERVO A circuit breaker. The left ailerons will droop. Open AILERON SERVO B circuit breaker. The left ailerons will move to neutral.

(f) Rotate Captains control wheel left and right. Verify left inboard aileron follows control wheel movement.

(g) Close AILERON SERVO B (J21) circuit breaker. The left ailerons will droop. Open AILERON C circuit

breaker. (System C supplies both inboard ailerons.) The left ailerons will move to neutral.

(h) Rotate Captains control wheel left and right. Verify left inboard aileron follows control wheel movement. Center the control wheel.

(i) Depress AILERON L INBD switchlight on PFCS panel. The switchlight OFF light must go off. The left ailerons will remain in neutral.

(j) Close AILERON SERVO C circuit breaker.

(7) Check right inboard aileron as follows:

(a) Release AILERON R INBD switchlight on PFCS panel. The switchlight OFF light must come on, FLT CONT PANELS light must come on, and right inboard aileron must droop down followed by right outboard aileron.

NOTE: The control wheels will turn approximately 20 degrees left roll. DO NOT HOLD.

(b) Rotate Captains control wheel first to left and then to right sufficiently to verify right inboard aileron is inactive. (it is not necessary to exert enough force to override first officers torque limiter.)

(c) Open AILERON SERVO B (J21) circuit breaker. Right ailerons will move to neutral and control wheels will center.

(d) Rotate Captains control wheel left and right. Verify right inboard aileron follows control wheel movement, followed right outboard aileron.

(e) Close AILERON SERVO B (J21) circuit breaker. The right ailerons will droop. Open the AILERON SERVO C (J19) circuit breaker. The right ailerons will fair.

(f) Rotate Captains control wheel left and right. Verify right inboard aileron follows control wheel movement.

(g) Close AILERON SERVO C (J19) circuit breaker. The right ailerons will droop. Open AILERON D (J22) circuit breaker. (System D hydrualic system supplies both right ailerons.) The right ailerons will move to neutral.

(h) Rotate Captains control wheel left and right. Verify right inboard aileron follows control wheel movement. Center control wheel.

(i) Depress AILERON R INBD switchlight on PFCS panel. Switchlight OFF light must go off. Right ailerons will remain in neutral.

(j) Close AILERON SERVO D (J22) circuit breaker.

(8) Check right outboard aileron as follows:

(a) Release AILERON R OUTBD switchlight on PFCS panel. The switchlight OFF light must come on, the FLT CONT PANELS light must come on, and the right outboard aileron must droop to full down.

(b) Rotate Captains control wheel left and right. Verify right outboard aileron is inactive.

(c) Open AILERON SERVO B circuit breaker. Right outboard aileron will move to neutral.

(d) Rotate Captains control wheel left and right. Verify right outboard aileron follows right inboard aileron movement.

(e) Close AILERON SERVO B circuit breaker. Right outboard aileron will droop. Open AILERON SERVO D circuit breaker. Right outboard aileron will move to neutral.

(f) Rotate Captains control wheel left and right. Verify right outboard aileron follows inboard aileron movement. Center control wheel.

(g) Depress AILERON R OUTBD switchlight on PFCS panel. Switchlight OFF light must go off. Right outboard aileron will remain in neutral.

(h) Close AILERON SERVO D (J22) circuit breaker.

(9) Turn off hydraulic power if no longer required (Ref. 29-11-00).

R (10) Turn off electrical power if no longer required (Ref.
R 24-41-00).

4C. Aileron Servo Hydraulic Integrity Test

This test verifies aileron servo and actuator hydraulic lines are not crossed. If any aileron does not meet

requirements of this test, determine cause and correct or replace affected hydraulic lines.

(1) Verify following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1:

SURF POS IND (J23).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2:

R AILERON SERVO -

R C INBD L&R (J19)

R A INBD & OUT BD (J20)

R B INBD & OUT BD (J21)

R D INBD & OUT BD (J22)

(2) Position ROLL trim wheel on center console to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(3) Verify all four AILERON switchlights on PFCS panel are depressed and latched (flush with panel).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

NOTE: It is extremely important only hydraulic systems specified for each individual test be pressurized, and only hydraulic sources specified be used.

(4) Check hydraulic system B servo channels as follows:

(a) Pressurize only hydraulic system B. (Hydraulic system B supplies all four ailerons.) All ailerons will move to neutral.

NOTE: For hydraulic source, use ground test cart, ATM, or AC pumps.

(b) Rotate Captains control wheel full left. Left inboard an outboard ailerons must move to full up. (Use surface position indicator; press OUTBD AIL PUSH switch on surface position indicator to read outboard ailerons.) Right inboard and outboard ailerons must move to full down.

(c) Rotate Captains control wheel full right. Left inboard and outboard ailerons must move to full down, right inboard and outboard ailerons must move to full up.

(d) Turn off hydraulic system B.

(5) Check hydraulic system C servo channels as follows:

(a) Pressurize only hydraulic system C. (Hydraulic system C supplies left and right inboard ailerons.) Inboard ailerons will fair, outboard ailerons will remain drooped.

NOTE: For hydraulic source, use ground test cart, ATM, or AC pump.

(b) Rotate Captains control wheel full left. Left inboard aileron must move to full up, right inboard aileron must move to full down. Use surface position indicator to follow aileron movement.

(c) Rotate Captains control wheel full right. Left inboard aileron must move to full down, right inboard aileron must move to full up.

(d) Turn off hydraulic system C.

(6) Check hydraulic system A and D servo channels as follows:

(a) Pressurize only hydraulic system A and D. (System A supplies both left ailerons; system D supplies both right ailerons.) All ailerons will position to neutral.

NOTE: For hydraulic source, use ground test cart or engine-driven pumps. Do not use AC pumps or ATMs.

(b) Rotate Captains control wheel full left. Left inboard and outboard ailerons must move to full up, right inboard and outboard ailerons must move to full down.

(c) Rotate Captains control wheel full right. Left inboard and outboard ailerons must move to full down, right inboard and outboard ailerons must move to full up.

(d) Turn off all hydraulic power if no longer required (Ref. 29-11-00).

(e) Turn off electrical power if no longer required (Ref. 24-41-00).

4D. Left Inboard Aileron Servo Autopilot Test

This test is performed to verify proper operation of left inboard servo autopilot components. If requirements of this test are not met, refer to appropriate fault isolation in 22-12-23.

(1) On pilots overhead circuit breaker panel CB1, verify the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS

SPEED CONT (A2)

YAW SAS (A5)

PITCH & ROLL (A6)

TRIM AGMT AC (A7)

TRIM AGMT DC (A8)

AFCS MODE IND (B1)

FCES COMPUTERS DC (B4)

FCES COMPUTERS AC & L AOA (B5)

FCES STICK SHAKE (B6)

SPOILER DWELL AC (B8)

NO. 2 SYSTEMS

SPEED CONT (A20)

YAW SAS (A23)

PITCH & ROLL (A24)

TRIM AGMT AC (A25)

TRIM AGMT DC (A26)

AFCS MODE IND (B19)

ALT ALERT 2 (J21)

ALT ALERT 1 (K27)

(2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify the following circuit breakers are closed:

AILERON SERVO

C INBD L&R (J19)

A INBD & OUT BD L (J20)

B INBD & OUT BD L&R (J21)

FLIGHT STATION MISC

R AOA (F1)

STICK SHAKE (F2)

AFCS WARNING

CAPT (K18)

F/O (K19)

(3) On Flight Engineer/Second Officer aft circuit breaker panel CB3, zone 215, verify the following circuit breakers are closed:

IND LT

PFCS/ADS DH (G8)

FLT CONT ALT ALERT (G9)

R (4) On pilots overhead circuit breaker RAT AUTO DEPLOY (L3).

(5) Install RAT ground safety lock (Ref. 29-11-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on electrical power (Ref. 24-41-00).

(7) Turn on hydraulic system A, B, and C (Ref. 29-11-00).

(8) Prepare autopilot flight director system for operation (Ref. 22-12-00, Maintenance Practices); accomplish Paragraph 4B (Autopilot Setup).

(9) On APFDS SELECT panel (glareshield), position autopilot A switch to CMD position. Verify autopilot B switch is OFF.

(10) On pilots main instrument panel, note aircraft heading on Captains and First Officers horizontal situation indicator (HSI).

(11) On HEADING/PITCH MODE panel (glareshield), use heading knob and establish a reading on HEADING indicator (directly above the knob) of 15 degrees greater then actual aircraft heading. Verify selected heading indicators on both HSI's indicate the 15-degree increase.

(12) On HEADING/PITCH MODE panel, momentarily depress HDG switchlight. Verify the following:

(a) HDG switchlight comes on.

(b) HDG SEL light on Captains and First Officers AFCS MODES indicators come on.

(c) Roll control wheels roll right after a short delay.

(13) On HEADING/PITCH MODE panel, rotate heading knob to establish a reading of 15 degrees less than actual aircraft heading. Momentarily depress HDG switchlight.

R Verify the same annunciations come on as in Step 4D(12) except the roll control wheels roll left.

(14) On APFDS SELECT panel, position autopilot A switch to OFF. Position autopilot B switch to CMD.

R (15) Perform Steps 4D(10) through 4D(14) for autopilot B channel.

(16) Position autopilot B switch to OFF.

(17) Return circuit breakers to normal operating position.

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-41-00).

(20) Remove RAT ground safety lock, if not needed for other tests (Ref. 29-11-00).

5. Rigging Check and Adjustment

This section includes an in-service rigging check and detailed system rigging checks. The in-service rigging check (Para. 5A) determines if ailerons are in acceptable rig and provides minimum amount of adjustment to bring ailerons into rig. The detailed rigging checks (Para. 5B through 5N) should be accomplished for removal and installation, or major rework of aileron control components. Accomplish only those paragraphs in detailed rigging checks that affect installed or reworked components.

Rigging check and adjustment procedures are presented separately for each part of the aileron control system. Each part may be rigged separately without disturbing the remainder of the

system. The completion check procedure must be performed after any rigging check and adjustment. The following are the individual procedures:

PARAGRAPH	PROCEDURE
5A	In-Service Rigging Check and Adjustment
5B	Captains and First Officers Control Wheel Linkage
5C	Captains and First Officers Aileron Control Cables
5D	Captains Aileron Pushrods, Fuselage
5E	First Officers Aileron Pushrods, Fuselage
5F	Aileron Pushrods, Left Wheel Well to Left Inboard Aileron Servo
5G	Left Inboard Aileron Servo
5H	Left Inboard Aileron to Left Outboard Aileron Servo Control System
5I	Left Outboard Aileron Servo
5J	Aileron Pushrods, Right Wheel Well to Right Inboard Aileron Servo
5K	Right Inboard Aileron Servo
5L	Right Inboard Aileron to Right Outboard Aileron Servo Control System
5M	Right Outboard Aileron Servo
5N	Completion Check

NOTE: General:

Ailerons may be rigged with or without both wing engines or simulated engine weights installed. The ailerons should not be rigged with only one wing engine or simulated engine weight installed.

Before making a rigging check or adjustment, allow aircraft structure and cable temperature to stabilize. Do not operate air conditioning equipment while rigging the aileron control system.

After making pushrod adjustment, check for minimum thread

engagement by verifying rod end thread is visible at inspection hole.

The pushrod-to-bellcrank connection normally incorporates a slip fit bushing in one of the fork tangs. A missing slip fit bushing can cause rigging problems that are difficult to troubleshoot. When connecting a pushrod to a bellcrank, verify slip fit bushing is installed.

After making a turnbuckle adjustment, check for minimum thread engagement by verifying no more than three threads are exposed on cable terminal.

Some cables are covered with polyolefin clear tubing to protect cables from corrosive spillage. When checking cable tension, verify tensiometer is NOT positioned on polyolefin tubing area of cable or results will be erroneous.

When measuring tension of lockclad aileron primary control cables (Captain and First Officer), use tensiometer on cables in forward cargo compartment ceiling or galley ceiling area and not in FESC; results will be more consistent.

Rig Pin Fit Requirements:

Rigging requirements normally call for a free rig pin fit. In addition, rigging of aileron control system is normally accomplished with hydraulic power off. When hydraulic power is turned on, some rig pins may not be a free fit in their respective bellcranks. In those positions where the 5/16-inch rig pin can be freely inserted with hydro off but not with hydro on, if aileron neutral rig and aileron displacement are within tolerance, it is acceptable if a 9/32-inch rig pin can be freely inserted with hydro on.

Hydraulic Power Requirements:

Aileron control system rigging is normally accomplished with hydraulic power turned off for safety reasons. However, turning off hydraulic power may prevent other technicians from completing their tasks. Aileron control system rigging can be accomplished with hydraulic power on but extreme precautions must be taken to protect personnel and equipment; they include:

(a) Tag control wheels to prevent inadvertent movement.

(b) Be extremely careful with a disconnect aileron control system. Slight input system movements to aileron

servo can result in large aileron displacement.

(c) Remove all rig pins from aileron control system before turning off hydraulic power.

(d) Be extremely careful when rig pins are installed in those sections of the aileron control system that are driven by both left and right inboard aileron servos. Leave rig pins in these sections only long enough to verify rig, then remove rig pins.

Roll Trim Bias:

On certain aircraft, adjustment of the roll trim wheel and roll control wheels has been biased to provide wings-level flight with roll trim wheel indicator at zero and roll control wheel index marks aligned. A decal, located on underside of alternate landing gear control cover (Ref. Fig. 501), specifies right-wing-down (RWD) trim bias, if any, required for that aircraft. Table 501 tabulates control wheel and trim wheel neutral (rig pin) positions for each trim bias requirement.

Specific rigging of trim wheel and control wheel is covered in appropriate sections of 27-11-00 and 27-12-00 with references to Table 501. It should be noted that RWD bias is accomplished by rigging the control wheels and trim wheel in a LWD direction with the rig pins installed. Removing rig pins and positioning roll control and roll trim control wheels to neutral produces a RWD bias.

CAUTION: TRIM BIAS RIGGING IS ALWAYS ACCOMPLISHED WITH CONTROLS IN LWD POSITION. (ON AIRCRAFT RIGGED TO 2.7 RWD BIAS, IT IS POSSIBLE TO INSERT RIG PIN IN THE FORWARD ROLL TRIM CABLE DRUM IN EITHER THE LWD OR RWD POSITION.)

Roll Trim Bias Adjustment
Table 501

TRIM, BIAS REQUIRED (SEE DECAL UNDER AFT LG CONT COVER OR NOTE BELOW)	TRIM WHEEL NEUTRAL RIGGING POINT (MARKS ON TRIM CONTROL INDICATOR) WITH RIG IN FWD CABLE DRUM	CONTROL WHEEL NEUTRAL RIGGING INDEX (INCHES AND DIRECTION) FROM HUB INDEX WITH RIG PIN IN OUTPUT BELLCRANKS ON BOTTOM OF CONTROL COLUMN
Zero	0	Aligned
1.0 MARK RWD	1.0 MARK LWD	0.09 (±0.03) inches left
1.5 MARKS RWD	1.5 MARKS LWD	0.14 (±0.03) inches left
1.7 MARKS RWD	1.7 MARKS LWD	0.16 (±0.03) inches left
2.0 MARKS RWD	2.0 MARKS LWD	0.19 (±0.03) inches left
2.3 MARKS RWD	2.3 MARKS LWD	0.21 (±0.03) inches left
2.5 MARKS RWD	2.5 MARKS LWD	0.23 (±0.03) inches left
2.7 MARKS RWD	2.7 MARKS LWD	0.25 (±0.03) inches left

R NOTE: Aircraft 012, 017, 019, 021, 023, 025, 027, 029, 031-036 require 1.0 mark RWD trim bias.

Aircraft 018 requires 1.5 marks RWD trim bias.

Aircraft 011 require 2.0 marks RWD trim bias.

Aircraft 014 requires 2.3 marks RWD trim bias.

Aircraft 001 requires 2.7 marks RWD trim bias.

All other aircraft require zero trim bias.

5A. In-Service Rigging Check and Adjustment

The in-service rigging check and adjustment procedure determines that aileron neutral and aileron displacement are within tolerance, depending on fuel loads and aircraft condition (on jacks or gear).

Tables are provided for both inspection and adjustment of aileron neutral position. The inspection limits are looser than adjustment limits.

If aileron neutral position is out of tolerance, a minimum amount of rigging adjustment is provided to bring ailerons within tolerance. If aileron displacement is out of tolerance, perform necessary detailed rigging check and
R adjustment procedures in Paragraphs 5B through 5N. (Accomplish only those paragraphs that affect out-of-tolerance aileron.)

The in-service rigging check and adjustment procedures should be used to maintain the aileron control system in acceptable rig. For removal and installation, or major rework of aileron control components, use appropriate detailed rigging check and adjustment procedures in paragraphs 5B through 5N.

(1) On overhead PFCS panel, verify all four AILERON switchlights are depressed (latched in).

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on all four hydraulic systems (Ref. 29-11-00).

(4) Cycle control wheel several times to normalize aileron servos. Allow control wheel to return to trim position.

(5) Position ROLL trim wheel on center console to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on the decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(6) In forward electronic service center, install rig pin R3 in roll trim cable drum (Ref. 27-12-00 Fig. 501).

(7) In hydraulic service center, check that rig pin R2 can be freely installed in aileron trim actuator output bellcrank (Ref. 27-12-00 Fig. 501). Remove rig pin from trim actuator output bellcrank.

NOTE: If either rig pin cannot be freely installed in trim control system, check trim control system rigging (Ref. 27-12-00, Adjustment/Test).

(8) Allow roll control system to assume neutral aileron position (Ref. Trim Bias Table 501) from feel spring centering force, then check all four aileron neutral positions (Ref. Table 502 or 503).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

CR On aircraft 001-017, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

CR

On aircraft 018-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(a) If ailerons meet inspection limits of Table 502 or 503, aileron neutral rig is acceptable. Remove all rig pins and check aileron displacement in accordance with Step 5A(16).

(b) If ailerons do not meet inspection limits of Table 502 or 503, proceed with following steps and make adjustments to all ailerons as required, starting with left inboard, to meet requirements of adjustment limits of Table 504.

In-Service Rigging Check Inspection Requirements - Aircraft On Jacks or Gear and Fuel Load Less Than 85,000 Pounds
Table 502

AILERON	NEUTRAL POSITION TOLERANCE
L INB'D	+0.50, -0.35 inch from index
L OUTB'D	+0.50, -0.35 inch from index (also must agree with L INB'D within 0.35 inch)
R INB'D	+0.50, -0.35 inch from index
R OUTB'D	+0.50, -0.35 inch from index (also must agree with R INB'D within 0.35 inch)

NOTE:

1. Fuel tanks must be filled equally
2. (+) equals above index, (-) equals below index

EXAMPLES:

L INB'D at +0.50; L OUTB'D must be +0.15 to +0.50

L INB'D at -0.30; L OUTB'D must be -0.35 to +0.05

L INB'D at +0.50; R INB'D must be -0.35 to +0.50

In-Service Rigging Check Inspection Requirements - Aircraft on Gear and Fuel Load More than 85,000 Pounds
Table 503

AILERON	NEUTRAL POSITION TOLERANCE
L INB'D	+1.00, -0.20 inch from index
L OUTB'D	+1.00, -0.20 inch from index (also must agree with L INB'D aileron within 0.50 inch)
R INB'D	+1.00, -0.20 inch from index (also must agree with L INB'D aileron within 1.00 inch)
R OUTB'D	+1.00, -0.20 inch from index (also must agree with R INB'D aileron within 0.50 inch)

NOTE:

1. Fuel tanks must be filled equally
2. (+) equals above index, (-) equals below index

EXAMPLES:

L INB'D at +0.60; L OUTB'D must be +0.10 to +1.00

L INB'D at +1.00; L OUTB'D must be +0.50 to +1.00

L INB'D at +1.00; R INB'D must be .00 to +1.00

In-Service Rigging Check Adjustment Requirements
Table 504

AIRCRAFT CONDITION	NEUTRAL POSITION TOLERANCE (all four ailerons)[1]
On gear or jacks, zero fuel	±0.25 inch from index
On gear or jacks, 1,000-57,000 lbs fuel	+0.35, -0.20 inch from index
On gear or jacks, 57,000-85,000 lbs fuel	+0.40, -0.20 inch from index
On gear, more than 85,000 lbs fuel	+0.70, -0.10 inch from index

NOTE:

R [1] Inboard and outboard ailerons on same wing must agree within one-half the tolerance (plus or minus one-fourth of the total tolerance range) shown above.

EXAMPLE:

With more than 85,000 lbs fuel, L INB'D is at +0.40; L OUTB'D must be between +0.60 and +0.20

(9) Verify rig pin (R3) is installed in roll trim control system in accordance with Step 5A(6).

(10) With roll trim wheel and aileron control wheel in neutral aileron positions, (Ref. Roll Trim Bias Table 501), install rig pins R2 and R3 in bellcranks (21) and (22) in left wheel well (Ref. Fig. 503). If left inboard aileron moves more than ±0.12 inch, adjust dual input pushrods (23) and (24) in left wheel well to align rig pin holes of bellcranks (21) and (22).

WARNING: WITH HYDRAULIC POWER ON, DO NOT ALLOW BOTH INPUT PUSHRODS (23) AND (24) TO BE DISCONNECTED AT SAME TIME. AN UNCONTROLLABLE SERVO WILL RESULT.

(11) Verify left inboard aileron is in tolerance in accordance with Table 504. If not, check left inboard aileron servo rig as follows:

(a) Remove rig pins from left wheel well bellcranks (21) and (22).

(b) Remove access panels 551AT, 551BB, 551BB-1, and pylon fairing 453H (Ref. 6-40-00) to gain access to left inboard aileron servo.

CAUTION: DO NOT SHUT OFF HYDRAULIC POWER WITH RIG PIN INSTALLED IN ANY AILERON SERVO AS PERMANENT DAMAGE TO SERVO CAN RESULT.

(c) Install rig pins R2 in left inboard aileron servo upper and lower input arms (69) and (70) and servo (Ref. Fig. 506). (Rig pins may not be a free fit.) Aileron should be in neutral (±0.12 inch). If so, proceed to Step 5A(11)(k).

(d) If left inboard aileron is not in neutral position (±0.12 inch), adjust servo feedback pushrods in accordance with Steps 5A(11)(e) through 5A(11)(i) as required.

WARNING: WITH HYDRAULIC POWER ON, THE SERVO IS VERY SENSITIVE AND DANGEROUS WITH BOTH SERVO INPUT OR BOTH FEEDBACK PUSHRODS DISCONNECTED.

(e) Disconnect lower feedback pushrod (74) from feedback arm (Ref. Fig. 506). If aileron moves to neutral position (±0.12 inch), adjust and reconnect lower feedback pushrod (74) to hold aileron in same neutral position. Proceed to Step 5A(11)(k).

R (f) If aileron does not move to neutral position with
R lower feedback pushrod disconnected, accomplish
R Steps 5A(11)(g) through 5A(11)(j).

(g) Note direction and amount aileron is out of neutral. Adjust lower feedback pushrod (74) half the required correction (but not more than two turns). Reconnect lower feedback pushrod.

NOTE: One turn of feedback pushrod changes aileron position approximately 0.35 inch at neutral index. Lengthening pushrod raises aileron, shortening pushrod lowers aileron.

(h) Disconnect upper feedback pushrod (73) from feedback bellcrank.

(i) Note direction and amount aileron is out of neutral. Adjust upper feedback pushrod half the required correction (but no more than two turns). Reconnect upper feedback pushrod.

R (j) Repeat Step 5A(11)(e)

NOTE: If aileron was more than one inch out of neutral, it may require several adjustments of feedback pushrods to safely "walk" aileron to neutral position by adjusting one feedback pushrod at a time.

(k) Remove both rig pins from servo.

(l) Reinstall rig pins in left wheel well bellcranks (21) and (22). These rig pins should remain
R installed until Step 5A(15).

(m) Install access panels and pylon fairing.

R (n) Recheck that left inboard aileron is in tolerance
R in accordance with Table 504. If not, equally adjust dual pushrods (29) and (31) in left wheel well the minimum amount necessary to meet Table 504 requirements. (Lengthening pushrods will raise aileron, shortening pushrods will lower aileron.)

NOTE: Adjusting left inboard aileron neutral position will cause the other three ailerons to move to new neutral positions,
R and readjustment in accordance with Steps
R 5A(12), 5A(13), and 5A(14) may be required.

R (12) Verify right inboard aileron is in tolerance in
R accordance with Table 504. If not, check right inboard aileron servo rig as follows:

(a) Remove access panel 651AT, 651BB, 651BB-1, and pylon fairing 463H to gain access to right inboard aileron servo (Ref. 6-40-00).

(b) Install rig pins R2 in right inboard servo upper and lower input arms (103) and (104) and servo (Ref. Fig. 510). (Rig pins will not fit freely due to deslop bungee preload). Ailerons should be
R in neutral (±0.12 inch). If so, proceed to Step
R 5A(12)(j).

NOTE: Servo feedback pushrods are properly adjusted when the following occurs: when only upper rig pin is installed in servo input arm, aileron will droop slightly. When only lower rig pin is installed in servo input arm, aileron will rise slightly. Droop and rise should be nearly equal. When both rig pins are installed in servo input arms, aileron should assume the mid-position between droop and rise and be in neutral (±0.12 inch).

(c) If right inboard aileron is not in neutral (±0.12
R inch), adjust servo feedback pushrods in
R accordance with Steps 5A(12)(d) through 5A(12)(i),
R as required.

WARNING: WITH HYDRAULIC POWER ON, SERVO IS SENSITIVE AND DANGEROUS IF BOTH SERVO INPUT OR BOTH FEEDBACK PUSHRODS ARE DISCONNECTED.

(d) Disconnect lower feedback pushrod (108) from feedback arm (Ref. Fig. 510). If aileron moves to neutral position (±0.12 inch) adjust and reconnect lower feedback pushrod (108) to hold aileron in
R same neutral position. Proceed to Step 5A(12)(j).

R (e) If aileron does not move to neutral position with
R lower feedback pushrod disconnected, accomplish
R following Steps 5A(12)(f) through 5A(12)(i).

(f) Note direction and amount aileron is out of neutral. Adjust lower feedback pushrod half the required correction (but not more than two turns). Reconnect lower feedback pushrod.

NOTE: One turn of feedback pushrod changes aileron position approximately 0.35 inch at neutral index. Lengthening pushrod raises aileron, shortening pushrod lowers aileron.

(g) Disconnect upper feedback pushrod (107) from feedback bellcrank.

(h) Note direction and amount aileron is out of neutral. Adjust upper feedback pushrod half the required correction (but not more then two turns). Reconnect upper feedback pushrod.

R (i) Repeat Step 5A(12)(d).

NOTE: If aileron is more than one inch out of neutral, it may take several adjustments of feedback pushrods to "walk" aileron safely to neutral position by adjusting one feedback pushrod at a time.

(j) Remove rig pins from servo.

(k) Verify rig pins are installed in left wheel well bellcranks (21) and (22).

R (l) Recheck that right inboard aileron is in neutral
R in accordance with Table 504 and that deslop
R bungee is in approximately mid-stroke. If not,
R accomplish appropriate Steps 5A(12)(m) through
R 5A(12)(r).

NOTE: The servo lower input override bungee assembly contains an additional deslop bungee spring (small spring). The deslop bungee stroke is 0.20 inch. The servo input and feedback pushrods are adjusted to position aileron to neutral and compress deslop bungee to approximately mid-stroke. Mid-stroke condition can be determined by pushing and pulling on servo lower input arm (with hydraulic power on) and note that deslop bungee spring shows approximately equal compression in both directions.

(m) If aileron is low and deslop bungee is in mid-stroke, equally lengthen dual pushrods (50) and (52) (Ref. Fig. 504) in right wheel well the minimum amount necessary to meet Table 504 requirements. (Adjust one pushrod at a time.)

(n) If aileron is high and deslop bungee is in mid-stroke, equally shorten dual pushrods (50) and (52) in right wheel well. (Adjust one pushrod at a time.)

R (o) If aileron is low and deslop bungee is long, shorten servo upper input pushrod (140) (Ref. Fig. 510) just enough to compress deslop bungee to mid-stroke, then raise aileron in accordance with Step 5A(12)(m).

R (p) If aileron is low and deslop bungee is short, shorten servo lower input pushrod (141) (Ref. Fig. 510) just enough to extend deslop bungee to mid-stroke, then raise aileron in accordance with Step 5A(12)(m).

R (q) If aileron is high and deslop bungee is long, lengthen servo lower input pushrod (141) (Ref. Fig. 510) just enough to compress deslop bungee to mid-stroke, then lower aileron per Step (n).

R (r) If aileron is high and deslop bungee is short, lengthen servo upper input pushrod (140) (Ref. Fig. 510) just enough to extend deslop bungee to mid-stroke, then lower aileron in accordance with Step 5A(12)(n).

(s) Install access panels and pylon fairing.

NOTE: Adjusting right inboard aileron neutral position will cause the right outboard aileron to move to new neutral position, and readjustment per Step (14) may be required.

(13) With rig pins installed in left wheel well bellcranks (21) and (22), verify left outboard aileron is in R tolerance in accordance with Table 504. If not, check left outboard aileron rig as follows:

(a) Remove access panel 571CB to gain access to left outboard aileron servo (Ref. 6-40-00).

(b) Install rig pin R2 in the servo input arm (82) and servo (Ref. Fig. 508). (Rig pin may not be a free fit.)

(c) Verify left outboard aileron is in neutral (±0.12 R inch). If so, proceed to Step 5A(13)(j).

R R R (d) If left outboard aileron is not in neutral (±0.12 inch), accomplish Steps 5A(13)(e) through 5A(13)(i), as required.

WARNING: WITH HYDRAULIC POWER ON, THE SERVO IS SENSITIVE AND DANGEROUS WITH EITHER SERVO INPUT OR BOTH FEEDBACK PUSHRODS DISCONNECTED.

(e) Disconnect secondary (outboard) feedback pushrod (85) from bellcrank (Ref. Fig. 508). With only primary feedback pushrod connected, the aileron should be in neutral (±0.12 inch). If it is, determine mid-point of free play in secondary feedback control system; adjust secondary feedback pushrod (85) to mid-point of free play and connect to bellcrank. Aileron must remain in neutral R (±0.12 inch). Proceed to Step 5A(13)(j).

(f) If aileron is not in neutral (±0.12 inch) with only primary feedback pushrod connected, R accomplish Steps 5A(13)(g) through 5A(13)(i).

(g) Note direction and amount aileron is out of neutral. Adjust secondary feedback pushrod half the required correction (but not more than two turns). Reconnect secondary feedback pushrod to bellcrank.

NOTE: One turn of feedback pushrod changes aileron position approximately 0.3 inch at trailing edge. Lengthening pushrod raises aileron, shortening lowers aileron.

(h) Disconnect primary (inboard) feedback pushrod (84) from bellcrank. Note direction and amount aileron is out of neutral. Adjust primary feedback pushrod half the required correction (but not more than two turns). Reconnect primary feedback pushrod to bellcrank.

R (i) Repeat Step 5A(13)(e).

NOTE: If aileron is more than one inch out of neutral, it may require several adjustments of feedback pushrods to "walk" aileron safely to neutral position by adjusting one feedback pushrod at a time.

(j) Remove rig pin from servo.

(k) Verify rig pins are installed in left wheel well bellcranks (21) and (22) (Ref. Fig. 503).

R CAUTION: BEFORE DISCONNECTING SERVO INPUT BUNGEE (83),
R INSTALL RIG PIN IN SERVO INPUT ARM (82).
R SERVO IS UNCONTROLLABLE WITH SERVO INPUT
R BUNGEE DISCONNECTED FROM SERVO. REMOVE RIG
R PIN AFTER RECONNECTING SERVO INPUT BUNGEE.

R (l) Recheck left outboard aileron is in tolerance in
R accordance with Table 504. If not, adjust servo input bungee (83) the minimum amount necessary to meet requirements of Table 504. (Lengthening bungee raises aileron, shortening bungee lowers aileron.)

(m) Install access panel.

R (14) Verify right outboard aileron is in tolerance in
R accordance with Table 504. If not, check right
R outboard aileron servo rig as follows:

R (a) Remove access panel 671CB (Ref. 6-40-00) to gain access to right outboard aileron servo.

(b) Install rig pin R2 in servo input arm (127) and servo (Ref. Fig. 512).

(c) Verify right outboard aileron is in neutral (±0.12
R inch). If it is, proceed to Step 5A(14)(j).

R (d) If right outboard aileron is not in neutral (±0.12
R inch), accomplish Steps 5A(14)(e) through
R 5A(14)(i), as required.

WARNING: WITH HYDRAULIC POWER ON, THE SERVO IS SENSITIVE AND DANGEROUS WITH EITHER SERVO INPUT OR BOTH FEEDBACK PUSHRODS DISCONNECTED.

(e) Disconnect secondary (outboard) feedback pushrod (130) from bellcrank (Ref. Fig. 512). With only primary feedback pushrod connected, aileron should be in neutral (± 0.12 inch). If it is, determine mid-point of free play in secondary feedback control system; adjust secondary feedback pushrod (130) to mid-point of free play and connect to bellcrank. Aileron must remain in neutral (± 0.12
R inch). Proceed to Step 5A(14)(j).

R (f) If aileron is not in neutral (± 0.12 inch) with
R only primary feedback pushrod connected,
R accomplish following Steps 5A(14)(g) through
R 5A(14)(i).

(g) Note direction and amount aileron is out of neutral. Adjust secondary feedback pushrod half the required correction (but not more than two turns). Reconnect secondary feedback pushrod to bellcrank.

NOTE: One turn of feedback pushrod changes aileron position approximately 0.3 inch at trailing edge. Lengthening pushrod raises aileron, shortening lowers aileron.

(h) Disconnect primary (inboard) feedback pushrod (124) from bellcrank. Note direction and amount aileron is out of neutral. Adjust primary feedback pushrod half the required correction (but not more than two turns). Reconnect primary feedback pushrod to bellcrank.

R (i) Repeat Step 5A(14)(e).

NOTE: If aileron is more than one inch out of neutral, it may require several adjustments of feedback pushrods to "walk" aileron safety to the neutral position by adjusting one feedback pushrod at a time.

(j) Remove rig pin from servo.

(k) Verify rig pins are installed in left wheel well bellcranks (21) and (22) (Ref. Fig. 503).

R CAUTION: BEFORE DISCONNECTING SERVO INPUT BUNGEE
R (128), INSTALL RIG PIN IN SERVO INPUT ARM
R (127). SERVO IS UNCONTROLLABLE WITH SERVO
R INPUT BUNGEE DISCONNECTED FROM SERVO. REMOVE
R RIG PIN AFTER RECONNECTING SERVO INPUT
R BUNGEE.

R (l) Recheck right outboard aileron is in accordance
R with Table 504. If not, adjust servo input bungee (128) the minimum amount necessary to meet requirements of Table 504. (Lengthening bungee raises aileron, shortening bungee lowers aileron.)

(m) Install access panel.

(15) When all four ailerons meet requirements of Table 504, aileron neutral rig is satisfactory. Remove all rig pins except the one in trim system.

(16) Check ailerons for proper displacement as follows:

(a) On left and right inboard ailerons, mark the aileron lower surface just opposite the neutral index mark on the No. 3 flap torque box. On left and right outboard ailerons, at the inboard edge, mark the lower surface of the aileron and fixed trailing edge ten inches forward of the trailing edge.

(b) Verify all rig pins are removed from aileron control system.

(c) Rotate control wheel full left. Verify left inboard and outboard ailerons position up and right inboard and outboard ailerons position down a minimum of 19 degrees. If this requirement cannot be met, verify total displacement of left and right inboard ailerons, and of left and right outboard ailerons, is a minimum of 38 degrees. (Example: If left inboard aileron positions up 18 degrees, this is acceptable if right inboard aileron positions down a minimum of 20 degrees.)

NOTE: Inboard aileron displacement of 19 degrees equals 15.5 inches measured between index mark on flap torque box and index mark on aileron lower surface.

CR On aircraft 001-017, outboard displacement of 19 degrees equals 9.8 inches measured between index marks made on aileron lower surface and wing fixed structure trailing edge.

CR On aircraft 018-999, outboard aileron displacement of 19 degrees equals 9.8 inches measured between index mark made on aileron lower surface and neutral index notch on wing fixed structure trailing edge.

(d) Rotate control wheel full right. Verify left inboard and outboard ailerons position down and the right inboard and outboard ailerons position up a minimum of 19 degrees. If this requirement cannot be met, verify total displacement of left and right inboard ailerons, and of left and right outboard ailerons, is a minimum of 38 degrees.

(e) If aileron displacement requirement cannot be satisfied, check rigging of aileron control system (Ref. Para. 5B through 5N). (Accomplish only those sections affecting out-of-rig ailerons.)

5B. Captains and First Officers Control Wheel Linkage - Rigging Check and Adjustment

(1) Verify all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Manually position both inboard ailerons to neutral (±0.06 inch) and install aileron support tool (Ref. Fig. 513). (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

NOTE: Aileron neutral index mark is a red paint-filled dimple on No. 3 flap torque box. Align aileron lower surface with index mark.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R Maintenance Practices.

(3) Remove screws attaching shields to control columns, and shrouds to flight station floor.

(4) Remove shields and slide shrouds up control column to expose roll output bellcranks.

(5) Remove console right side trim panel to expose roll disconnect.

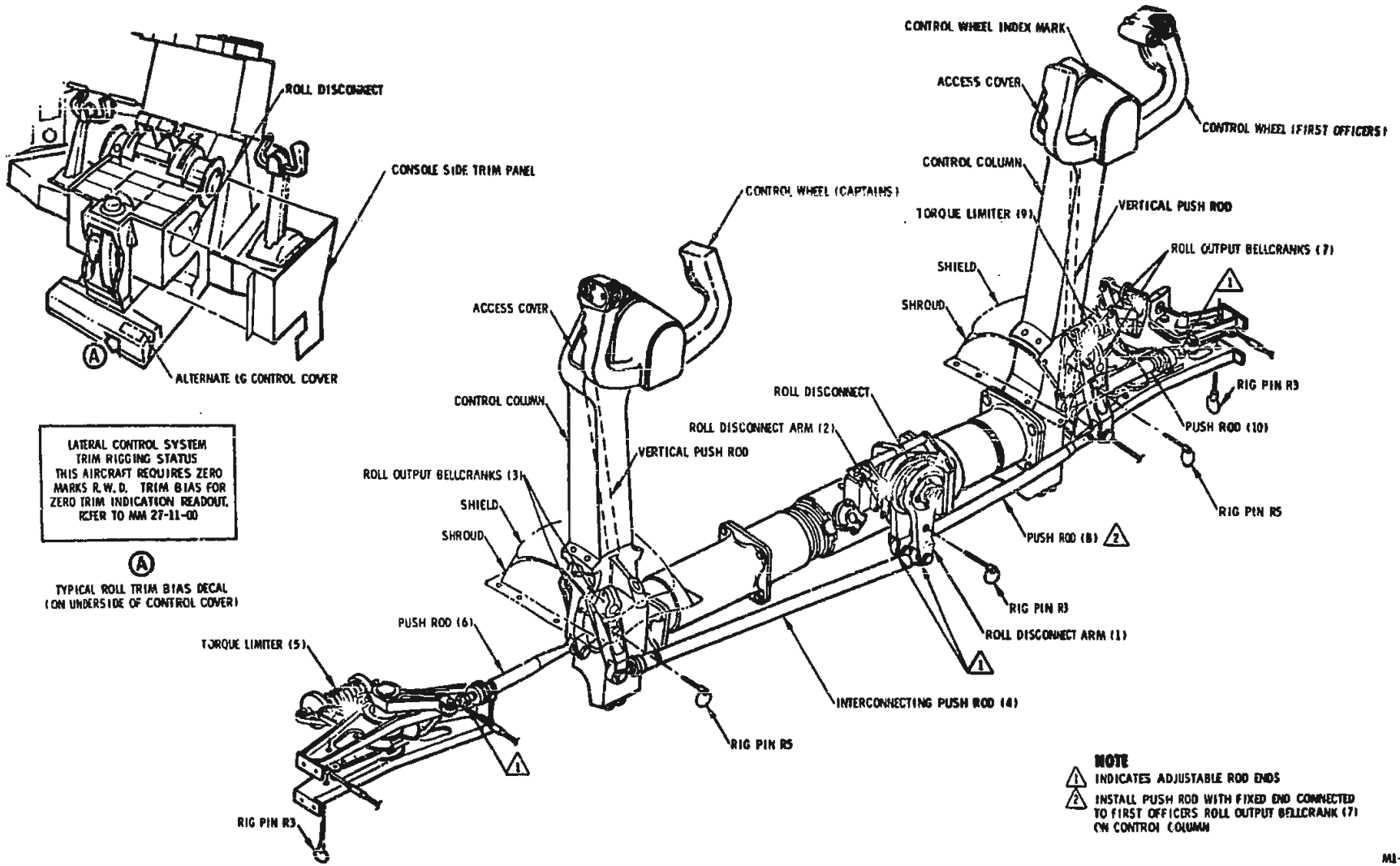
(6) Pull up on ROLL DISC handle and lock in extended position to remove lost motion.

(7) Install rig pin R3 through roll disconnect arms (1) and (2) and bracket. Rig pin R5 must fit freely through Captains roll output bellcranks (3) and control column. If not, adjust pushrod (4) (Ref. Fig. 501).

(8) With rig pin installed in Captains roll output bellcranks (3), verify index mark on Captains control wheel is at neutral setting; if not, adjust vertical pushrod in control column (Ref. Table 501).

NOTE: Alignment of control wheel index is accomplished by adjusting vertical aileron output pushrod within control column housing. This is normally a shop adjustment.

(9) With rig pin installed in Captains roll output bellcranks (3), rig pin R3 must fit freely through



Control Wheel Linkage - Rigging Check and Adjustment
Figure 501

bracket and left torque limiter (5). If not, adjust pushrod (6).

NOTE: Remove floor panel between control column and side console to gain access to pushrod (6).

(10) With rig pin R3 installed through roll disconnect arms (1) and (2), rig pin R5 must fit freely through First Officers roll output bellcranks (7) and control column. If not, adjust pushrod (8).

(11) With rig pin installed in First Officers roll output bellcranks (7), verify index mark on First Officers control wheel is at neutral setting (Ref. Table 501). If not, adjust vertical pushrod in control column.

(12) With rig pin installed in First Officers roll output bellcranks (7), rig pin R3 must fit freely through bracket and right torque limiter (9). If not, adjust pushrod (10).

NOTE: Remove floor panel between control column and side console to gain access to pushrod (10).

(13) Release ROLL DISC handle and allow handle to retract against panel.

(14) Remove all rig pins.

(15) Close access door opened in Step 5B(3).

(16) Install control column shroud and shield.

(17) Install console side trim panel.

(18) Remove aileron support tool if no additional rigging checks are to be made.

5C. Captains and First Officers Aileron Control Cables - Rigging Check and Adjustment

(1) Verify all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Manually position both left and right inboard ailerons to neutral (±0.06 inch) and install aileron support tool (Ref. Fig. 513). (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

NOTE: Aileron neutral index mark is a red paint-filled dimple on flap torque box No. 3. Align lower surface of aileron with index mark.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R Maintenance Practices.

(3) Open following access doors and floor panels (Ref. 6-40-00 and 6-50-00).

(a) 112AB to forward electronic service center.

(b) 262CB and 261GB passenger compartment floor panels to aft cable bellcrank.

(c) 262BB and 261CB floor panels to cable aft idlers

(4) Install rig pins R4 through aft cable bellcranks (11) and (15). Verify the following:

(a) Rig pins R3 fit freely through bracket and torque limiters (5) and (9) (Ref. Fig. 502).

(b) Cable tension conforms to temperature compensation chart.

C NOTE: When measuring tension of the Lockclad
C aileron control cables (Captains and First
C Officer) the tensiometer should be used in
C the forward cargo compartment or galley
C ceiling area and not in the FESC area.

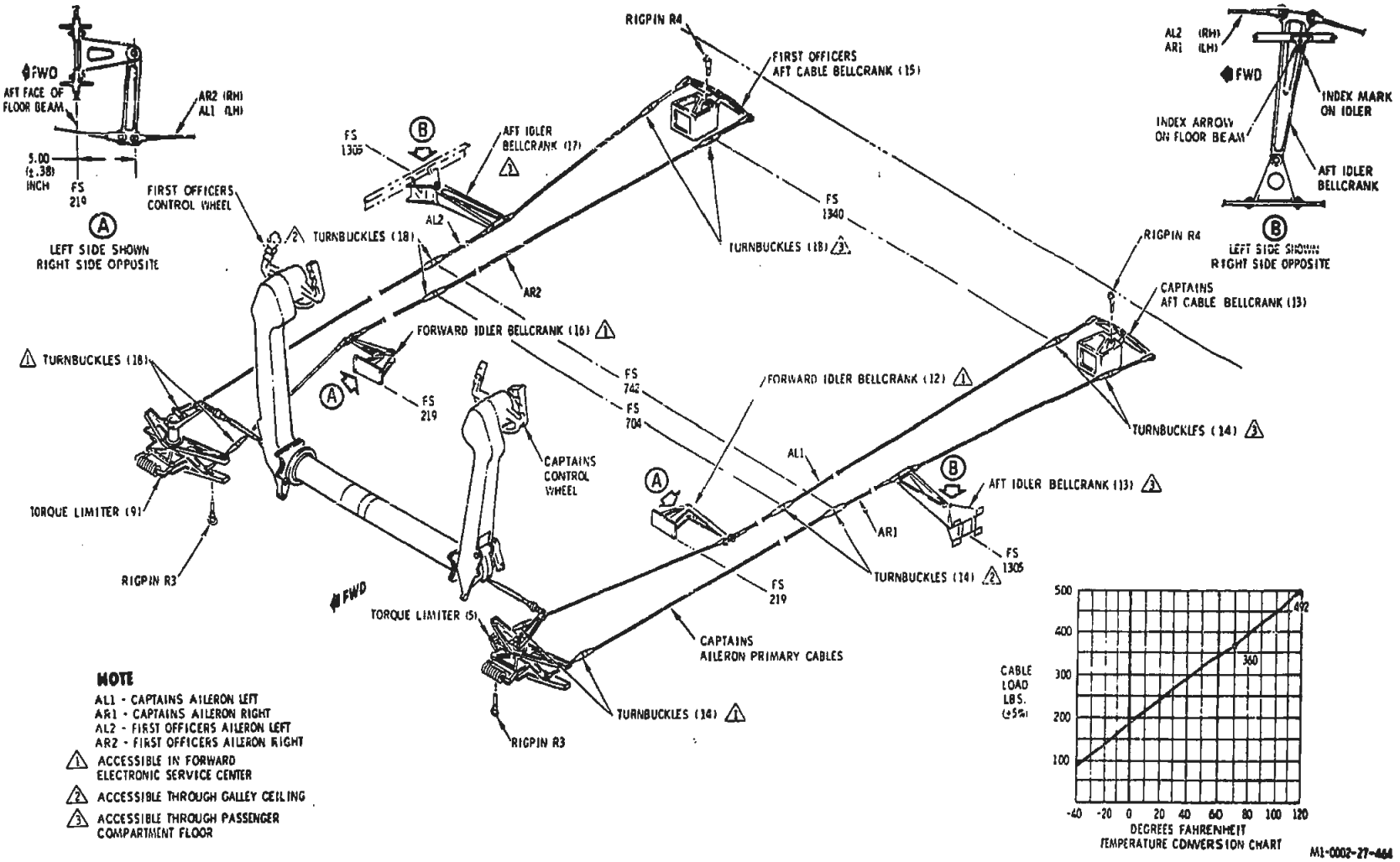
(c) Forward idler bellcranks (12) and (16) are 5.0 (±0.38) inches from floor beam (measured at center of aft cable attach bolt).

(d) Aft idler bellcranks (13) and (17) index mark aligns with arrow (±0.10 inch).

(5) If any of the above requirements are not met, adjust turnbuckles (14) (Captains cables) and (18) (First Officers cables).

(6) Remove all rig pins.

(7) Remove aileron support tool if no additional rigging checks are to be made. Close access doors and install floor panels opened in Step 5C(3).



R Aileron Control Cables - Rigging Check and Adjustment
R Figure 502

EFFECTIVITY: ALL

001B

5D. Captains Aileron Pushrods, Fuselage - Rigging Check and Adjustment

(1) Verify all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Open access door 147AB or 147BB to hydraulic service center. From passenger compartment, remove floor access panel 261GB to Captains aft cable bellcrank (Ref. 6-40-00 and 6-50-00).

(3) Position roll trim wheel to neutral aileron position and install rig pin R2 in aileron trim actuator output bellcrank (99), in hydraulic service center.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on the decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(4) Position both inboard ailerons to neutral (±0.060 inch) and install aileron support tool. (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

NOTE: Aileron neutral index mark is on flap torque box No. 3. Align lower surface of aileron to index mark.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(5) From passenger compartment, install rig pin R4 in the Captains aft cable bellcrank (13). Verify the following (Ref. Fig. 503):

(a) Rig pin R2 fits freely through bellcrank (21) in aft outboard corner of left wheel well. If not, adjust pushrods (23).

(b) Rig pin R3 fits freely through bellcrank (22) in aft outboard corner of left wheel well. If not, adjust pushrod (24).

(c) The feel/trim spring is in caged position (no spring force applied). If not, adjust pushrod (53).

(6) Install rig pin R4 through bellcrank (25) and bracket in aft corner of left wheel well.

NOTE: If rig pin cannot be inserted through bellcrank (25), remove wing access panel 551AB and disconnect pushrod (75) from outboard bellcrank (67) (just inboard of inboard aileron servo) (Ref. Fig. 506).

(7) With rig pins installed in bellcranks (21), (22), and (25), rig pin R5 must fit through stacked bellcranks (26), (27), and (28) in left wheel well. If not, adjust pushrods (29), (30) and (31) (Ref. Fig. 503).

(8) With rig pin R4 installed in bellcrank (25) in aft corner of left wheel well, rig pin R5 must fit freely through dual bellcrank (32) in left wheel well. If not, adjust pushrod (33).

(9) With rig pin installed in bellcrank (32), verify the following:

(a) Rig pin R5 must fit freely through left mixer cam and frame. If not, adjust pushrod (34).

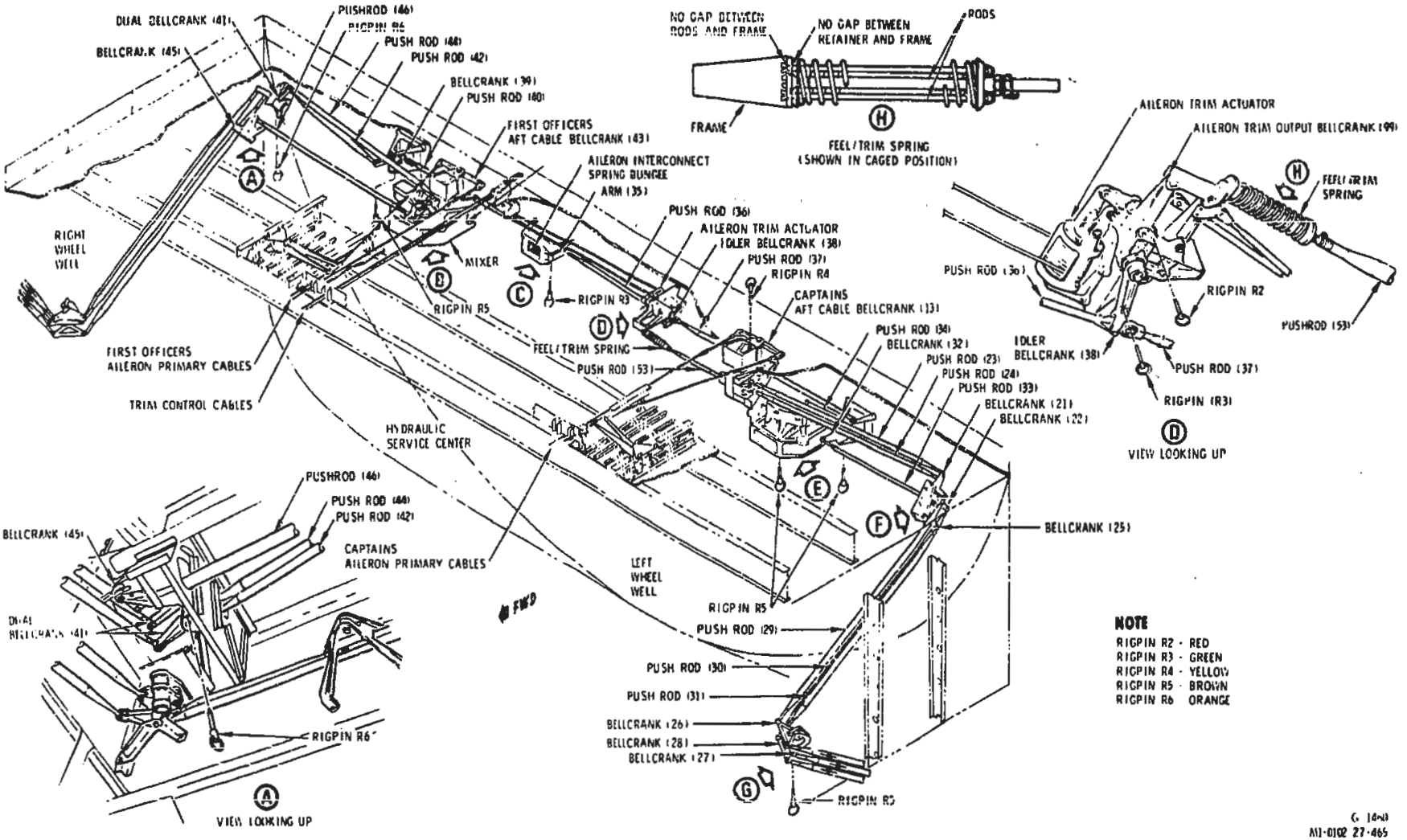
NOTE: Mixer electrical dwell actuator must be in flaps-extended (actuator-retracted) position. To accomplish, position flaps to 4 degrees or more. (Actuator retract dimension is 7.03 (±0.01) inches between actuator attaching bolt centers.)

(b) Rig pin R3 must fit freely through idler bellcrank (38) and bracket (mounted on aileron trim actuator bracket) in hydraulic service center. If not, adjust pushrod (37).

(10) With rig pin installed in idler bellcrank (38), rig pin R3 must fit freely through aileron interconnect sping bungee arm (35) in hydraulic service center. If not, adjust pushrod (36).

(11) With rig pin installed in spring bungee arm (35), rig pin R5 must fit freely through bellcrank (39) in right wheel well. If not, adjust pushrod (40).

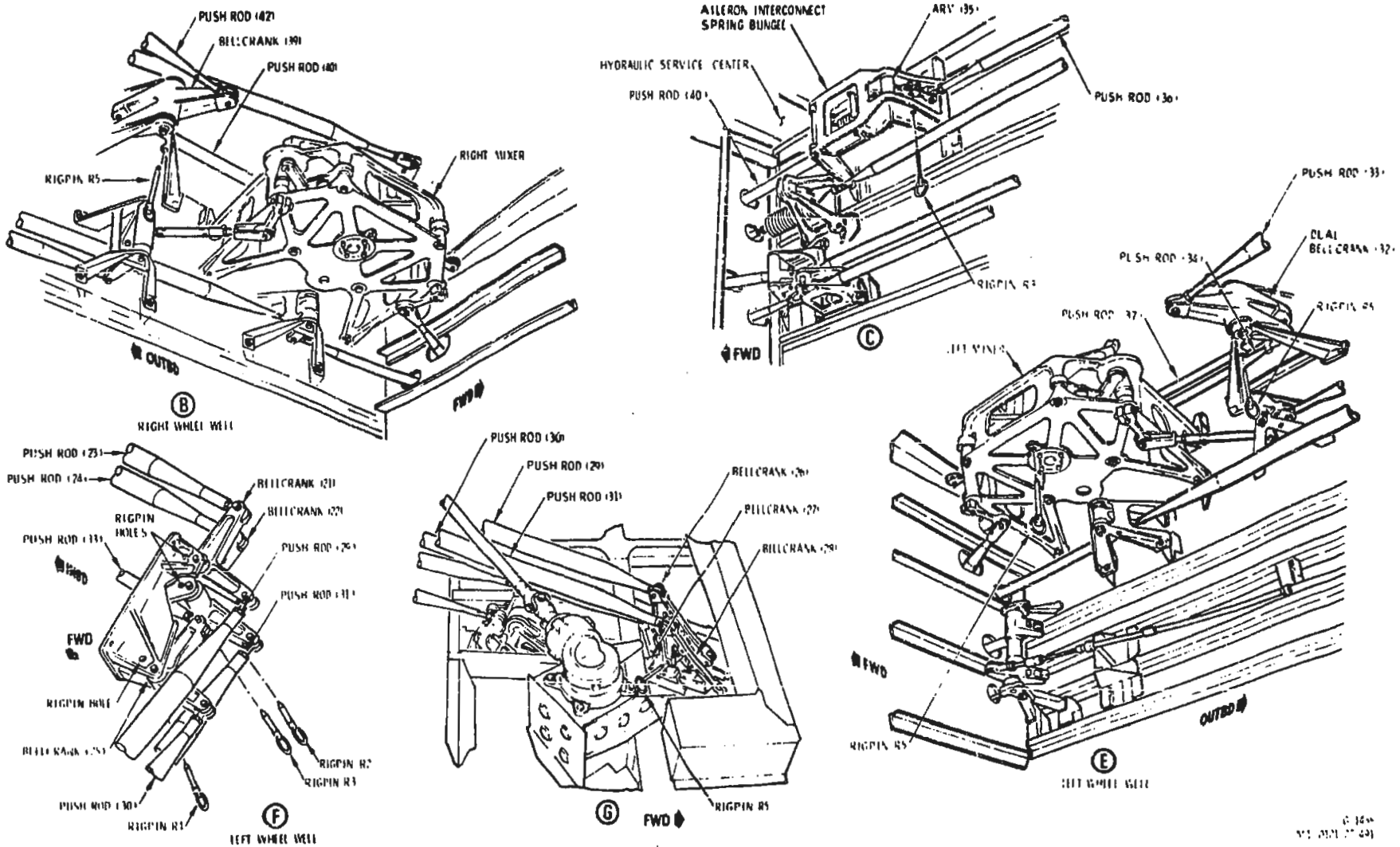
(12) With rig pin installed in bellcrank (39), rig pin R6 must fit freely through dual bellcrank (41) in aft



G 1840
M1-0102 27-465

Captains Aileron Pushrods, Fuselage
Rigging Check and Adjustment
Figure 503 (Sheet 1)

R
R
0018 EFFECTIVITY: ALL



Captains Aileron Pushrods, Fuselage
Rigging Check and Adjustment
Figure 503 (Sheet 2)

R
R
0018 EFFECTIVITY: ALL

corner of right wheel well. If not, adjust pushrod (42).

(13) Remove all rig pins if no additional rigging is to be done.

(14) Reconnect pushrod (75) to bellcrank (67) if removed for Step 5D(6) (Ref. Fig. 506).

(15) Install access panels and close access door opened in Steps 5D(2) and 5D(6).

(16) Remove aileron support tool if no additional rigging checks are to be made.

5E. First Officers Aileron Pushrods, Fuselage - Rigging Check and Adjustment

(1) Verify all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Open access door 147AB or 147BB to hydraulic service center. Remove passenger compartment floor access panel 262CB to First Officers aft cable bellcrank. (Ref. 6-40-00 and 6-50-00).

(3) Position both inboard ailerons to neutral (±0.060 inch) and install aileron support tool (Ref. Fig. 513). (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

NOTE: Aileron neutral index mark is a red paint-filled dimple on flap torque box No. 3. Align lower surface of aileron with index mark.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(4) From passenger compartment, install rig pin R4 in First Officers aft cable bellcrank (43). Rig pin R6 must fit freely through dual bellcrank (41) in aft corner of right wheel well. If not, adjust pushrod (44) (Ref. Fig. 504).

(5) Install rig pin R2 in bellcrank (45) in aft corner of right wheel well; rig pin R5 must fit freely through right mixer cam and frame. If not, adjust pushrod (46).

NOTE: If rig pin cannot be inserted in bellcrank (45), disconnect pushrod (109) from bellcrank (110) (just inboard of inboard aileron servo) (Ref. Fig. 509).

Mixer electrical dwell actuator must be in flaps-extended position (actuator retracted). To accomplish, position flaps to 4 degrees or more. (Retract dimension of actuator is 7.03 (±0.01) inches between actuator attaching bolt centers.)

(6) With rig pins installed in dual bellcrank (41) and bellcrank (45), rig pin R5 must fit through forward stacked bellcranks (47), (48), and (49). If not, adjust parallel pushrods (50), (51), and (52) (Ref. Fig. 504).

(7) Remove all rig pins if no additional rigging is to be done.

(8) Reconnect pushrod (109) to bellcrank (110) if removed for Step 5E(5) (Ref. Fig. 509).

(9) Install access panel and close access door opened in Steps 5E(2) and 5E(5).

(10) Remove aileron support tool if no additional rigging checks will be made.

5F. Aileron Pushrods, Left Wheel Well to Left Inboard Servo - Rigging Check and Adjustment

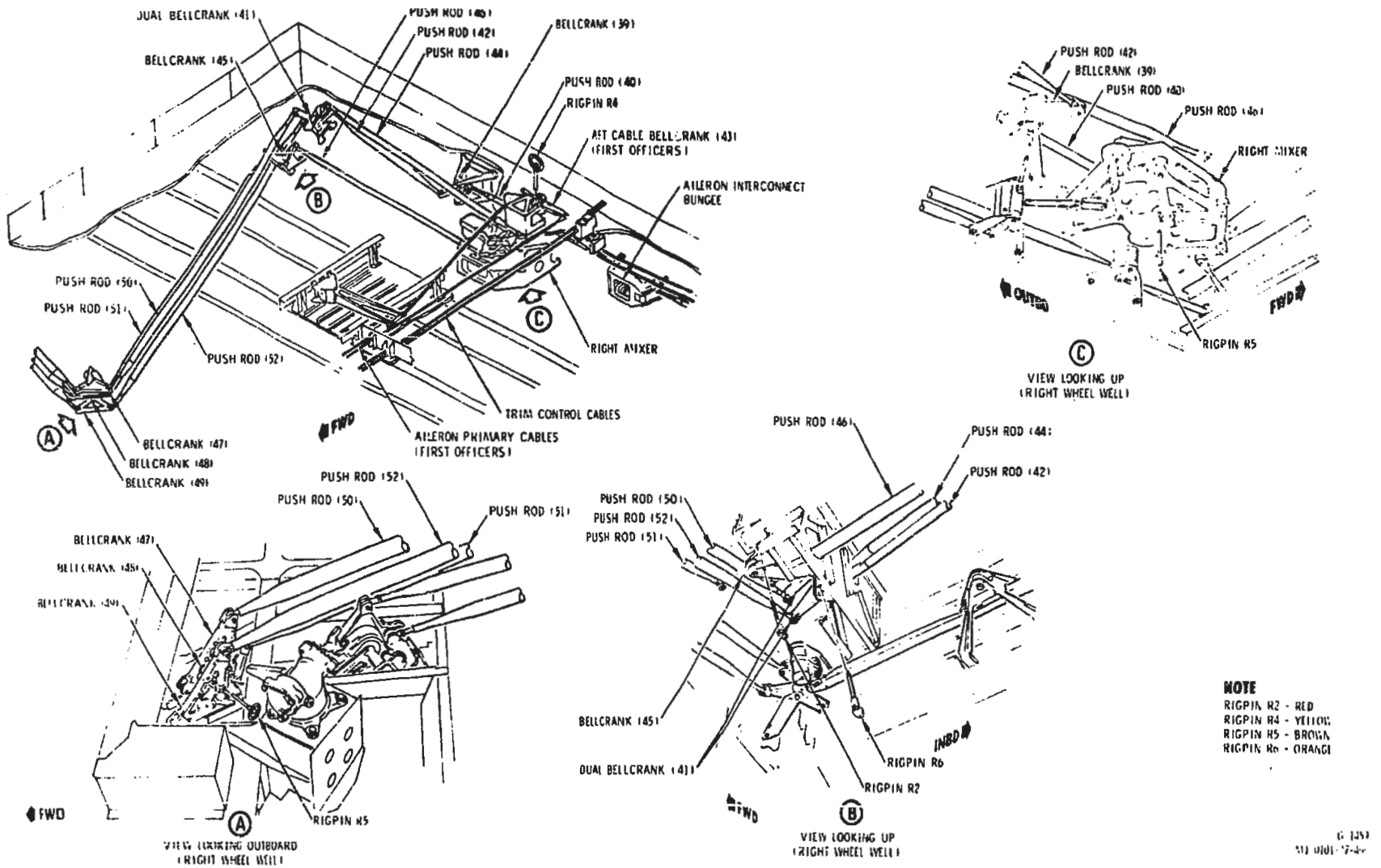
(1) Verify all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Open access doors 541EB and 551AB (Ref. 6-40-00).

(3) Manually position both inboard ailerons to neutral (±0.060 inch) and install aileron support tool (Ref. Fig. 513). (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

NOTE: Aileron neutral index mark is a red paint-filled dimple on No. 3 flap torque box. Align aileron lower surface with index mark.

If location of inboard aileron neutral index mark is in doubt it may be checked or



First Officers Aileron Pushrods, Fuselage
Rigging Check and Adjustment
Figure 504

R EFFECTIVITY: ALL
R
001B

reestablished in accordance with 27-11-00, Maintenance Practices.

(4) Install rig pin R5 through stacked bellcranks (26), (27), and (28) (Ref. Fig. 505) in left wheel well. Rig pin R6 must fit through stacked bellcranks (55), (56), and (57) in wing trailing edge just inboard of No. 2 spoiler servo. If not, adjust pushrods (58), (59), and (60).

NOTE: If rig pin cannot be inserted through bellcrank (27), disconnect pushrod (75) from bellcrank (67) (just inboard of inboard aileron servo) (Ref. Fig. 506).

(5) With rig pin R6 installed in stacked bellcranks (55), (56), and (57) rig pin R6 must fit freely through stacked bellcranks (61), (62), and (63) just inboard of inboard aileron servo. If not, adjust parallel pushrods (64), (65), and (66) (Ref. Fig. 505).

(6) Remove all rig pins if no additional rigging is to be done.

(7) Reconnect pushrod (75) to bellcrank (67) if removed for Step 5F(4) (Ref. Fig. 506).

(8) Close access doors opened in Step 5F(2).

(9) Remove aileron support tool if no additional rigging checks are to be made.

5G. Left inboard Aileron Servo - Rigging Check and Adjustment

(1) Verify all hydraulic power is turned off (Ref. 29-11-00).

(2) Position roll trim wheel to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of the alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(3) Position both inboard ailerons to neutral (±0.060 inch) and install aileron support tool (Ref. Fig. 513). (On aircraft without SB27-162, inboard aileron neutral is

with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

NOTE: Inboard aileron neutral index mark (dimple filled with red paint) is on flap torque box No. 3. Align lower surface of aileron with index mark.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(4) Open access panels 551AB and 551BB (Ref. 6-40-00).

(5) On aircraft 001-006
rig pin R6 should fit freely through stacked bellcranks (61), (62) and (63) (Ref. Fig. 506). If rig pin does not fit freely through the center bellcrank (62), adjust pushrod (75) and aileron inboard bungee (68). (Forward arm of bellcrank (67) should be approximately parallel to wing spar.)

(5) On aircraft 007-999,
install rig pin R6 through stacked bellcranks (61), (62), and (63) (Ref. Fig. 506); Rig pin R3 must fit freely through bracket and bellcrank (67). If not, adjust aileron inboard bungee (68) and pushrod (75).

(6) With left inboard aileron in neutral (±0.060 inch), and rig pin R6 installed in bellcranks (61), (62), and (63), rig pins R2 must fit freely through aileron servo upper input arm (69) and servo, and through servo lower input arm (70) and servo. If not, adjust as follows:

(a) Loosen two serrated tie-plate bolts connecting pushrods (71) and (72).

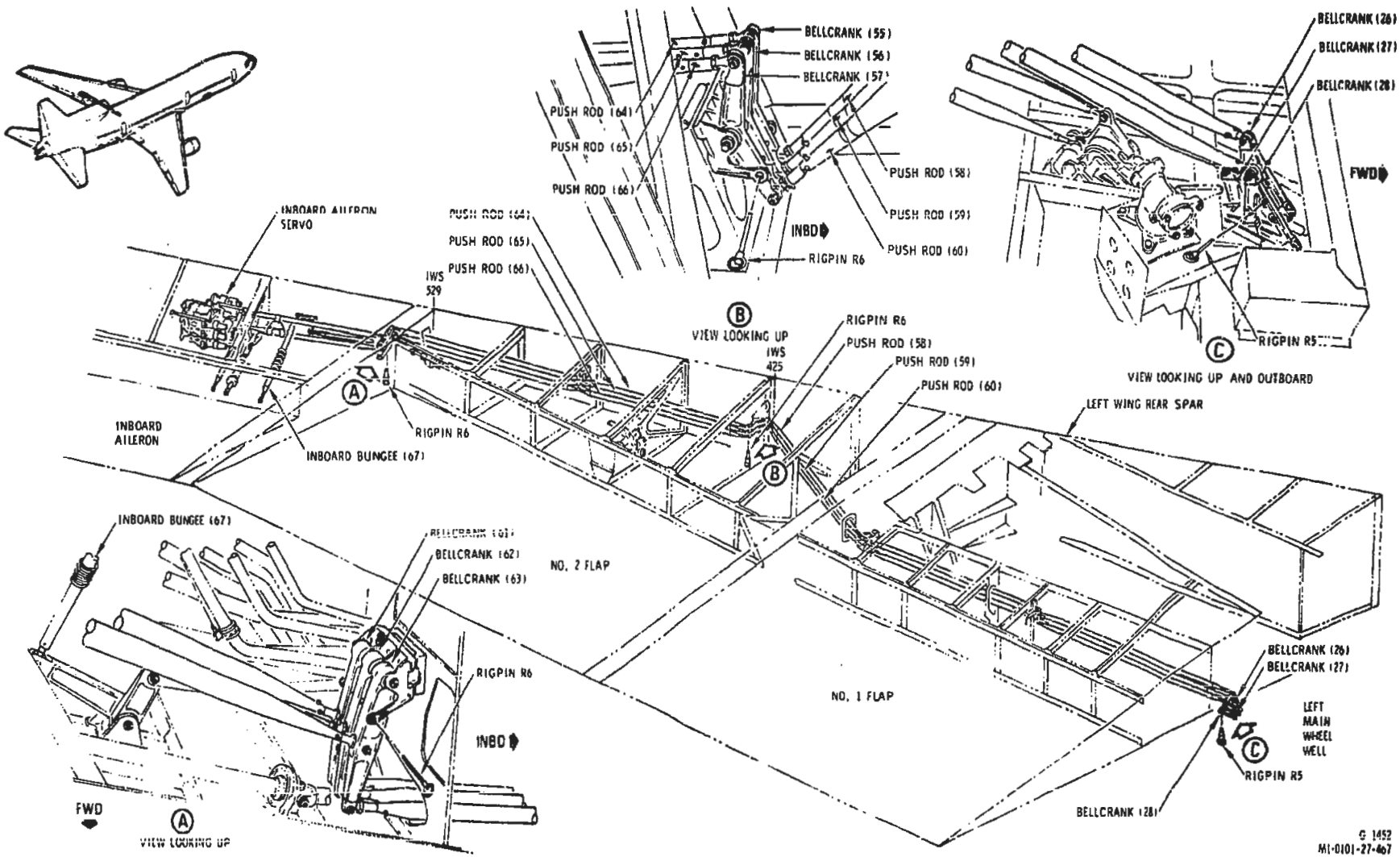
(b) Adjust pushrods (71) and (72) so rig pins R2 can be inserted through servo upper input arm (69) and servo lower input arm (70).

(c) Tighten serrated tie-plate bolts.

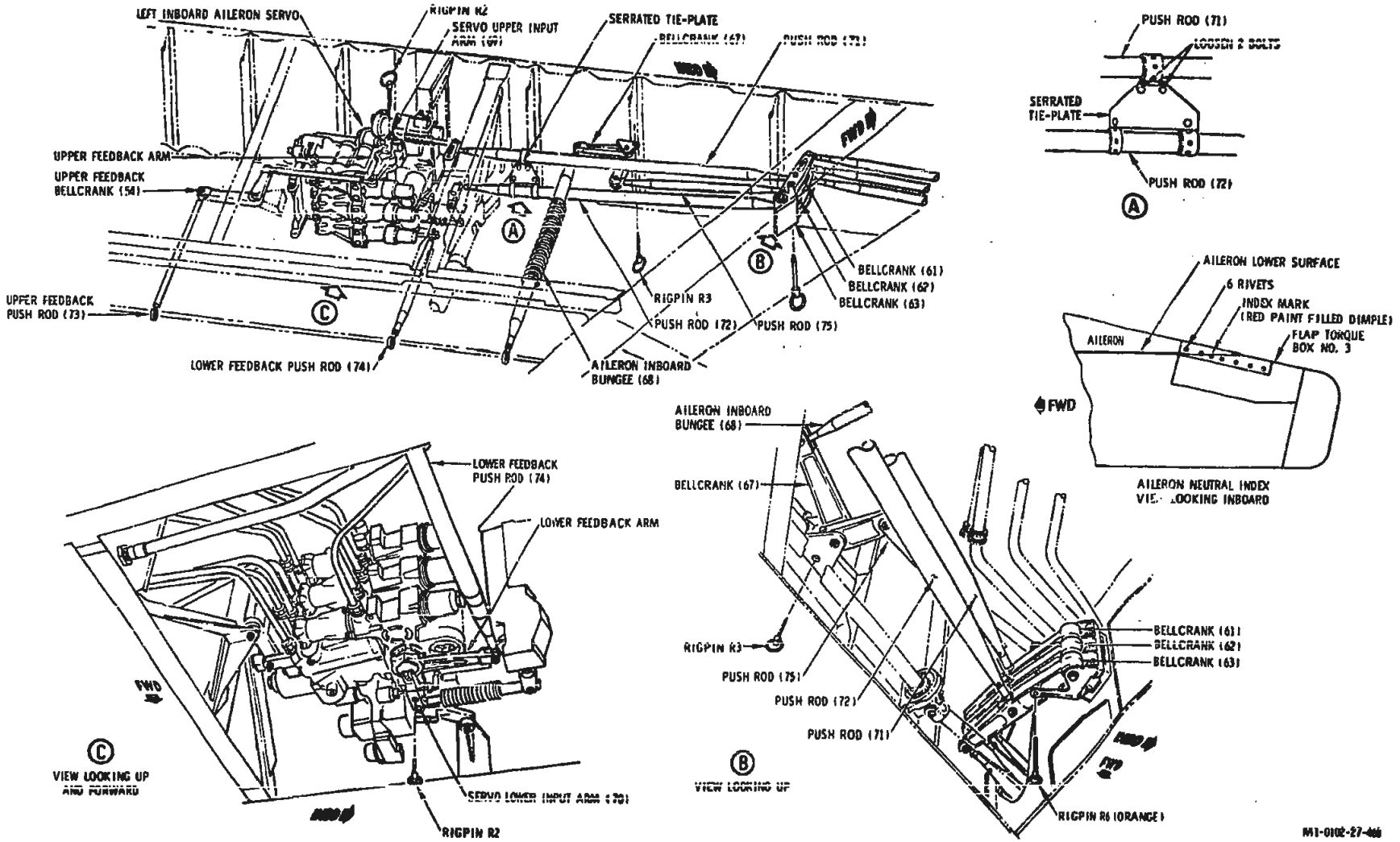
(7) Remove all rig pins.

(8) Remove aileron support tools and allow both inboard ailerons to droop.

(9) Remove tags from hydraulic control panels.



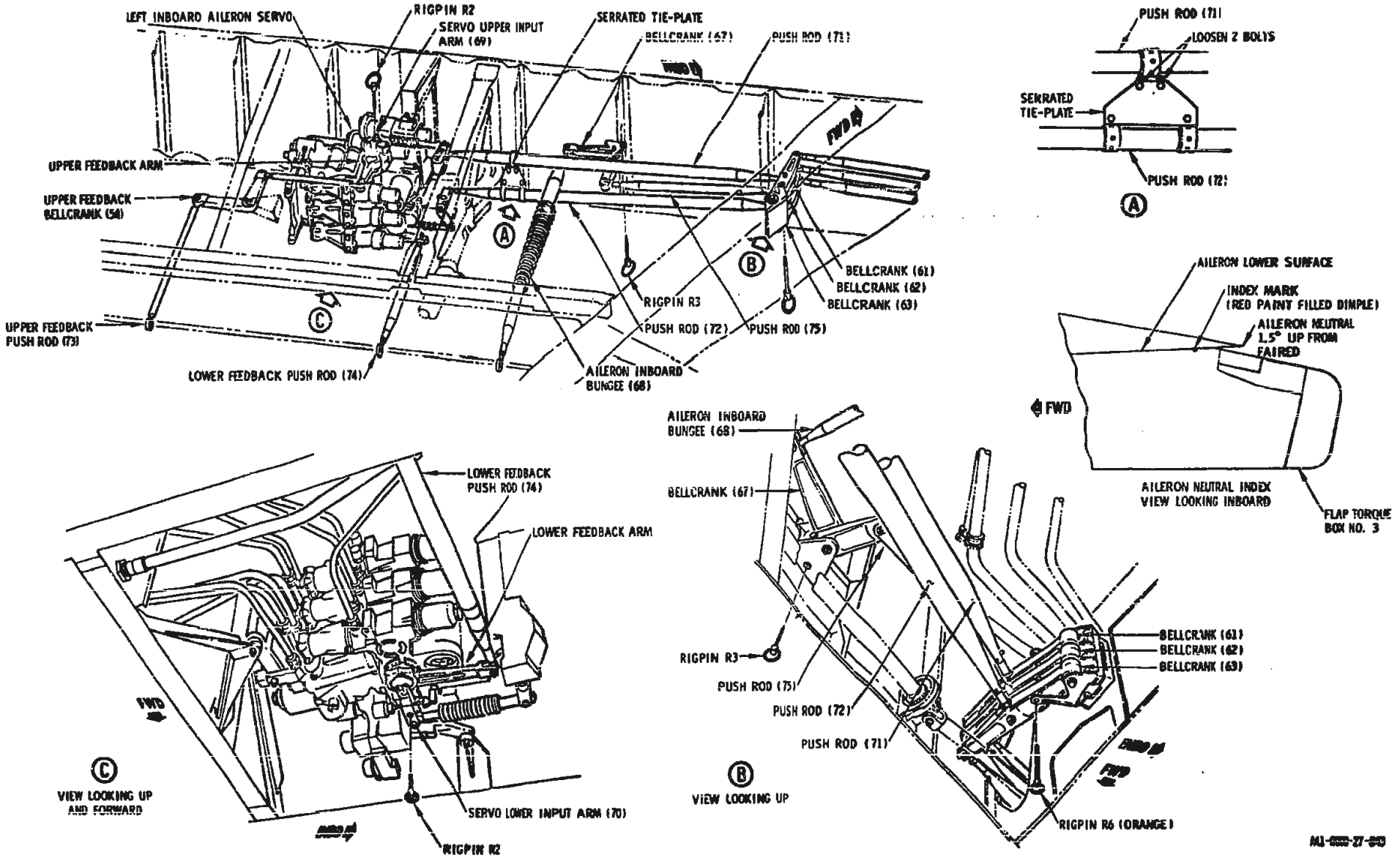
Aileron Pushrods, Left Wheel Well to Left Inboard Servo
Rigging Check and Adjustment
Figure 505



R Left Inboard Aileron Servo - Rigging Check and Adjustment
R Figure 506

EFFECTIVITY: WITHOUT SB27-162

001B



R Left Inboard Aileron Servo - Rigging Check and Adjustment
R Figure 506

R EFFECTIVITY: WITH SB27-162
R
001B

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(10) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

CAUTION: DO NOT TURN OFF HYDRAULIC PRESSURE WITH RIG PINS IN AILERON SERVO AS PERMANENT DAMAGE TO SERVO CAN RESULT.

(11) Install rig pins R2 through servo upper input arm (69) and servo, and through servo lower input arm (70) and servo. Aileron must be in neutral (±0.06 inch). If not adjust as follows:

WARNING: WITH HYDRO PRESSURE ON THE SERVO IS VERY SENSITIVE AND DANGEROUS IF BOTH SERVO INPUT OR BOTH FEEDBACK PUSHRODS ARE DISCONNECTED.

(a) Disconnect lower feedback pushrod (74) from feedback arm. If aileron moves to neutral position (±0.060 inch), adjust lower feedback pushrod (74) to hold aileron same neutral position and install bolt. If aileron does not move to neutral position with lower feedback pushrod disconnected, accomplish Steps 5G(11)(b) through 5G(11)(f).

(b) Note direction and amount aileron is out of neutral. Adjust lower feedback pushrod half the required correction (but not more than two turns). Reconnect lower feedback pushrod.

NOTE: One turn of feedback pushrod changes aileron position approximately 0.35 inch at neutral index. Lengthening pushrod raises aileron, shortening pushrod lowers aileron.

(c) Disconnect upper feedback pushrod (73) from feedback bellcrank.

(d) Note direction and amount aileron is out of neutral. Adjust upper feedback pushrod half required correction (but no more than two turns). Reconnect upper feedback pushrod.

(e) Repeat Step 5G(11)(a).

NOTE: If aileron was more than one inch out of neutral, it might require several adjustments of feedback pushrods to safely "walk" the aileron to neutral position, by adjusting one feedback pushrod at a time.

(f) Remove both rig pins from servo.

(12) Mark inboard aileron lower skin opposite neutral index mark on No. 3 flap torque box.

(13) Verify all rig pins are removed.

(14) With roll control wheel and roll trim control wheel at neutral setting, verify left inboard aileron is in neutral (±0.12 inch) (Ref. Roll Trim Bias Table 501).

R (15) Rotate Captains control wheel full left until control wheel stop (bottom of control column) is contacted. Verify the following:

(a) Left inboard aileron displaces up a minimum of 19 degrees (15.5 inches measured from index mark to aileron lower surface); if this cannot be met, verify total displacement of left and right inboard ailerons is a minimum of 38 degrees. (Example: If one aileron displaces up only 18.5 degrees, this is acceptable if opposite aileron displaces down at least 19.5 degrees.)

(b) Left inboard servo upper and lower input arms (69) and (70) are contacting servo up stops.

NOTE: It is only necessary for one servo input arm to contact its servo stop if aileron displacement is within tolerance. Gap on non-contacting stop should not exceed 0.011 inch. If 0.011 inch is exceeded, adjust pushrod serrated tie-plate or pushrod (71) or (72) rod end.

R (16) Rotate Captains control wheel full right until control wheel stop is contacted. Verify the following:

(a) Left inboard aileron displaces down a minimum of 19 degrees (15.5 inches measured between index mark and aileron lower surface); if this cannot be met, verify total displacement of left and right inboard ailerons is a minimum of 38 degrees [See Step 5G(15)(a) Example].

(b) Left inboard servo upper and lower input arms are contacting their down stops [See Step 5G15(b) Notes].

(c) On aircraft 001-006, with aileron full down, verify a minimum gap of 0.10 inch exists between forward arm of bellcrank (67) and wing spar. If not, readjust pushrod (75) and bungee (68).

(17) Return control wheel to neutral.

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Close access panels opened in Step 5G(4).

5H. Left Inboard Aileron to Left Outboard Aileron Servo Control System - Rigging Check and Adjustment

(1) Verify hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Manually position left inboard and outboard aileron to neutral (±0.060 inch) and install aileron support tool (Ref. Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

CR On aircraft 001-017, outboard aileron is in neutral position when

lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

CR On aircraft 018-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(3) Open access panels 551CB, 561BB, and 571AB (Ref. 6-40-00).

(4) With left inboard and outboard ailerons in neutral (±0.060 inch), rig pin R3 must freely through bellcrank (86) just outboard of inboard aileron (Ref. Fig. 507). If not, adjust length of inboard aileron outboard bungee (77).

(5) With rig pin in bellcrank (86), rig pin R6 must fit freely through upper scissor linkage arm (76). If not, adjust pushrod (19).

(6) With rig pin in scissor linkage arm (76), verify the following:

(a) Rig pin R3 fits freely through outboard scissor linkage arm (78).

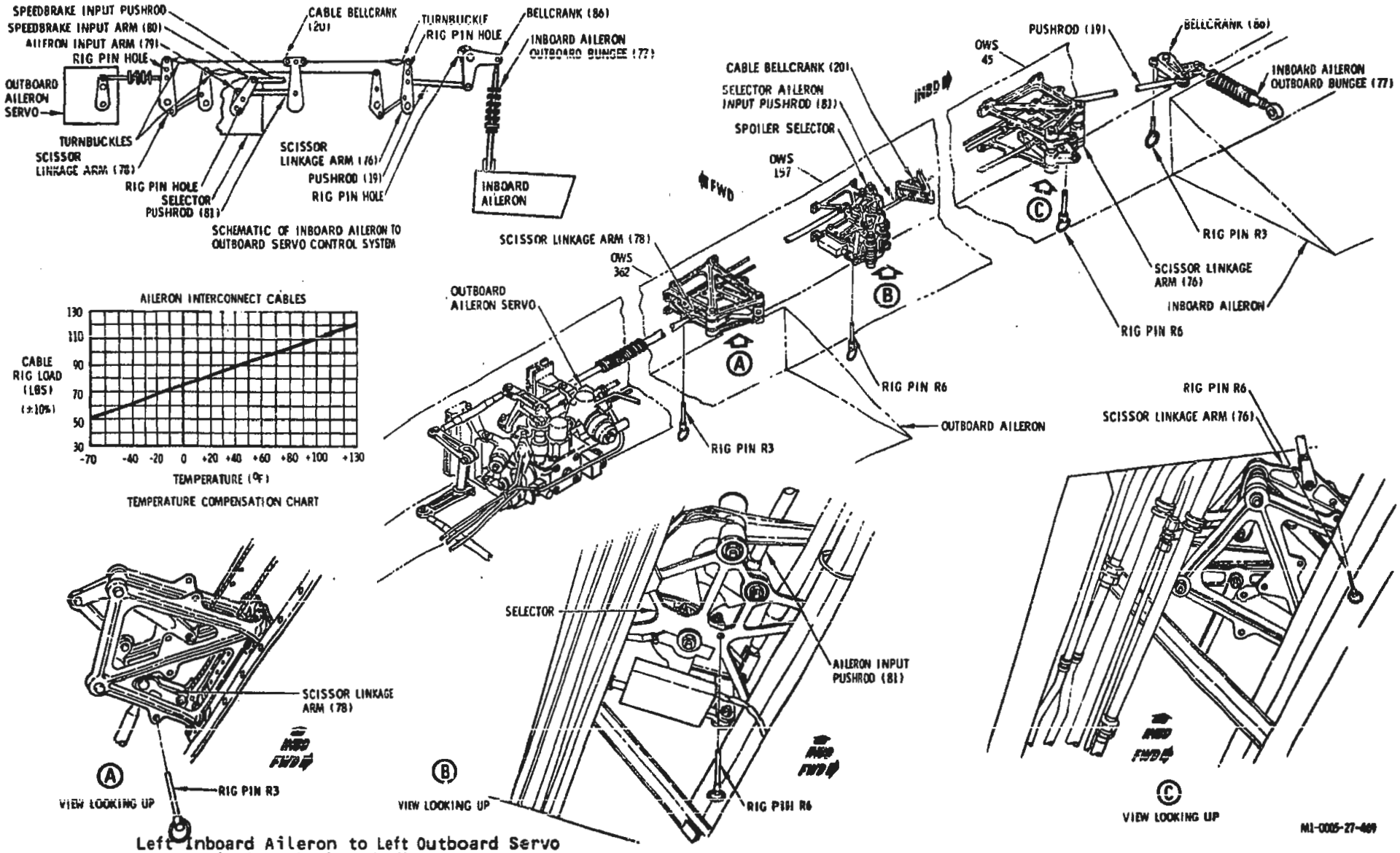
(b) Cable bellcrank (20) is 90 (±2) degrees to wing rear spar.

(c) Cable tension conforms to temperature compensation chart (Ref. Fig. 507).

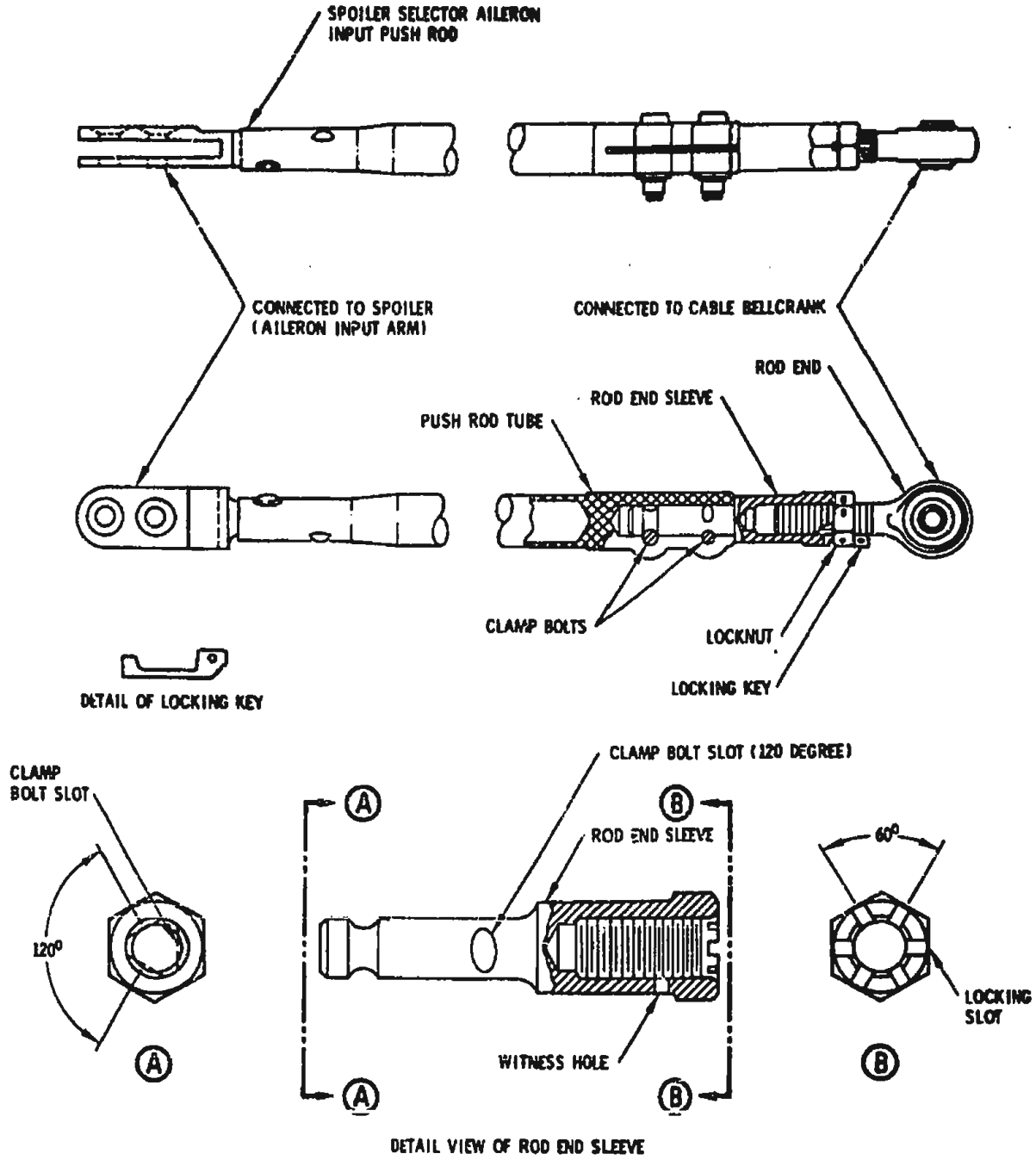
(7) If any of the above requirements are not met, adjust appropriate turnbuckles.

(8) On aircraft 001-026, check aileron input pushrod to spoiler selector as follows:

(a) With cable bellcrank (20) positioned 90 (±2) degrees to wing rear spar, rig pin R6 must fit freely through spoiler selector frame, aileron input arm (79), and speedbrake input arm (80). If not, adjust selector aileron input pushrod (81). [If selector dash number is 121 or higher



Left Inboard Aileron to Left Outboard Servo
Rigging Check and Adjustment
Figure 507 (Sheet 1)



Left Inboard Aileron to Left Outboard Servo
Rigging Check and Adjustment
Figure 507 (Sheet 2)

(1506801-121), use stepped rig pin R6A (5/16 and 3/16 inch diameter) in selector and ignore Steps 5H(8)(c) and 5H(8)(d).]

NOTE: To align speedbrake input arm (80) for rig pin installation, spoilers must be full down (speedbrake lever to 0 degrees) and speedbrake input pushrod must be properly adjusted (Ref. 27-61-00).

(b) Remove rig pin from selector.

(c) If R6 rig pin (5/16 inch diameter) was used, lengthen selector aileron input pushrod (81) two full turns.

(d) After lengthening pushrod (81), verify a 1/4-inch rig pin can be inserted in selector.

NOTE: Due to an adverse accumulation of tolerances, spoilers 5 and 6 may not deflect a minimum of 38.5 degrees in roll mode. Lengthening pushrod (81) so a 1/4-inch rig pin will fit in 5/16 inch rig holes ensures minimum spoiler deflection of 38.5 degrees.

(8) On aircraft 027-999, check aileron input pushrod (81) to spoiler selector as follows:

With cable bellcrank (20) positioned 90 (±2) degrees to rear spar, rig pin R6A (stepped rig pin 5/16 and 3/16 inch diameter) must fit freely through spoiler selector frame, aileron input arm (79), and speedbrake input arm (80). If not, adjust selector aileron input pushrod (81). [To align speedbrake input arm (80) for rig pin installation, spoilers must be full down (speedbrake lever to 0 degrees) and speedbrake input pushrod must be properly adjusted (Ref. 27-61-00)].

NOTE: On some aircraft, pushrod (81) incorporates a turnbarrel adjustment that eliminates the necessity of disconnecting the pushrod to adjust its length. Adjust turnbarrel pushrod as follows (Ref. Fig. 507):

(a) Remove lock-wire from rod-end locknut of pushrod (81).

(b) Loosen rod-end locknut until locking key is disengaged from rod-end sleeve.

(c) Remove clamping bolt, closest to rod-end, from pushrod tube.

(d) Loosen (but do not remove) second clamping bolt.

(e) Using hex on rod-end sleeve, rotate rod-end sleeve to change length of pushrod.

NOTE: Final position of sleeve must align sleeve locking slot with locking key and sleeve clamp bolt slot with clamp bolt holes in pushrod tube. Locking slots are located every 60 degrees on sleeve. Clamp bolt slots are located every 120 degrees on sleeve (Ref. Fig. 507).

(f) Install clamping bolt removed in Step 5H(8)(c). Do not tighten.

(g) Tighten rod-end locknut while verifying locking key is engaged in sleeve locking slot. (Use wrench to hold rod-end sleeve while tightening locknut.)Install lock-wire between locking key and locknut.

(h) Tighten both clamping bolts.

(9) Remove all rig pins.

(10) Remove aileron support tool if no additional rigging checks are to be made.

(11) Close access panels opened in Step 5H(3).

5I. Left Outboard Aileron Servo - Rigging Check and Adjustment

C CAUTION: DO NOT LIFT THE SERVO BY ANY OF THE INPUT OR
C FEEDBACK ARMS AND DO NOT FORCE THE SECONDARY
C FEEDBACK INTO ANY POSITION AS SERVO INTERNAL
C LINKAGE CAN BE DAMAGED. THE INTERNAL LINKAGE OF
C THIS SERVO IS FRAGILE AND CAN BE DAMAGED EASILY IF
C NOT HANDLED CAREFULLY.

(1) Open access panels 571AB and 571CB (Ref. 6-40-00).

R (2) Turn off hydraulic power and install tags on hydraulic
R control panels (Ref. 29-11-00).

R (3) Manually position both left ailerons to neutral (±0.60
R inch) and install aileron support tool (Ref. Fig. 513).

R NOTE: Inboard aileron is in neutral when lower inboard
R surface of aileron is aligned with a red
R paint-filled dimple on No. 3 flap torque box.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R *Maintenance Practices*.

R On aircraft without SB27-162,
R inboard aileron neutral is with aileron faired.

R On aircraft with SB27-162,
R inboard aileron neutral is with aileron 1.5
R degrees up from faired.

CR On aircraft 001-017,
R outboard aileron is in neutral position when
R lower inboard surface of aileron is aligned with
R lower surface of adjacent fixed trailing edge
R structure at a point 10 inches forward of
R trailing edge.

CR On aircraft 018-999,
R outboard aileron is in neutral position when
R lower inboard surface of aileron is aligned with
R a red paint filled index notch on fixed trailing
R edge; notch is 10 inches forward of trailing
R edge and 1.54 inches up from lower edge.
R Aileron neutral is 3 degrees up from faired with
R fixed trailing edge.

R (4) Disconnect servo input bungee from servo input arm.

R (5) Install rig pin R3 in scissor linkage arm (78) (Ref.
R Fig. 508).

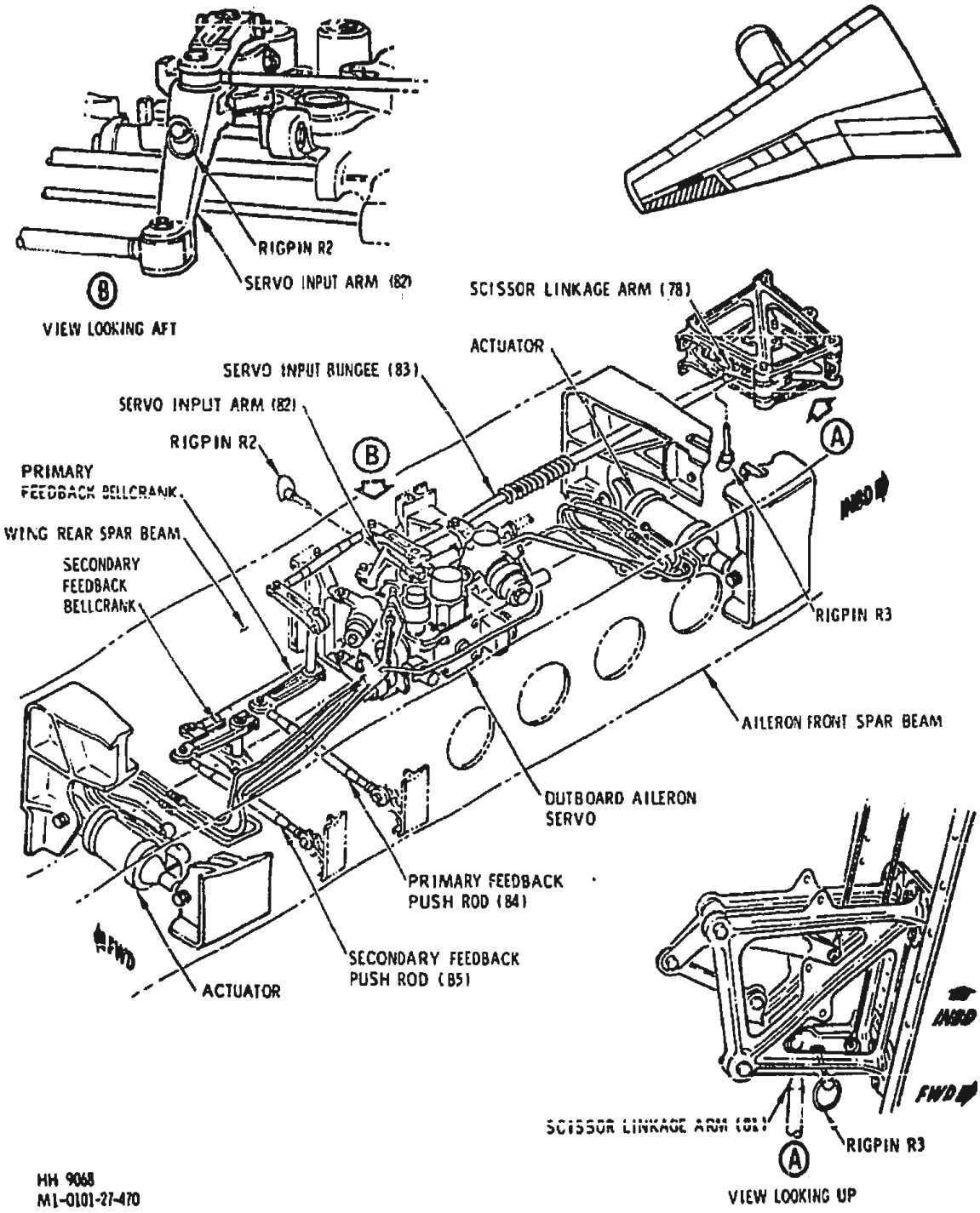
R (6) Install rig pin R2 through servo input arm (82) and
R servo.

R (7) With rig pins installed in accordance with Step 5I(5)
R and 5I(6), verify servo input bungee (83) can be
R connected to the servo input arm (82). If not adjust
R length of input bungee. Temporarily connect input
R bungee to servo input arm (do not safety).

R (8) Remove all rig pins.

R (9) Remove aileron support tool and allow ailerons to
R droop.

R (10) Remove tags from hydraulic control panels.



Left Outboard Aileron Servo
Rigging Check and Adjustment
Figure 508

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

CR (11) Turn on hydraulic systems A and B (Ref. 29-11-00). (Do
C not use A/C electric pumps).

R CAUTION: DO NOT SHUT OFF HYDRAULIC POWER WITH RIG PIN
R INSTALLED IN OUTBOARD AILERON SERVO AS PERMANENT
R DAMAGE TO SERVO CAN RESULT.

R (12) Install rig pin R2 in servo input arm (82) and servo.
R Outboard aileron must be in neutral within ±0.12 inch
R (measured at inboard edge). If not, accomplish Steps
R 5I(12)(a) through 5I(12)(f), as required.

R WARNING: WITH HYDRAULIC POWER ON, SERVO IS SENSITIVE
R AND DANGEROUS IF EITHER SERVO INPUT OR BOTH
R FEEDBACK PUSHRODS ARE DISCONNECTED.

R (a) Disconnect secondary (outboard) feedback pushrod
R (85) from bellcrank (Ref. Fig 508). With only
R primary feedback pushrod connected, the aileron
R should be in neutral (±0.12 inch). If it is,
R determine mid-point of free play in secondary
R control; adjust secondary feedback pushrod (85) to
R mid-point of free play and connect to bellcrank.
R Aileron must remain in same neutral position.
R Proceed to Step 5I(13).

R CAUTION: AN IMPROPERLY ASSEMBLED SECONDARY FEEDBACK
R BELLCRANK CAN CAUSE RIGGING DIFFICULTIES.
R CHECK BOTH FEEDBACK BELLCRANKS TO VERIFY
R BELLCRANK ARMS ARE APPROXIMATELY 90° TO EACH
R OTHER (ONE SPLINE OFF WOULD ROTATE ARM 14°)
R AND OUTBOARD ARM ON EACH BELLCRANK IS
R APPROXIMATELY PARALLEL TO WING REAR SPAR
R BEAM.

R NOTE: When adjusting feedback pushrods, if either
R pushrod cannot be shortened enough or

R rod-end witness hole is open, check
R feedback pushrod part number for correct
R application.

R (b) If aileron is not in neutral, with only primary
R feedback pushrod connected, accomplish following
R Steps (c) through (f).

C CAUTION: DO NOT FORCE SECONDARY FEEDBACK ARM (REF.
C FIG. 508) INTO ANY POSITION AS SERVO INTERNAL
C LINKAGE CAN BE DAMAGED.

R (c) Adjust secondary (outboard) feedback pushrod half
R the required correction (but not more than two
R turns). Reconnect secondary feedback pushrod to
R bellcrank.

R NOTE: One turn of feedback pushrod changes
R aileron position approximately 0.3 inch at
R neutral reference (inboard edge, ten inches
R forward of trailing edge). Lengthening
R pushrod raises aileron, shortening pushrod,
R lowers aileron.

R (d) Disconnect primary (inboard) feedback pushrod (84)
R from bellcrank.

R (e) Adjust primary feedback pushrod half the required
R correction (but not more than two turns).
R Reconnect primary feedback pushrod to bellcrank.

R (f) Repeat Step 5I(12)(a).

R NOTE: If aileron is more than one inch out of
R neutral, it may require several adjustments
R of feedback pushrods to safely "walk" the
R aileron to neutral position by adjusting
R one feedback pushrod at a time.

R (13) Mark outboard aileron lower surface just opposite
R neutral index mark on fixed trailing edge.

R (14) Remove all rig pins.

R (15) With roll control wheel and roll trim control wheel at
R neutral setting (Ref. Trim Bias Table 501), verify left
R outboard aileron is in neutral (±0.16 inch).

R (16) Rotate control wheel full left until control wheel stop
R (bottom of control column) is contacted. Verify the
R following:

R (a) Left outboard aileron displaces up a minimum of 19 degrees (9.8 inches measured between index mark on aileron inboard edge and index mark on fixed trailing edge structure): if this requirement cannot be met, verify total displacement of left and right outboard ailerons is a minimum of 38 degrees. (Example: If one aileron displaces up only 18.5 degrees, this is acceptable if opposite aileron displaces down at least 19.5 degrees.)

R (b) Left outboard servo input arm (82) is contacting servo up stop.

NOTE: It is not necessary for servo input arm to contact servo stop if aileron displacement is within tolerance.

Servo stops are the primary stops. Cable stretch allows control wheel stops to be contacted.

R (17) Rotate control wheel full right until control wheel stop is contacted. Verify the following:

R (a) Left outboard aileron displaces down a minimum of 19 degrees (9.8 inches measured between index mark on aileron inboard edge and index mark on fixed trailing edge structure); if this requirement cannot be met, verify total displacement of left and right outboard ailerons is a minimum of 38 degrees [Ref. Step (16)(a) Example].

R (b) Left outboard servo input arm (82) is contacting servo down stop [See Step 51(16)(b) Notes].

R (18) Return control wheel to neutral.

R (19) Check operation of servo internal fairing spring as follows:

NOTE: The servo internal fairing spring serves to position the servo control valve to neutral in the event of a disconnected servo input control.

R (a) Disconnect servo input bungee from servo input arm.

R WARNING: USE CAUTION WHEN OPERATING SERVO INPUT ARM.

R (b) Manually position servo input arm in one direction and release arm. Verify aileron returns to within 2 degrees of neutral but not past neutral.

R (c) Manually position servo input arm in opposite direction and release arm. Verify aileron returns to within 2 degrees of neutral but not past neutral.

R (d) If aileron does not return to approximately neutral or if it returns past neutral after arm is released, a damaged or broken fairing spring is indicated. Replace outboard aileron servo (Ref. 27-11-19).

C NOTE: If a PCU fails the fairing spring test, do not change the PCU until the primary and secondary feedback rod adjustment is checked and verified to be correct.

R (e) Reconnect servo input bungee to servo input arm.

R (20) Verify proper safeties are installed on all servo input and feedback arms.

R CAUTION: VERIFY ALL RIG PINS ARE REMOVED BEFORE TURNING OFF HYDRAULIC POWER, OR THE SERVO CAN BE DAMAGED.

R (21) Turn off hydraulic power if no longer required (Ref. 29-11-00).

R (22) Close access panels 571AB and 571CB (Ref. 6-40-00).

5J. Aileron Pushrods, Right Wheel Well to Right Inboard Aileron Servo - Rigging Check and Adjustment

(1) Verify all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Open access panels 641EB and 651AB (Ref. 6-40-00).

(3) Manually position both inboard ailerons to neutral (±0.060 inch) and install aileron support tool (Ref. Fig. 513).

NOTE: Position inboard ailerons to neutral by aligning aileron lower surface with red paint-filled dimple on flap torque box No. 3. (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired). If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(4) Install rig pin R5 through stacked bellcranks (47), (48), and (49) in right wheel well. Rig pin R6 must fit through stacked bellcranks (87), (88), and (89) (in the wing trailing edge just inboard of No. 2 spoiler servo). If not, adjust parallel pushrods (90), (91), and (92) (Ref. Fig. 509).

(5) With rig pin R6 installed in stacked bellcranks (87), (88), and (89), rig pin R6 must fit through stacked bellcranks (93), (94), and (95) (just inboard of inboard aileron servo). If not, adjust parallel pushrods (96), (97), and (98).

(6) On aircraft 001-006,
rig pin R6 should fit through stacked bellcranks (93), (94), and (95). If rig pin does not fit freely through center bellcrank (94), adjust inboard bungee (102) and pushrod (109). (Forward arm of bellcrank (110) should be approximately parallel to wing spar.)

(6) On aircraft 007-999,
with rig pin R6 installed in stacked bellcranks (93), (94), and (95), rig pin R3 must fit freely through bellcrank (110). If not, adjust inboard bungee (102) and pushrod (109).

(7) Remove all rig pins.

(8) Close access panels opened in Step 5J(2).

(9) Remove aileron support tool if no additional rigging checks are to be made.

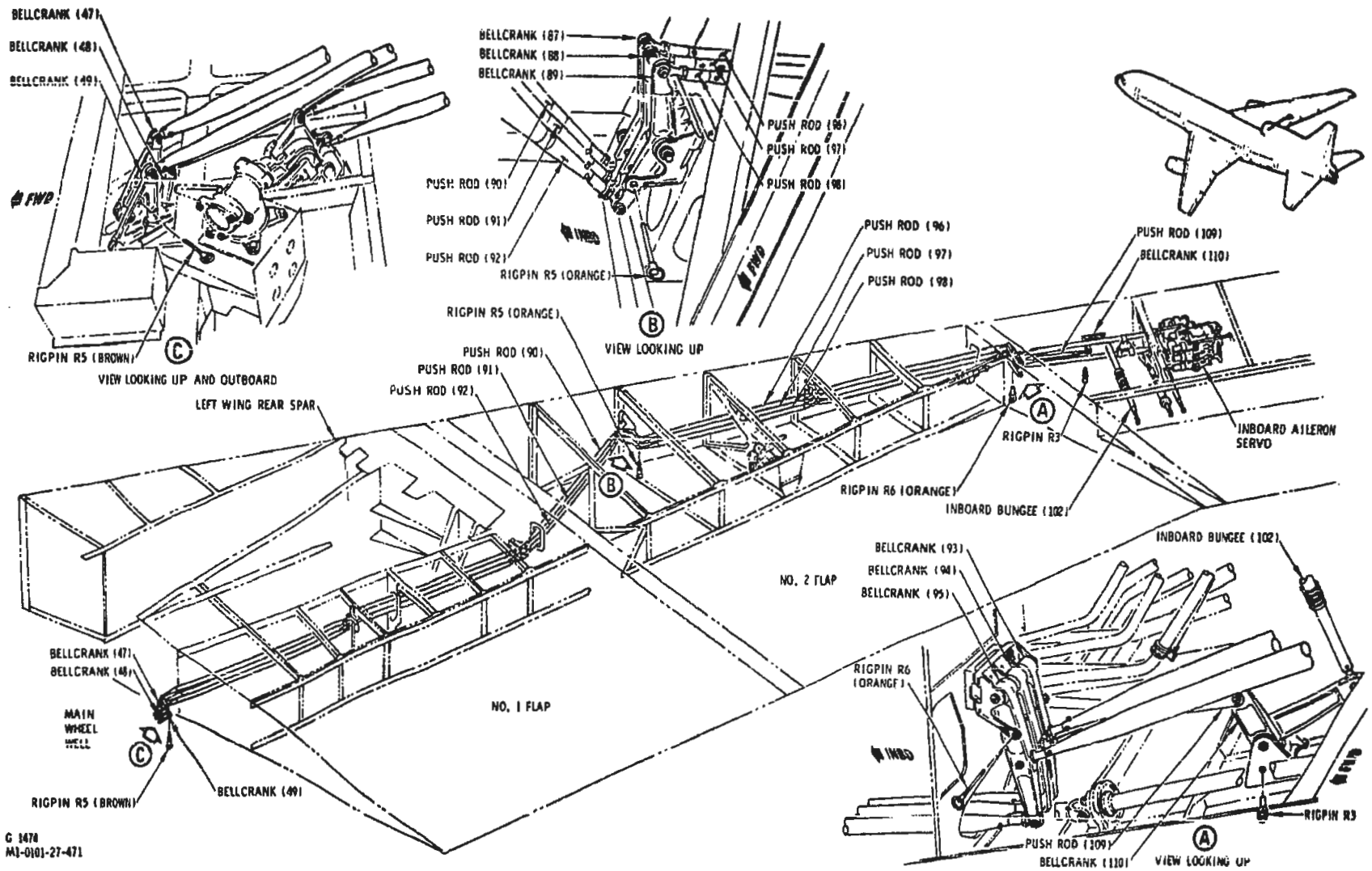
5K. Right Inboard Aileron Servo - Rigging Check and Adjustment

(1) Verify roll trim wheel is at neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. Of decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(2) Open access panels 651AB and 651BB (Ref. 6-40-00).

(3) Remove tags from hydraulic control panels.



Aileron Pushrods, Right Wheel Well to Right Inboard Servo
Rigging Check and Adjustment
Figure 509

R EFFECTIVITY: ALL
R
0018

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic systems B, C, and D (Ref. 29-11-00).

(5) Install rig pins R2 through servo upper input arm (103) and servo, and through servo lower input arm (104) and servo aileron must be in neutral (±0.060 inch) (Ref. Fig. 510). If not, accomplish following:

NOTE: Aileron neutral index mark (dimple filled with red paint) is on flap torque box No. 3. Align lower surface of aileron with index mark. (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

If position of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(a) Disconnect outboard ends of the two servo input pushrods (140) and (141) from their respective bellcranks.

(b) Install rig pin R6 through stacked bellcranks (93), (94) and (95).

WARNING: WITH HYDRAULIC PRESSURE ON, SERVO IS SENSITIVE AND DANGEROUS IF EITHER SERVO INPUT OR BOTH FEEDBACK PUSHRODS ARE DISCONNECTED.

(c) Disconnect lower feedback pushrod (108) from feedback arm (Ref. Fig. 510). If aileron moves to neutral position (±0.06 inch) adjust and reconnect lower feedback pushrod (108) to hold aileron in same neutral position. Proceed to Step 5K(5)(i).

(d) If aileron does not move to neutral position, with lower feedback pushrod disconnected, accomplish Steps 5K(5)(e) through 5K(5)(h).

(e) Note direction and amount aileron is out of neutral. Adjust lower feedback pushrod half the required correction (but not more than two turns). Reconnect lower feedback pushrod to arm.

NOTE: One turn of feedback pushrod changes aileron position approximately 0.35 inch at index. Lengthening pushrod raises aileron, shortening pushrod lowers aileron.

(f) Disconnect upper feedback pushrod (107) from feedback bellcrank (121).

(g) Note direction and amount aileron is out of neutral. Adjust upper feedback pushrod half the required correction (but not more than two turns). Reconnect upper feedback pushrod.

(h) Repeat Step 5K(5)(c).

NOTE: If aileron is more than one inch out of neutral, it may require several adjustments of feedback pushrods to "walk" aileron safely to neutral position by adjusting one feedback pushrod at a time.

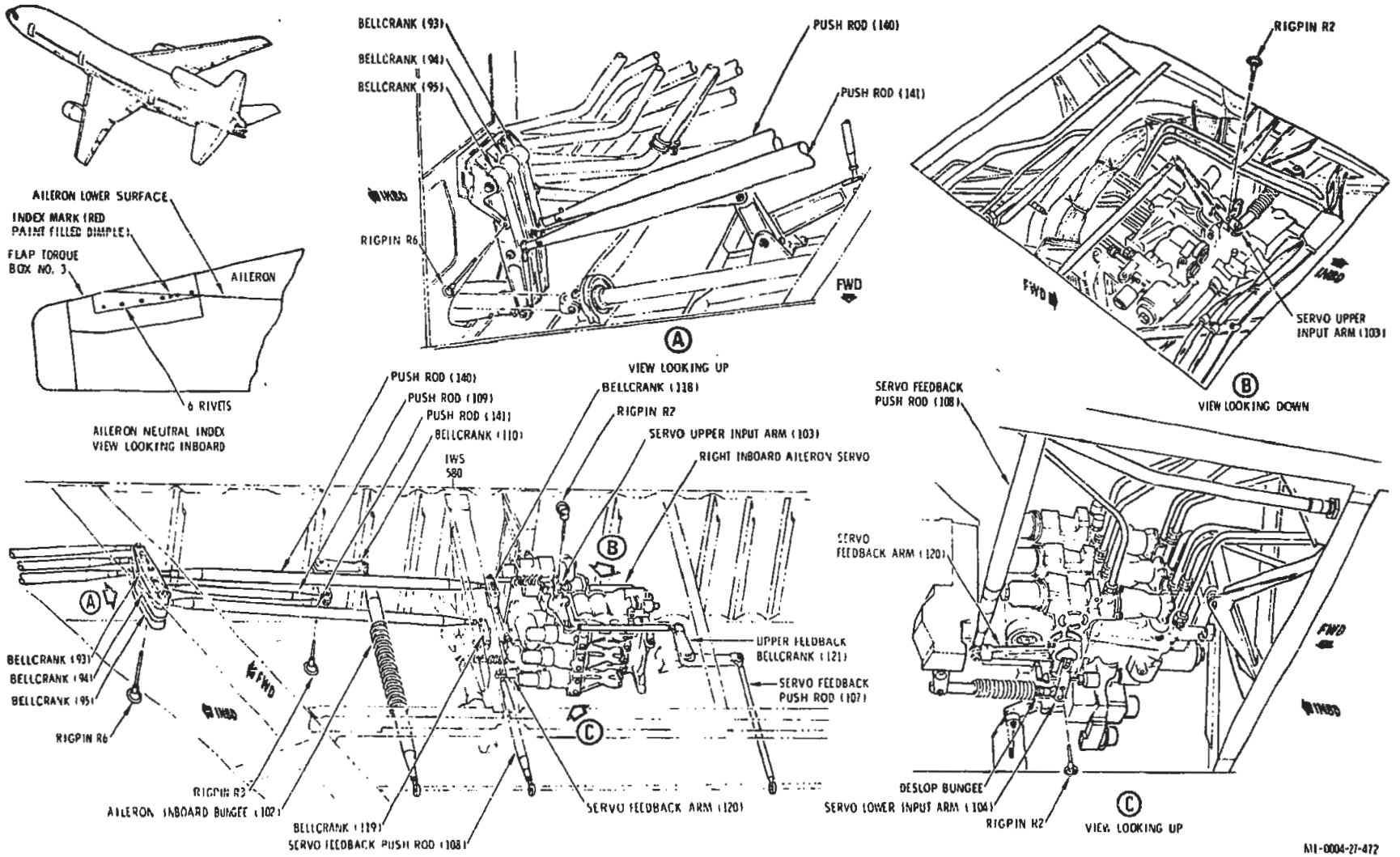
(i) Adjust servo lower input pushrod (141) to fit, then lengthen this rod 0.10 inch (2.5 turns) and install. This compresses deslop bungee 0.10 inch (mid-stroke).

NOTE: The servo lower input bungee assembly includes a deslop bungee (small spring) at outboard end. The deslop bungee stroke is 0.20 inch. The servo input and feedback control system are adjusted to position aileron to neutral and compress deslop bungee to mid-stroke.

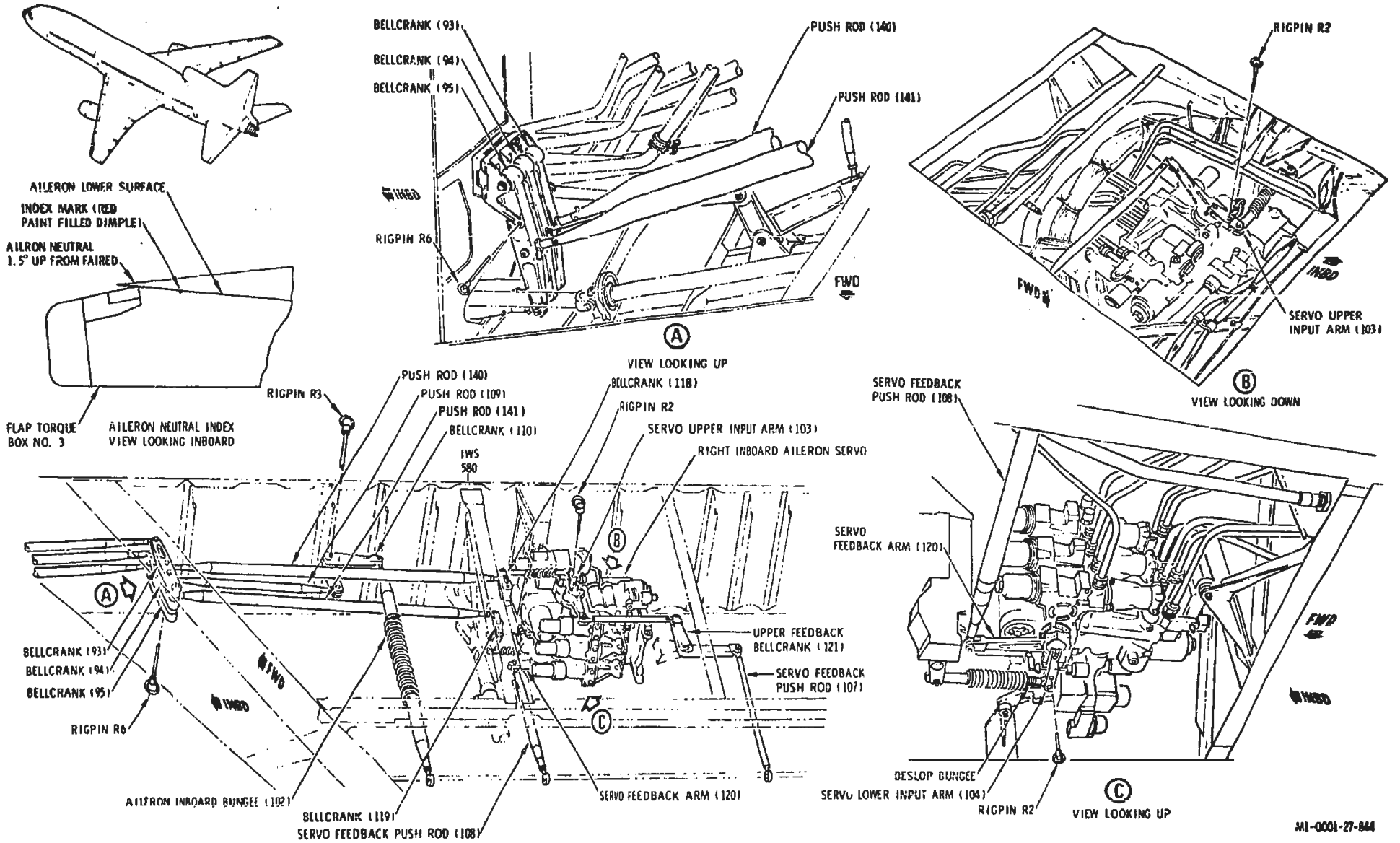
(j) Adjust upper input pushrod (140) to fit. Do not tighten attaching bolt.

(k) Remove both rig pins R2 from servo input arms (103 and 104).

(l) Readjust upper input pushrod (140) to hold aileron in neutral (±0.060 inch) (pushrod will usually require shortening 1 to 2 turns).



Right Inboard Aileron Servo - Rigging Check and Adjustment
Figure 510



Right Inboard Aileron Servo Rigging Check and Adjustment
Figure 510

R EFFECTIVITY: WITH SB27-162
R
001B

NOTE: When properly adjusted, rig pins R2 will not fit freely through servo input arm (103 and 104). When only upper rig pin is installed, aileron will droop slightly. When only lower rig pin is installed, aileron will rise slightly. Droop and rise should be nearly equal.

When both rig pins are installed in servo input arms, aileron should assume mid-position between droop and rise and be in neutral. In addition, deslop bungee should be in mid-stroke. Mid-stroke of deslop bungee can be determined by pushing and pulling on the servo lower input arm with hydraulic power on. The deslop bungee spring should show approximately equal compression during push and pull on servo input arm.

(6) Mark aileron lower surface directly opposite neutral index mark.

(7) Remove all rig pins.

(8) With roll control wheel and roll trim control wheel at neutral settings (Ref. Trim Bias Table 501), verify right inboard aileron is in neutral (±0.12 inch). Measure between index mark and aileron lower surface.

C (8.1) Pull roll disconnect.

C (9) Rotate F/O control wheel full left until control wheel
C stop (bottom of control column) is contacted. Verify
C the following:

(a) Right inboard servo upper and lower input arms (103 and 104) are contacting servo down stops.

NOTE: It is only necessary for one servo input arm to contact its servo stop if aileron displacement is within tolerance. Gap on non-contacting stop should not exceed 0.035 inch. If 0.035 inch is exceeded, adjust pushrod (140) or (141) rod end.

C (b) Return F/O wheel to neutral.

C (9.1) Close roll disconnect.

C (9.2) Rotate Captain's control wheel full left until control
C wheel stop (bottom of control column) is contacted.
C Verify the following:

C (a) Right inboard aileron displaces down a minimum of 19 degrees (15.5 inches measured between index mark and aileron lower surface); if this cannot be met, verify differential displacement of right and left inboard aileron is a minumum of 38 degrees. (Example: If one aileron displaces down only 18.5 degrees, this is acceptable if opposite aileron displaces up at least 19.5 degrees.)

C (b) On aircraft 001-006, with aileron full down, verify a minimum gap of 0.10 inch exists between forward arm of bellcrank (110) and wing spar. If not, readjust inboard bungee (102) and push rod (109).

C (9.3) Open roll disconnect.

C (10) Rotate F/O control wheel full right until control wheel stop is contacted. Verify the following:

(a) Right inboard servo upper and lower input arms are contacting servo up stops [See Step 5K(9)(a) NOTES].

C (10.1) Close roll disconnect.

C (10.2) Rotate Captain's control wheel full right until stop
C is contacted. Verify the following:

C (a) Right inboard aileron positions up a minimum of 19 degrees (15.5 inches measured between index mark and aileron lower surface); if this cannot be met, verify total displacement of right and left inboard ailerons is a minimum of 38 degrees. (Example: If one aileron displaces down only 18.5 degrees, this is acceptable if opposite aileron displaces up at least 19.5 degrees).

(11) Return control wheel to neutral.

(12) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(13) Close access panels opened in Step 5K(2).

5L. Right Inboard Aileron to Right Outboard Aileron Servo Control System - Rigging Check and Adjustment

(1) Verify all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Manually position both right inboard and outboard ailerons to neutral (±0.060 inch) and install aileron support tool (Ref. Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

C On aircraft 001-017, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

C On aircraft 018-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(3) Open access panels 651CB, 661BB, and 671AB (Ref. 6-40-00).

(4) With right inboard and outboard ailerons in neutral, (±0.060 inch) rig pin R3 must fit freely through bellcrank (122) just outboard of inboard aileron. If not, adjust length of aileron outboard bungee (113) (Ref. Fig. 511).

(5) With rig pin R3 in bellcrank (122), rig pin R6 must fit freely through upper scissor linkage arm (112). If not, adjust pushrod (123).

(6) With rig pin R6 in scissor linkage arm (112), verify the following:

(a) Rig pin R3 fits freely through outboard scissor linkage arm (114).

(b) Cable bellcrank (124) is 90(±2) degrees to wing rear spar.

(c) Cable tension conforms to temperature compensation chart (Ref. Fig. 511).

(7) If any of the three above requirements are not met, adjust appropriate turnbuckles (Ref. schematic, Fig. 511).

(8) On aircraft 001-026, check aileron input pushrod to spoiler selector as follows:

(a) With cable bellcrank (124) positioned 90 (±2) degrees to wing rear spar, rig pin R6 must fit freely through selector frame, aileron input arm (115), and speedbrake input arm (116). If not, adjust selector aileron input pushrod (117). [If selector part number dash number is 121 or higher (1506801-121), use stepped rig pin R6A (5/16 and 3/16-inch diameter) in selector and ignore Steps 5L(8)(c) and 5L(8)(d).]

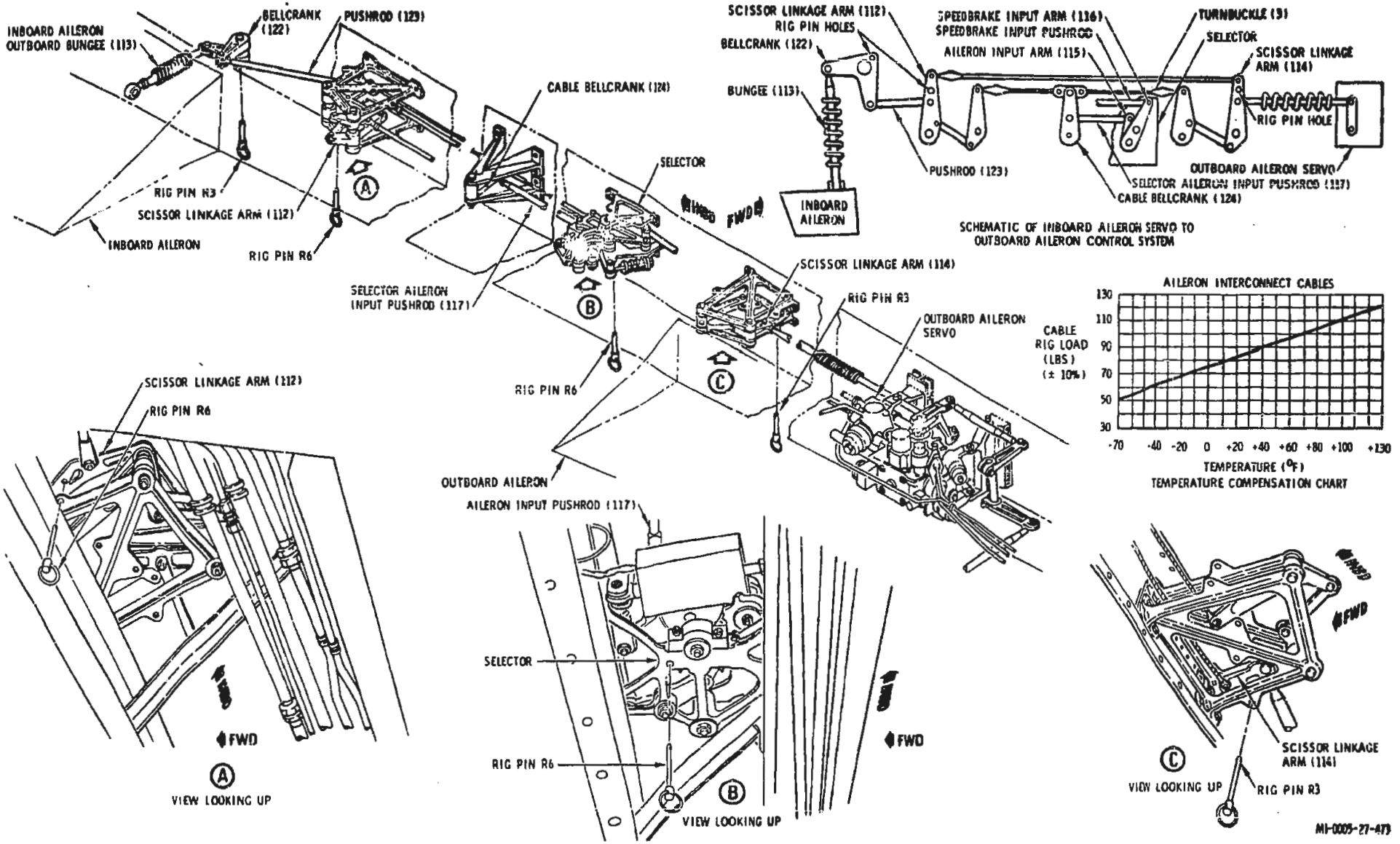
NOTE: To align speedbrake input arm (116) for rig pin installation, spoilers must be full down (speedbrake lever at 0 degrees) and speedbrake input pushrod must be properly adjusted (Ref. 27-61-00).

(b) Remove rig pin from selector.

(c) Shorten selector aileron input pushrod (117) two full turns.

(d) After shortening pushrod (117), verify a 1/4-inch rig pin can be inserted in selector.

NOTE: Due to an adverse accumulation of tolerances, spoilers 5 and 6 may not deflect a minimum of 38.5 degrees in roll mode. Shortening pushrod (117) so a 1/4-inch rig pin will fit in 5/16-inch rig holes ensures minimum spoiler deflection of 38.5 degrees.



Right Inboard Aileron to Right Outboard Servo
Rigging Check and Adjustment
Figure 511

(8) On aircraft 027-999, check aileron input pushrod (117) to spoiler selector as follows:

With cable bellcrank (124) position 90 (±2) degrees to wing rear spar, rig pin R6A (stepped rig pin, 5/16 and 3/16-inch diameter) must fit freely through selector frame, aileron input arm (115), and speedbrake input arm (116). If not, adjust selector aileron input pushrod (117). Remove rig pin R6A from selector. [To align speedbrake input arm (116) for rig pin installation, spoilers must be full down (speedbrake lever at 0 degrees) and speedbrake input pushrod must be properly adjusted (Ref. 27-61-00)].

NOTE: On some aircraft, pushrod (117) incorporates a turnbarrel adjustment that eliminates the necessity of disconnecting pushrod to adjust its length. Adjust turnbarrel pushrod as follows (Ref. Fig. 507):

(a) Remove lock-wire from rod-end locknut of pushrod (117).

(b) Loosen rod-end locknut until locking key is disengaged from rod-end sleeve.

(c) Remove clamping bolt, closest to rod-end, from pushrod tube.

(d) Loosen (but do not remove) second clamping bolt.

(e) Using hex on rod-end sleeve, rotate rod-end sleeve to change length of pushrod.

NOTE: Final position of sleeve must align sleeve locking slot with locking key and sleeve clamp bolt slot with clamp bolt holes in pushrod tube. Locking slots are located every 60 degrees on sleeve. Clamp bolt slots are located every 120 degrees on sleeve (Ref. Fig. 507).

(f) Install clamping bolt removed in Step 5L(8)(c). Do not tighten.

(g) Tighten rod-end locknut while verifying locking key is engaged in sleeve locking slot. (Use wrench to hold rod-end sleeve while tightening locknut.)Install lockwire between locking key and locknut.

(h) Tighten both clamping bolts.

(9) Remove all rig pins.

(10) Remove aileron holding devices if no additional rigging checks are to be made.

(11) Close access panels, opened in Step 5L(3).

5M. Right Outboard Aileron Servo - Rigging Check and Adjustment

C CAUTION: DO NOT LIFT THE SERVO BY ANY OF THE INPUT OR
C FEEDBACK ARMS AND DO NOT FORCE THE SECONDARY
C FEEDBACK INTO ANY POSITION AS SERVO INTERNAL
C LINKAGE CAN BE DAMAGED. THE INTERNAL LINKAGE OF
C THIS SERVO IS FRAGILE AND CAN BE DAMAGED EASILY IF
C NOT HANDLED CAREFULLY.

R (1) Open access panel 671CB (Ref. 6-40-00).

R (2) Turn off hydraulic power and install tags on the
R hydraulic control panels (Ref. 29-11-00).

R (3) Manually position both right ailerons to neutral
R (±0.060 inch) and install aileron support tool (Ref.
R Fig. 513).

R NOTE: Inboard aileron is in neutral when lower inboard
R surface of aileron is aligned with a red
R paint-filled dimple on No. 3 flap torque box.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R Maintenance Practices.

R On aircraft without SB27-162,
R inboard aileron neutral is with aileron faired.
R On aircraft with SB27-162,
R inboard aileron neutral is with aileron 1.5
R degrees up from faired.

CR On aircraft 001-017,
R outboard aileron is in neutral position when
R lower inboard surface of aileron is aligned with
R lower surface of adjacent fixed trailing edge
R structure at a point 10 inches forward of
R trailing edge.

CR On aircraft 018-999,
R outboard aileron is in neutral position when
R lower inboard surface of aileron is aligned with

R a red paint filled index notch on fixed trailing
R edge; notch is 10 inches forward of trailing
R edge and 1.54 inches up from lower edge.
R Aileron neutral is 3 degrees up from faired with
R fixed trailing edge.

R (4) Disconnect servo input bungee from servo input arm.

R (5) Install rig pin R3 in scissor linkage arm (114) (Ref.
R Fig. 512).

R (6) Install rig pin R2 through servo input arm (127) and
R servo.

R (7) With rig pins installed per Step 5M(5) and 5M(6),
R verify servo input bungee (128) can be connected to
R servo input arm (127). If not adjust length of input
R bungee. Temporarily connect input bungee to servo
R input arm (do not safety).

R (8) Remove all rig pins.

R (9) Remove aileron support tool and allow ailerons to
R droop.

R (10) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

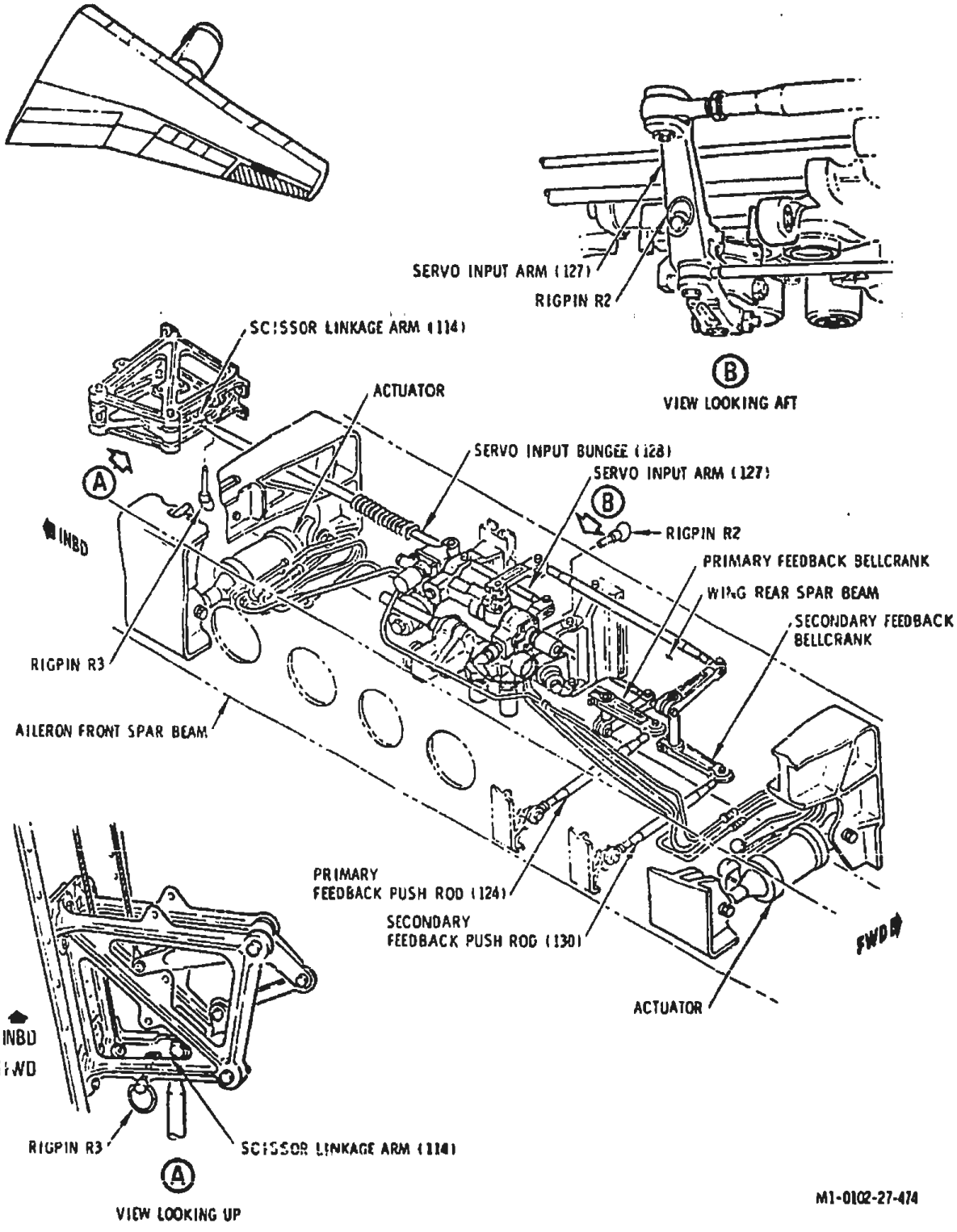
R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

CR (11) Turn on hydraulic systems B and D (Ref. 29-11-00). (Do
C not use A/C electric pumps).

R CAUTION: DO NOT SHUT OFF HYDRAULIC POWER WITH RIG PIN
R INSTALLED IN OUTBOARD AILERON SERVO OR SERVO CAN
R BE DAMAGED.

R (12) Install rig pin R2 in servo input arm (127) and servo.
R Outboard aileron must be in neutral with wing trailing



Right Outboard Servo - Rigging Check and Adjustment
Figure 512

R edge within ±0.12 inch. If not, accomplish Steps
R 5M(12)(a) through 5M(12)(f), as required.

R WARNING: WITH HYDRAULIC POWER ON, SERVO IS VERY
R SENSITIVE AND DANGEROUS WITH EITHER SERVO
R INPUT OR BOTH FEEDBACK PUSHRODS DISCONNECTED.

R (a) Disconnect secondary (outboard) feedback pushrod
R (130) from bellcrank. With only primary feedback
R pushrod connected, aileron should be in neutral
R (±0.12 inch). If so, determine mid-point of free
R play in secondary feedback control system. Adjust
R the secondary feedback pushrod to mid-point of
R free play and connect to bellcrank. Aileron must
R remain in same neutral position. Proceed to Step
R 5M(13).

R CAUTION: AN IMPROPERLY ASSEMBLED SECONDARY FEEDBACK
R BELLCRANK CAN CAUSE RIGGING DIFFICULTIES.
R CHECK BOTH FEEDBACK BELLCRANKS TO VERIFY
R BELLCRANK ARMS ARE APPROXIMATELY 90° TO EACH
R OTHER (ONE SPLINE OFF WOULD ROTATE ARM 14°)
R AND OUTBOARD ARM ON EACH BELLCRANK IS
R APPROXIMATELY PARALLEL TO WING REAR SPAR
R BEAM.

R NOTE: When adjusting the feedback pushrods, if
R either pushrod cannot be shortened enough
R or rod-end witness hole is open, check
R feedback pushrod part number for correct
R application.

R (b) If the right outboard aileron is not in neutral
R with only primary feedback pushrod connected,
R accomplish Steps 5M(12)(c) through 5M(12)(f).

C CAUTION: DO NOT FORCE SECONDARY FEEDBACK ARM (REF.
C FIG. 512) INTO ANY POSITION AS SERVO INTERNAL
C LINKAGE CAN BE DAMAGED.

R (c) Adjust secondary feedback pushrod half required
R correction (but not more than two turns).
R Reconnect secondary feedback pushrod to bellcrank.

R NOTE: One turn of feedback pushrod changes
R aileron position approximately 0.3 inch at
R neutral reference. Lengthening pushrod
R raises aileron, shortening pushrod lowers
R aileron.

R (d) Disconnect primary (inboard) feedback pushrod
R (124) from bellcrank.

R (e) Adjust primary feedback pushrod half required
R correction (but not more than two turns).
R Reconnect primary feedback pushrod to bellcrank.

R (f) Repeat Step 5M(12)(a).

R NOTE: If aileron is more than one inch out of
R neutral it may require several adjustments
R of feedback pushrods to safely "walk" the
R aileron to neutral position by adjusting
R one feedback pushrod at a time.

R (13) Remove all rig pins.

R (14) Mark lower surface of aileron just opposite neutral
R index mark on fixed trailing edge.

R (15) With roll control wheel and roll trim control wheel at
R neutral settings verify right outboard aileron is in
R neutral [(±0.12 inch) (Ref. Trim Bias Table 501].

R (16) Rotate control wheel full left until control wheel stop
R (bottom of control column) is contacted. Verify the
R following:

R (a) Right outboard aileron displaces down a minimum of
R 19 degrees (9.8 inches, measured between index
R mark on aileron inboard edge and index mark on
R fixed trailing edge structure); if this
R requirement cannot be met, verify total
R displacement of left and right outboard ailerons
R is a minimum of 38 degrees. (Example: If one
R aileron displaces down only 18.5 degrees, this is
R acceptable if opposite aileron displaces up at
R least 19.5 degrees.)

R (b) Right outboard servo input arm (127) is contacting
R the servo down stop.

R NOTE: It is not necessary for servo input arm to
R contact servo stop if aileron displacement
R is within tolerance.

R Servo stops are the primary stops. Cable
R stretch allows control wheel stops to be
R contacted.

R (17) Rotate control wheel full right until control wheel
R stop is contacted. Verify the following:

R (a) Right outboard aileron displaces up a minimum of
R 19 degrees (9.8 inches, measured between index

R mark on aileron inboard edge and index mark on
R fixed trailing edge structure); if this
R requirement cannot be met, verify total
R displacement of left and right outboard ailerons
R is a minimum of 38 degrees [See Step 5M(16)(a)
R Example).

R (b) Right outboard servo input arm (127) is contacting
R servo up stop. [See Step 5M(16)(b) Notes].

R (18) Return control wheel to neutral.

R (19) Check operation of servo internal fairing spring as
R follows:

R NOTE: The servo internal fairing spring serves to
R position servo control valve to neutral in event
R of a disconnected servo input control.

R (a) Disconnect servo input bungee from servo input
R arm.

R WARNING: USE CAUTION WHEN OPERATING SERVO INPUT ARM.

R (b) Manually position servo input arm in one direction
R and release arm. Verify aileron returns to within
R 2 degrees of neutral but not past neutral.

R (c) Manually position servo input arm in opposite
R direction and release arm. Verify aileron returns
R to within 2 degrees of neutral but not past
R neutral.

R (d) If aileron does not return to approximately
R neutral or if it returns past neutral after servo
R arm is released, a damaged or broken fairing
R spring is indicated. Replace outboard aileron
R servo (Ref. 27-11-19).

C NOTE: If a PCU fails the fairing spring test, do
C not change the PCU until the primary and
C secondary feedback rod adjustment is
C checked and verified to be correct.

R (e) Reconnect servo input bungee to servo input arm.

R (20) Verify proper safetys are installed on all servo input
R and feedback arms.

R CAUTION: VERIFY ALL RIG PINS ARE REMOVED BEFORE TURNING OFF
R HYDRAULIC POWER OR SERVO CAN BE DAMAGED.

R (21) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

R (22) Close access panels 671AB and 671CB (Ref. 6-40-00).

5N. Completion Check

(1) If no adjustment is made on any part of aileron control system, accomplish following:

(a) Verify all rig pins are removed from aileron control system.

(b) Verify all aileron support tools are removed from ailerons.

(c) Remove tags from hydraulic control panels, if installed for rigging check and adjustment (Ref. 29-11-00).

(d) Close all access panels opened for rigging check and adjustment.

(2) If an adjustment is made on any part of aileron control system, accomplish following:

(a) Verify all rig pins are removed from all flight control systems.

(b) Verify all adjustments and attachments are safetied.

(c) Verify all aileron support tools are removed from ailerons.

(d) Remove tags from hydraulic control panels (Ref. 29-11-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(e) Turn on all four hydraulic systems (Ref. 29-11-00).

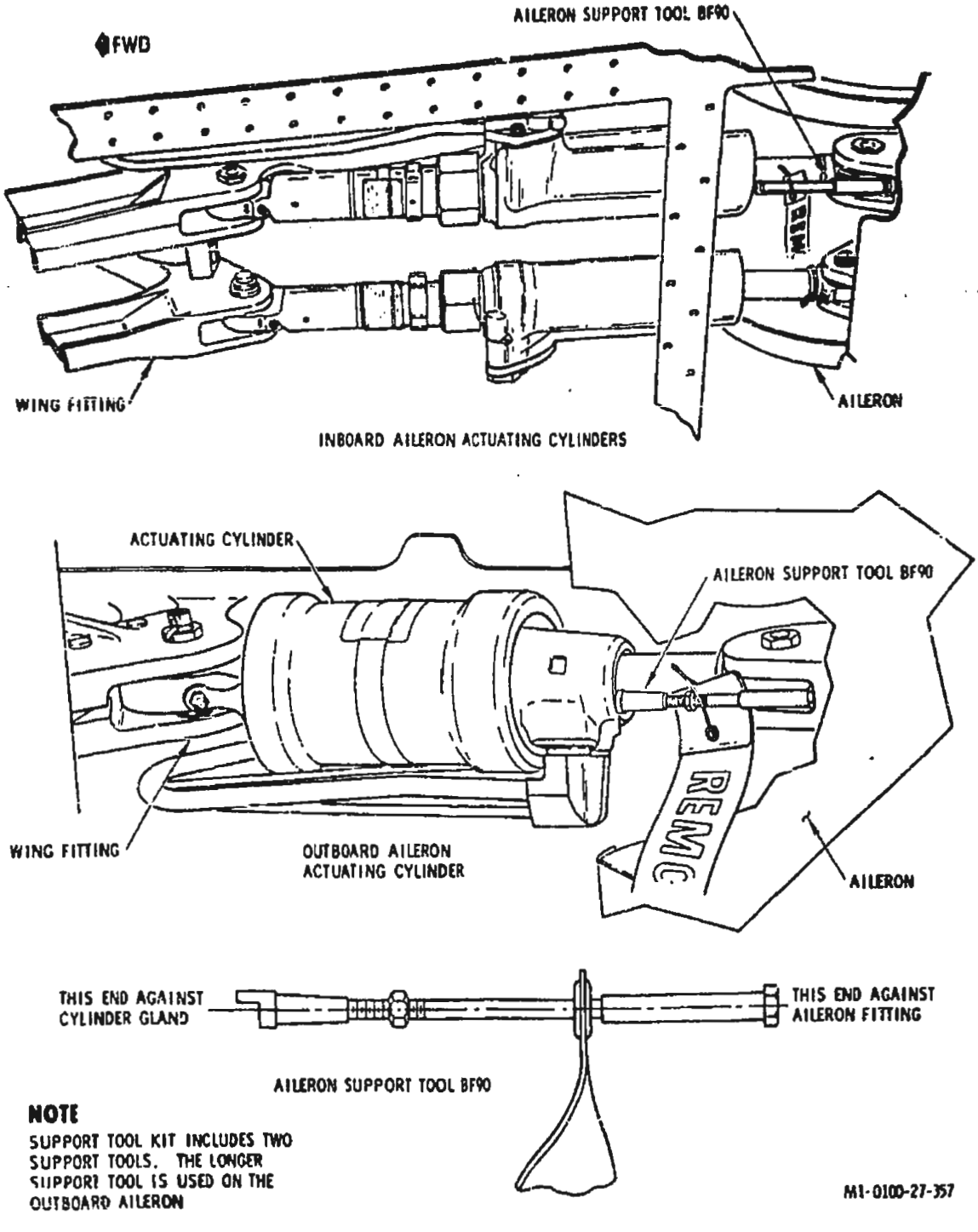
CAUTION: RAPID CYCLING OF OUTBOARD AILERONS CAN DAMAGE OUTBOARD AILERON DAMPER SEALS. CYCLE AILERONS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(f) Slowly cycle control wheel full left and full right several times. Visually verify components that were adjusted (pushrods, bellcranks, and cables) operate freely without interference from structure or equipment.

(g) Operate aileron control system to verify aileron neutral rig and aileron displacement (Ref. Quick Rigging Check, Para. A).

(h) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(i) Close access doors and panels opened for rigging check and adjustment (Ref. 6-40-00).



Aileron Support Tool (BF90) Installation
Figure 513

R CAPTAINS/FIRST OFFICERS AILERON CONTROL WHEEL AND CONTROL COLUMN
R WIRE HARNESS
REMOVAL AND INSTALLATION

1. General

R The aileron control wheel or the control wheel line replaceable
R units (LRUs), listed below, may be replaced without disturbing
R the control column wire harness. Replacement of the control
R column wire harness requires prior removal of aileron control
R wheel.

R The following is a list of Captains/First Officers Aileron
R Control Wheel LRUs:

R Control Wheel Autopilot Disconnect Switch, 22-10-21

R Control Wheel Go Around Switch, 22-10-22

R Electrical Pitch Trim Generator, 22-10-23

Control Wheel Cable Assembly (Y-harness), 22-10-28

Control Wheel Communications Switch, 23-51-19

2. Equipment and Materials

Limiter Nut Torque Wrench Adapter, Collins Radio Co. PN 797-9711-001

Electrical Connector Wrench, Collins Radio Co. PN 797-9712-001

Control Wheel Alignment Tool, Collins Radio Co. PN 797-9713-001

C Lock-wire, 305 Stainless Steel Arm (TWA Stock No. 56-1463) 0.015
C inch diameter, or equivalent

R Matrix Insertion tool, Matrix Science Corp. (FSCM 14283) P/N
R 90-0001-022, Lockheed P/N L525C19-565, or equivalent

R Matrix Removal tool, Matrix Science Corp. (FSCM 14283) P/N
R 90-0002-022, Lockheed P/N L525C19-566, or equivalent

R Insertion tool, (Open Vendor) P/N NAS 1664-20, Lockheed P/N
R L525C19-467, or equivalent

R Sealing Compound, LAC C-40-769A, or equivalent

Sealing Compound, MIL-S-22473, Grade E, (Loctite) or equivalent

R Adhesive, Epoxy Resin Base, LCM30-1247 or equivalent

3. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
34-14-00	Central Air Data Computer System - Adjustment and Test
34-21-00	Attitude Reference System - Adjustment and Test
34-22-00	Magnetic Heading Reference System - Adjustment and Test
20-05-05	Wiring Diagram Manual Deutsch DL Series Circular Connectors - Maintenance Practices
20-15-01	Wiring Diagram Manual Matrix Single Wire Terminal Junction Splice - Maintenance Practices
90-10-00	Wiring Diagram Manual HOOK-UP CHART

4. Aileron Control Wheel Removal/Installation

CAUTION: CONTROL WHEEL REMOVAL SHOULD BE ACCOMPLISHED ONLY WHEN ABSOLUTELY NECESSARY AND NOT AS A FAULT ISOLATION STEP. DIFFICULTY MAY BE ENCOUNTERED DUE TO GALLING OF LIMITER NUT. IF GALLING OCCURS, IT MAY BE NECESSARY TO REMOVE CONTROL COLUMN ASSEMBLY.

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On the pilots circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

NO. 1 SYSTEMS

SPEED CONT (A2)

PITCH & ROLL (A6)

AUDIO CONTROL

CAPT & F/E (A12)

F/O & OBS (A13)

NO. 2 SYSTEMS

SPEED CONT (A20)

PITCH & ROLL (A24)

On the Flight Engineer/Second Officer's circuit breaker panel CB3, zone 215, open and tag the following circuit breakers:

AUDIO CONTROL

CAPT & F/E (C16)

F/O & OBS (C17)

FLT INPH AMPL (C18)

(2) Depress the MIC SEL INT switch on Captains and First Officers audio selector panels on the center console; tag panels to prevent inadvertent operation of the selector switches.

CAUTION: DO NOT PRY OFF CONTROL WHEEL COVER.

(3) To remove Control Wheel Cover, loosen setscrew at base of control wheel hub. Pull bottom of cover forward and downward to disengage locking tab at top of cover from wheel hub. Remove cover from control wheel (Ref. Fig. 401).

CAUTION: INSERT 797-9712-001 TOOL ONLY IN UPPER QUADRANT OF CONNECTOR NUT TO PREVENT DAMAGE TO CONNECTOR WIRES. IT IS STRONGLY RECOMMENDED THAT THE CONNECTOR BE REMOVED OR INSTALLED ONLY BY A QUALIFIED AVIONICS TECHNICIAN.

(4) Remove lock-wire from connector plug and remove connector plug using Collins wrench PN 797-9712-001.

CAUTION: UNDER NO CIRCUMSTANCES SHOULD A TORQUE IN EXCESS OF 80 LB FT BE APPLIED TO THE CONTROL WHEEL.

(5) Remove threaded limiter nut using Collins adapter PN 797-9711-001. If the limiter nut is galled it may be necessary to use torque in excess of 185 lb in. to

remove the nut from the control column shaft. If so, resist this torque at the control wheel rim. Hold Control Wheel off stops when force is applied. To avoid overstressing parts in the control column do not exceed 80 lb ft of torque.

CAUTION: WHEN REMOVING CONTROL WHEEL, DO NOT EXCEED A PULL FORCE OF 467 LBS WHICH IS THE THRUST RATING OF THE FORWARD SHAFT BEARING. IF THE WHEEL PULLER IS USED AT THE HAND GRIPS THE MAXIMUM ALLOWABLE PULL FORCE IS 300 LB (150 LB ON EACH GRIP).

(6) Remove control wheel from shaft. It may be necessary to use a wheel puller and Collins Alignment tool PN 797-9713-001 to disengage the control wheel hub from the shaft serrations. A straight pull is required to prevent racking or wedging.

B. Installation

(1) Verify that circuit breakers opened in Step 4A(1) are open and tagged.

CAUTION: DO NOT PRY OFF CONTROL WHEEL COVER.

(2) Remove cover, if installed, from new control wheel. To remove Control Wheel Cover, loosen setscrew at base of control wheel hub. Pull bottom of cover forward and downward to disengage locking tab at top of cover from wheel hub. Remove cover from control wheel (Ref. Fig. 401).

(3) Install wheel assembly on spline shaft using Collins Alignment Tool 797-9713-001.

(4) Install limiter nut. Torque limiter nut 165 to 185 lb in. Use Collins torque wrench adapter PN 797-9711-001.

CAUTION: DO NOT BEND OR STRESS HARNESS DURING INSTALLATION. INSTALL ELECTRICAL CONNECTOR SO THAT HARNESS IS UNDER MINIMUM LOAD.

INSERT 797-9712-001 TOOL ONLY IN UPPER QUADRANT OF CONNECTOR NUT. TORQUE ONLY FINGER TIGHT (10 to 20 LB IN). ENSURE WIRES ARE NOT DAMAGED. INSERT LOCK-WIRE FROM AFT FACE OF ELECTRICAL CONNECTOR BODY AND GO FORWARD AND UPWARD THROUGH BODY. ENSURE LOCK-WIRE IS NOT FORCED INTO POTTED ELECTRICAL WIRES.

(5) Carefully install electrical connector.

(6) Lock-wire limiter nut, connector nut and connector body as shown in Figure 401.

(7) Install cover on control wheel opening.

(8) Apply sealing compound MIL-S-22473 (Lotite) to threads of cover retaining set screw.

(9) Secure setscrew to retain cover in control wheel.

R (10) Remove tags and close circuit breakers opened in Step 4A(1).

(11) Remove placards from hydraulic control panels.

R (12) Perform functional test (Ref. Para. 6).

5. Control Column Wire Harness Removal/Installation

A. Removal

(1) Remove aileron control wheel (Ref. Para. 4A).

(2) On the pilots circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

NO. 1 SYSTEMS

SPEED CONT (A2)

PITCH & ROLL (A6)

AUDIO CONTROL

CAPT & F/E (A12)

F/O & OBS (A13)

NO. 2 SYSTEMS

SPEED CONT (A20)

PITCH & ROLL (A24)

On the Flight Engineer/Second Officers circuit breaker panel CB3, zone 215, open and tag the following circuit breakers:

AUDIO CONTROL

CAPT & F/E (C16)

(3) Depress the MIC SEL INT switch on Captains and First Officers audio selector panels on the center console; tag panels to prevent inadvertent operation of the selector switches.

(4) Remove wire cover and conduit from control column (Ref. Fig. 402).

NOTE: Wire cover on lower half of control column is attached by velcro strips. Conduit is attached by screws and washers.

(5) Disconnect both matrix single wire splices connecting wire harness with approach chart receptacle (Ref. WDM 20-15-01).

(6) Remove remaining three screws and washers attaching bearing retainer and separate bearing retainer from control column.

(7) Remove Cap, lock washer and wire harness guide from control wheel shaft.

R (8) Remove apoxy sealing compound covering Matrix Minimate
R connector set screw which is near aft and of control
R wheel shaft and remove set screw.

R (9) Remove clamps holding wire harness and disconnect Deutsch connector or bottom of wire harness in the forward electronic serivce center (FESC).

R (10) Remove pins from Deutsch connector on lower end of wire harness and remove harness aft through control wheel shaft.

NOTE: If harness is to be scrapped, wires may be cut close to control wheel shaft to ease removal.

Retain cap, lockwasher and bearing retainer for reuse.

B. Installation

(1) Verify circuit breakers opened in Step 5A(1) are opened and tagged.

(2) Verify Deutsch connector is not installed on bottom end of wire harness. If pins are installed on wires they need not be removed.

(3) Insert lower end of wire harness forward through the bore of the control wheel shaft. Pull harness through a short distance.

(4) Slide bearing retainer, lockwasher and cap over lower end of wire harness.

(5) Continue pulling wire harness through control wheel shaft and route harness to its installed position.

(6) Push Matrix minimate connector forward into control wheel shaft until dowel pin is engaged.

R (7) Install Matrix minimate connector set screw through aft
R end of control wheel shaft and torque to 5 - 10
R pound-inches. Seal head of set screw with epoxy resin
R base adhesive, LCM 30-1247 or equivalent.

R (8) Connect both matrix single wire splices connecting wire harness with approach chart receptacle (Ref. WDM 20-15-01).

R (9) Install both halves of the wire harness guide on wire harness and slide guide in bore of cap.

R (10) Slide lockwasher on cap. Verify tab on lockwasher is engaged in locking groove.

R (11) Install cap assembly on control wheel shaft. Torque to 250 pound-inches, and install lock-wire.

R (12) Install cable clamps on wire harness.

R (13) Rotate control wheel through several complete cycles. Verify wires move smoothly and control wheel turns without binding. Adjust adel clamp on control column for greatest freedom of movement.

R (14) Coat screw threads and washers with sealing compound LAC C-40-769A and install bearing retainer and conduit. Install lockwire.

NOTE: Install bearing retainer under conduit.

R (15) Install wire cover over lower half of control column.

R (16) Install Deutsch connector on lower end of wire harness (Ref. WDM 20-05-05 and WDM 91-10-00 HOOK-UP CHART).

R (17) Connect Deutsch connector to aircraft wiring.

R (18) Install control wheel (Ref. Para. 4B).

R (19) Perform functional test.

6. Functional Test

A. Test Procedure

(1) Turn on electrical power (Ref. 24-41-00).

(2) Verify that the following systems are on:

Avionics cooling (Ref. 21-00-00)

Central Air Data Computer System (Ref. 34-14-00)

Attitude Reference System (Ref. 34-21-00)

Magnetic Heading Reference System (Ref. 34-22-00)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic system A and B (Ref. 29-11-00).

(4) Check pitch force sensors as follows:

(a) On AUTOPILOT ENGAGE Panel, set AP ENGAGE switch A to CWS.

(b) Slowly exert an increasing nose-up pitch force (control column aft) on the control wheel (stabilizer will follow control column movement). Verify that AP ENGAGE switch A remains in CWS. Slowly release force on control wheel.

(c) Depress autopilot disconnect switch on control wheel and verify that AP ENGAGE switch A goes to OFF.

(d) Repeat check of pitch force sensors with AP ENGAGE switch B in the CWS position [Ref. Steps 6A(4)(a) through 6A(4)(c)].

(5) Check roll force sensors as follows:

(a) On AUTOPILOT ENGAGE panel, set AP ENGAGE switch A to CWS.

(b) Slowly exert a roll force to the left on the control wheel (ailerons will follow control wheel movement). Verify that AP ENGAGE switch A remains in CWS. Slowly release force on control wheel.

(c) Depress autopilot disconnect switch on control wheel and verify that AP ENGAGE switch A goes to OFF.

(d) Repeat check of roll force sensors with AP ENGAGE switch B in CWS [Ref. Steps 6A(5)(a) through 6A(5)(c)].

(6) Check GO-AROUND switch operation as follows:

(a) Set flight director switch A to ON and flight director switch B to OFF.

(b) Depress GO-AROUND switch and verify that AFCS MODES annunciator TAKE-OFF message is displayed.

(c) Set flight director switch A to OFF and verify that TAKE-OFF message goes out.

(d) Repeat check of GO-AROUND switch with flight director switch A set to OFF and flight director switch B set to ON [Ref. Steps 6A(6)(a) through 6A(6)(c)].

(7) Check pitch trim control operation as follows:

(a) On the overhead FCES panel, depress (in) PITCH TRIM NO. 1 switchlight and release (out) PITCH TRIM NO. 2 switchlight. PITCH TRIM NO. 2 switchlight OFF light will come on.

(b) Verify that autopilot is turned off.

(c) Rotate pitch trim control thumbwheel and verify motion of pitch trim wheel on pilots center console.

(d) Repeat check of pitch trim with PITCH TRIM NO. 1 switchlight released and PITCH TRIM NO. 2 switchlight depressed [Ref. Steps 6A(7)(a) through 6A(7)(c)].

(8) Check communications switch operation as follows:

(a) On Captains/First Officers audio selector panel, depress MIC SEL - INT, and FLT INT switch. On Captains/First Officers headset stowage and microphone selector console, release (out) PA - ON/OXY switchlight and select OXY/BOOM switch to OXY.

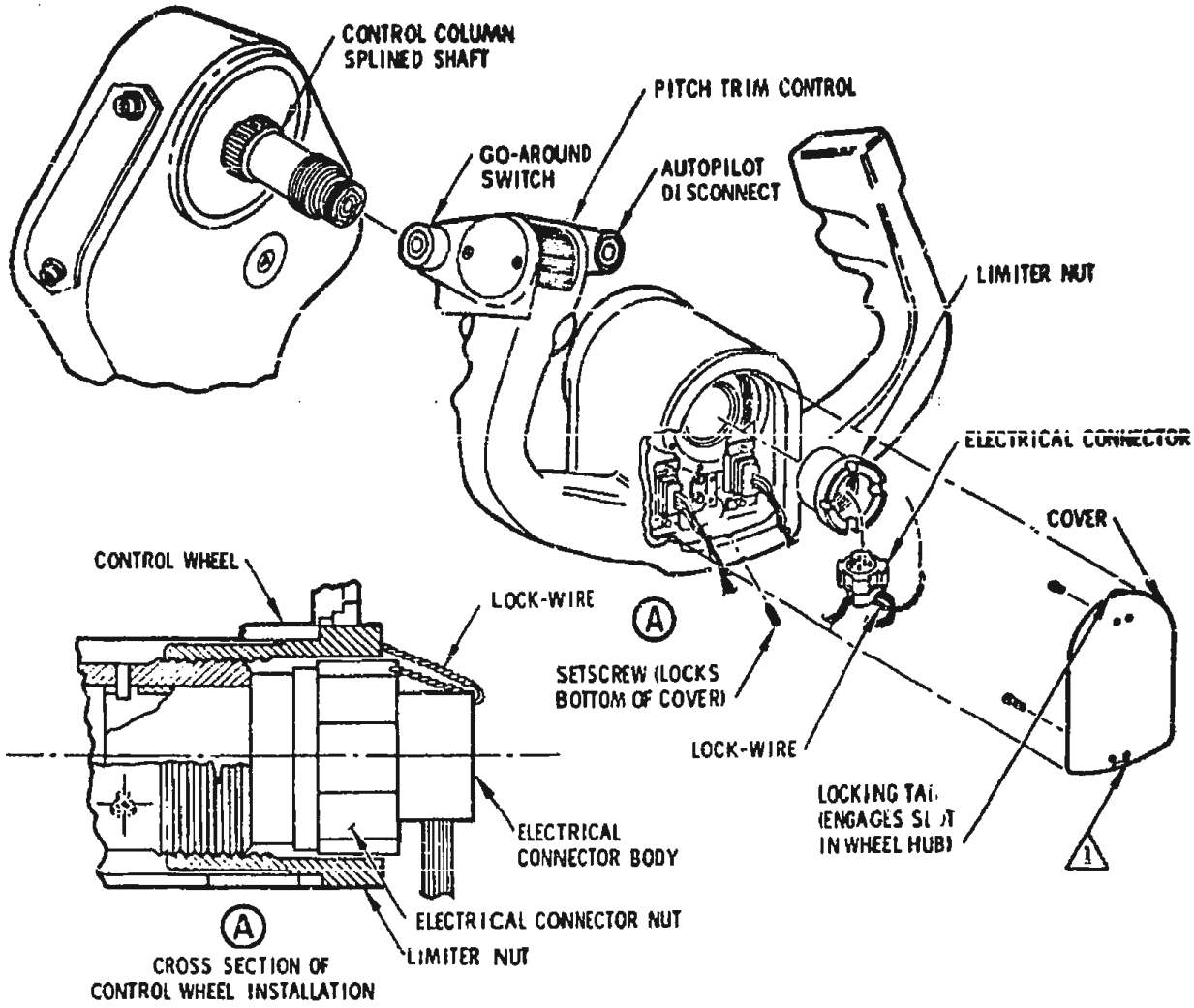
(b) On control wheel, depress communications switch and speak into oxygen mask microphone. Verify that headset audio is loud and clear (adjust volume as necessary).

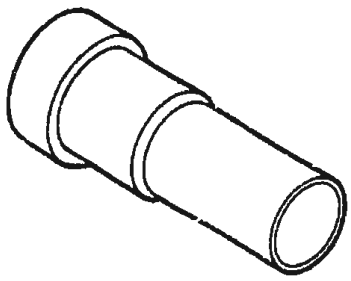
(c) After test position communication switches to normal ground condition.

(9) Turn off hydraulic power if no longer required (Ref. 29-11-00).

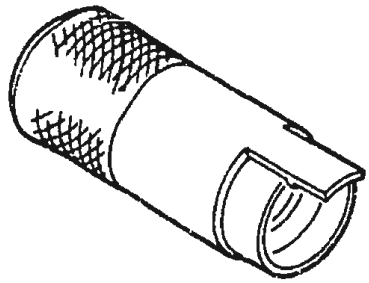
(10) Turn off all systems turned on in Step 6A(2).

(11) Turn off electrical power if no longer required (Ref. 24-41-00).

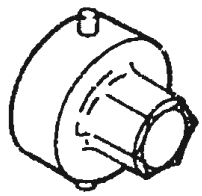




CONTROL WHEEL ALIGNMENT TOOL (COLLINS PN 797-9713-001)



ELECTRICAL CONNECTOR WRENCH (COLLINS PN 797-9712-001)



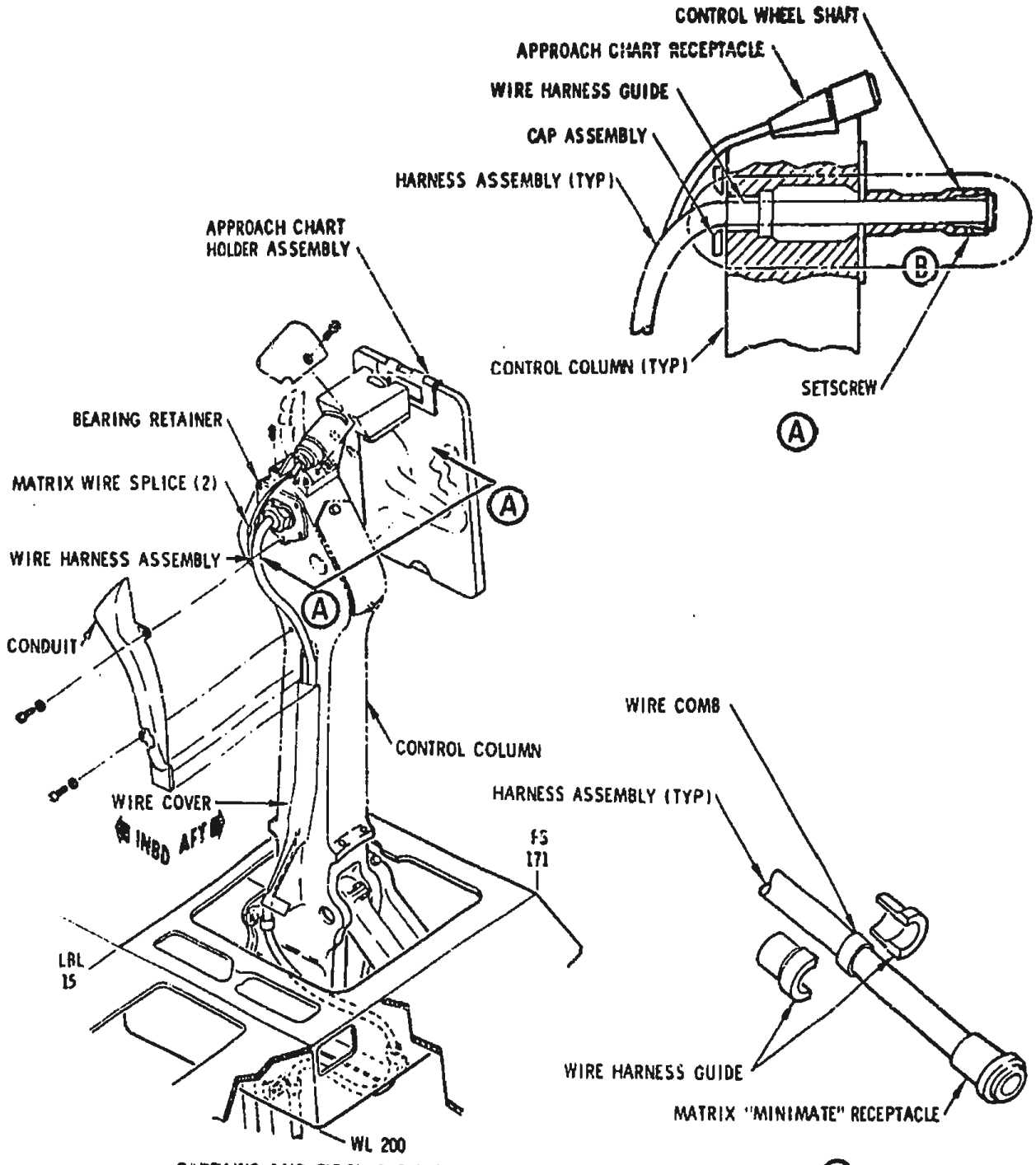
LIMITER NUT TORQUE WRENCH ADAPTER (COLLINS PN 797-9711-001)

NOTE

1 CAUTION: DO NOT PRY COVER TO REMOVE AS DAMAGE TO CONTROL WHEEL ELECTRICAL CONNECTOR WILL RESULT

M1-0002-27-443

Captains/First Officers Control Wheel - Removal and Installation
Figure 401



CAPTAINS AND FIRST OFFICERS CONTROL COLUMN (TYP). FLIGHT STATION AREA

MI-0001-27-1079

Control Column Wire Harness - Removal and Installation
Figure 402

R

R

AILERON CONTROL WHEEL LINKAGE - INSPECTION AND CHECK

1. General

This procedure provides a means of determining free play in the control wheel linkage system and the steps necessary to reduce excessive free play to acceptable limits.

2. Equipment and Materials

Rig Pins, 5/16-inch diameter by 5 inches long (R5) 2 each, and 3-inches long (R3)

Aileron Support Tool, BF90, or equivalent

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
27-41-01	Control Column Assembly - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Inspection/Check

(1) Remove the approach chart holder from top of First Officers control column. Place a piece of masking tape on the First Officers control column opposite the control wheel alignment index (Ref. Fig. 601).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on electrical power (Ref. 24-41-00).

(3) Turn on all four hydraulic systems (Ref. 29-11-00).

(4) Temporarily restrain the Captains control wheel.

(5) Rotate First Officers control wheel left and right with approximately two pounds force on control wheel rim. Observe the First Officers wheel hub alignment index and mark the masking tape at the left and right extreme positions. (Verify that the Captains control wheel is held steady and does not move.)

(6) After marking masking tape, release control wheels.

(7) Measure distance between the marks on the masking tape.

(a) If measurement is 0.125 inch or less, control wheel linkage free play is acceptable. Install the approach chart holder and turn off hydraulic and electrical power.

(b) If measurement is greater 0.125 inch, accomplish following Steps (8) through (22).

(8) Turn off all hydraulic power and tag hydraulic control panels.

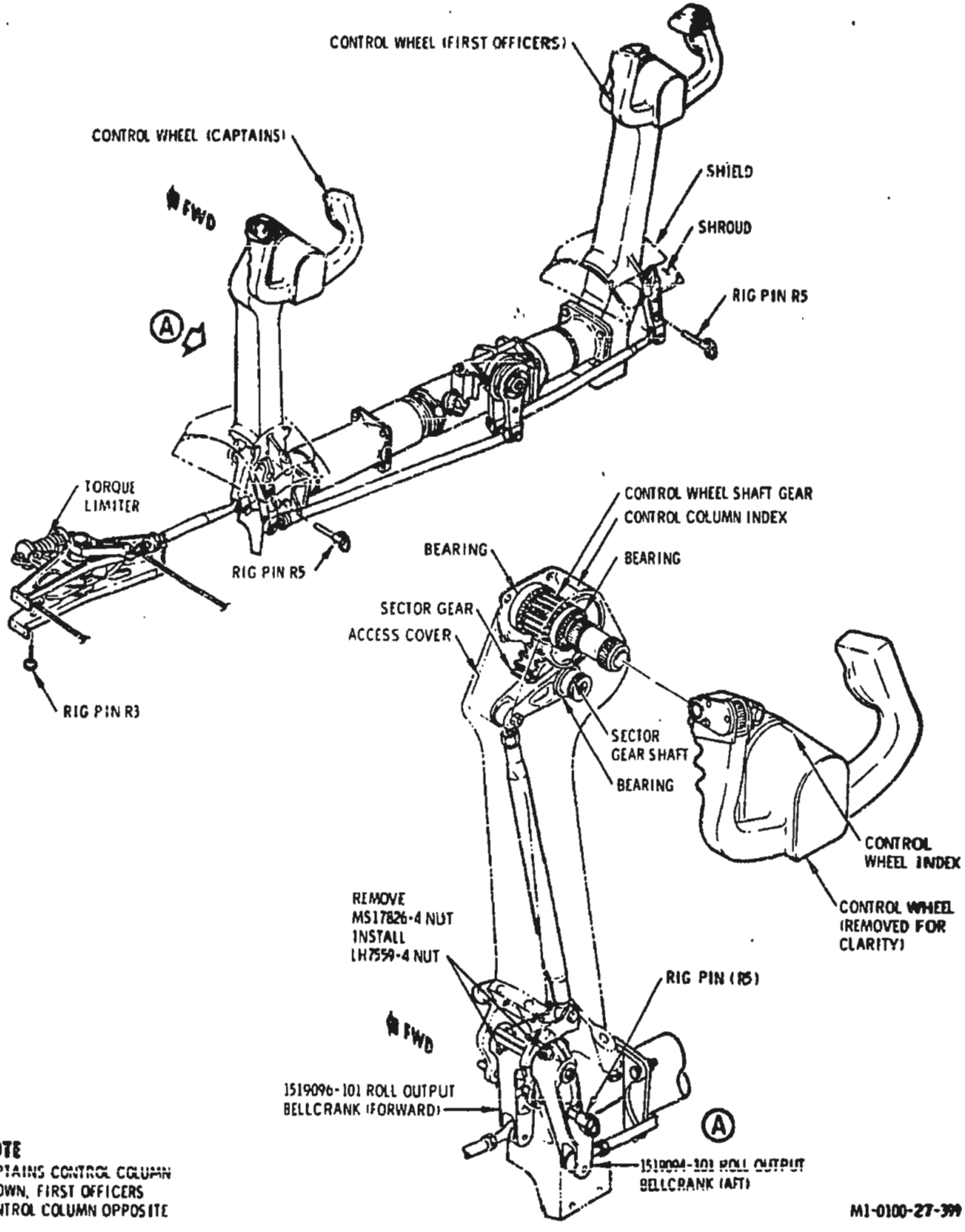
(9) Remove approach chart holder from top of Captains control column. Place a piece of masking tape on the control column opposite the control wheel alignment index.

(10) Remove screws attaching shield to base of both control columns. Remove shield.

(11) Remove screws attaching shroud of both control columns to flight station floor. Slide shroud up control column to expose roll output bellcranks.

(12) Manually position both inboard ailerons to approximately neutral position and install aileron support tool (Ref. 27-11-00, Fig. 513). (Ailerons are neutralized to remove loads on control wheel linkage.)

NOTE: On aircraft 001-006, at the bottom of both control columns, replace the MS17826-4 thin castellated nuts on both roll output bellcranks with LH 7559-4 self-locking external wrenching nuts (Ref. SB 27-047); torque nuts 60 to 65 lb in. (Ref. Fig. 601).



R Aileron Control Wheel Linkage - Inspection and Check
R Figure 601

(13) Install a tight-fitting rig pin (R5) through roll output bellcranks at bottom of both control columns. Check control wheel linkage as follows:

(a) Apply left and right roll inputs to each control wheel with approximately two-pounds force at control wheel rim. Measure wheel free play. Free play must not exceed 0.027 inch at hub index (0.018 inch is normal).

(b) Remove small access cover on upper outboard side of both control columns. Observe wheel free play due to backlash in gear mesh. If backlash exceeds 0.005 inch at pitch line of gear mesh or if the bearings on either end of either gear shaft show perceptible movement or lash, replace control column assembly (Ref. 27-41-01).

(c) Apply two-pound left and right roll inputs to Captains control wheel. Check the aft roll output bellcrank on the bottom of the First Officers control column. The bellcrank should not show any perceptible motion (0.005 inch maximum) at the R5 rig pin location.

(d) Apply two-pounds left and right roll inputs to the First Officers control wheel. Check the aft roll output bellcrank on the bottom of the Captains control column. The bellcrank should not show any perceptible motion (0.005 inch maximum) at the R5 rig pin location.

(e) If requirements of Step (c) or (d) cannot be met, verify that both roll output bellcranks on the bottom of both control columns contain LH 7559-4 external wrenching nuts and that nuts are torqued 60 to 65 lb in. Recheck per Steps (c) and (d).

(f) If requirement of Step (c) or (d) still cannot be met, replace the 1519094-101 (aft) or the 1509096-101 (forward) roll output bellcrank and recheck per Steps (c) and (d).

(14) Remove all rig pins.

(15) After the above inspection and repair is made, the following check can be made to confirm that control wheel linkage free play is within acceptable limits:

(a) Install a tight-fitting rig pin (R5) through the Captains roll output bellcranks at bottom of control column. The First Officers control wheel

backlash should not exceed 0.078 inch at hub index (0.060 inch or less is normal).

(b) Remove rig pin from Captains roll output bellcranks.

(c) With a tight-fitting rig pin (R3) in the Captains (left) torque limiter, compare the Captains wheel backlash to First Officers: the Captains wheel backlash should not exceed 0.063 inch at hub index (.036 inch or less is normal). The First Officers wheel backlash should not exceed 0.119 inch at hub index (0.060 inch or less is normal).

(16) Remove all rig pins.

(17) Install access cover on top of both control columns.

(18) Install approach chart holder on top of both control columns.

(19) Install control column shrouds and shields.

(20) Remove aileron support tool from both inboard ailerons.

(21) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(22) Turn on hydraulic systems B and C (Ref. 29-11-00).

(23) Alternately cycle both control wheels slowly from full left roll to full right roll for several cycles. Verify that the control wheel linkage operates smoothly without binding or interference. (While cycling control wheels, slowly move control column through full pitch up to pitch down limits to verify normal roll operation throughout pitch range.)

(24) Turn off hydraulic power (Ref. 29-11-00).

ROLL CONTROL DISCONNECT MECHANISM - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pins, 5/16-inch diameter by 3 inches long (R3) and 5 inches long (R5)

Aileron Support Tool, BF90, or equivalent

2. Referenced Procedures

R	21-41-00	External Power/Ground System - Maintenance Practices
	25-11-01	Captains Seat Assembly - Removal and Installation
	25-11-02	First Officers Seat Assembly - Removal and Installation
	27-11-00	Aileron Control System - Maintenance Practices
	27-11-39	Roll Disconnect Handle Light Switch - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Manually position both inboard ailerons to neutral (±0.12 inch) and install aileron support tool (Ref. Fig. 401).

NOTE: Inboard aileron neutral reference mark is a red paint-filled dimple on the No. 3 flap torque box. Align lower surface of aileron with index mark. If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

R On aircraft without SB27-162,
R inboard aileron neutral is with aileron faired.

R On aircraft with SB27-162,
R inboard aileron neutral is with aileron 1.5
R degrees up from faired.

(2) Remove Captains and First Officers seats (Ref. 25-11-01 and 25-11-02).

(3) Remove the center console forward and aft trim panels on both sides of the console (Ref. Fig. 401).

(4) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker IND LT - PILOTS (J2).

(5) Remove the Captains floor plate between control column and center console.

(6) On right (Captains) side of console, remove U-channel support next to floor (Ref. Fig. 401).

(7) Remove the clear plastic shield over the roll disconnect by removing the four attaching screws.

CAUTION: SUDDEN RELEASE OF THE ROLL DISCONNECT HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

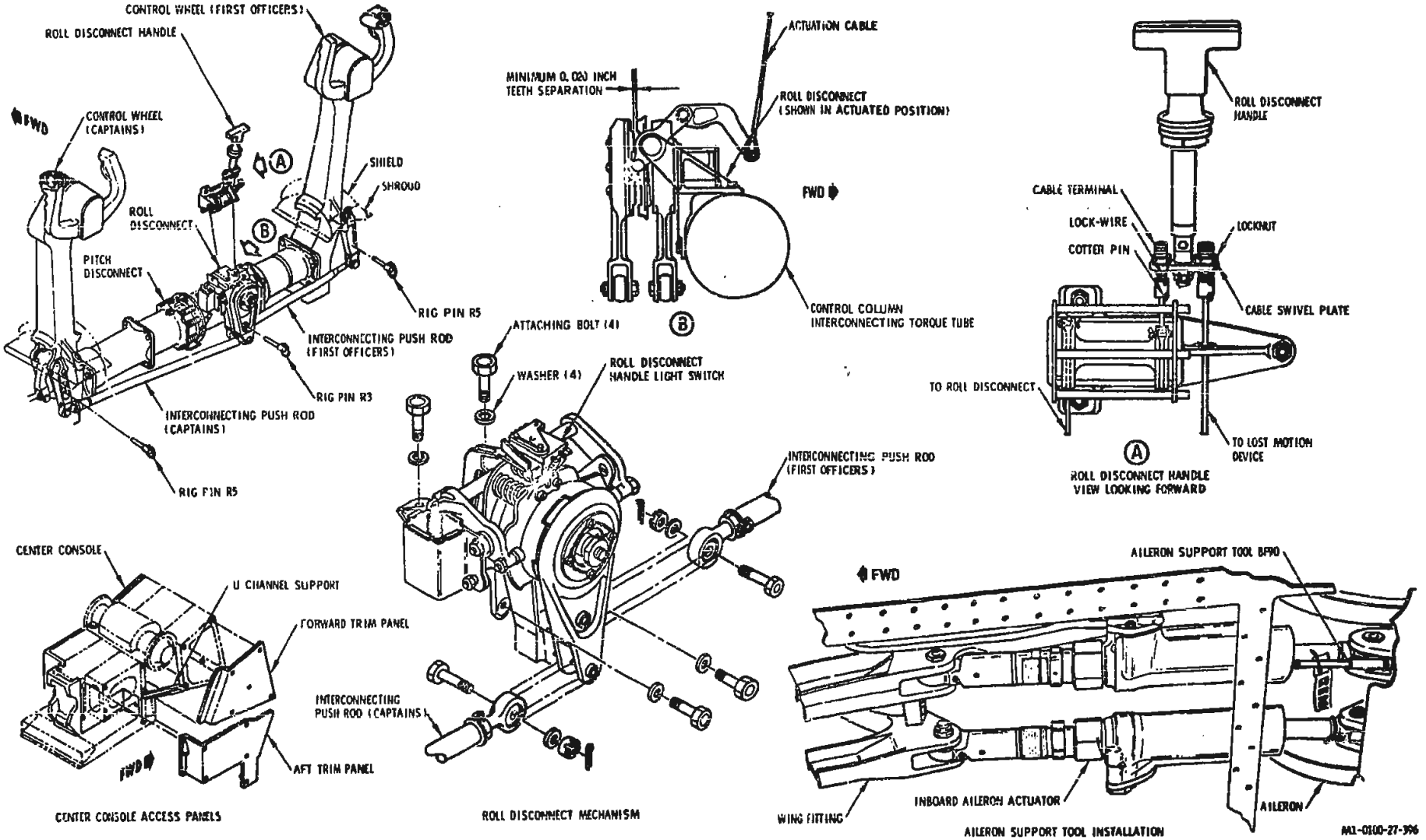
(8) On center console, pull up the ROLL DISC handle and turn it 90 degrees to the left to lock. (This will actuate the roll control disconnect to allow removal of the pushrods from the roll disconnect arms.)

(9) Disconnect the Captains and First Officers Interconnecting pushrods from the roll disconnect arms. (Operate either control wheel to rotate and separate the roll disconnect arms so the pushrod connecting bolts can be removed.)

CAUTION: SUDDEN RELEASE OF THE ROLL DISCONNECT HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(10) Release ROLL DISC handle and allow handle to retract against console.

(11) Disconnect actuation cable from the roll disconnect arm by removing the cable connecting bolt.



R Roll Control Disconnect Mechanism - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

(12) Tag and disconnect the wires to the roll disconnect handle light switch on top of roll disconnect.

NOTE: On aircraft 001-023, roll disconnect switch wires are routed to terminal module in forward electronic service center (FESC) at FS 175, WL 180, BL 25R.

NOTE: On aircraft 024-999, roll disconnect switch wires are routed to terminal board mounted on console structure just forward and to the left of roll disconnect.

(13) Remove the four roll disconnect-to-torque tube attaching bolts. Remove roll disconnect.

B. Installation

(1) Verify that all hydraulic power is turned off and hydraulic control panels tagged.

(2) Position roll disconnect on torque tube. Install and tighten four roll disconnect attaching bolts.

(3) Connect the actuation cable to the roll disconnect arm with connecting bolt. Install cotter pin through nut.

CAUTION: SUDDEN RELEASE OF THE ROLL DISCONNECT HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(4) On center console, pull up the ROLL DISC handle and turn it 90 degrees to the left to lock. Check rigging of roll disconnect cable as follows:

(a) With ROLL DISC handle pulled up and locked, verify that the roll disconnect clutch teeth are separated a minimum of 0.020 inch (Ref. Fig. 401). If not, loosen cable terminal locknut, adjust cable terminal and tighten locknut. Lock-wire locknut to top holes of cable anchor. (Bottom holes of cable anchor must contain cotter pin to secure cable ball.)

(5) Install Captains and First Officers interconnecting pushrods as follows:

(a) Connect First Officers interconnecting pushrod to the roll disconnect forward arm with bolt, washer, and nut. Install cotter pin. (Bolt head must face aft.)

CAUTION: VERIFY THAT ADJUSTABLE END OF FIRST OFFICERS INTERCONNECTING PUSHROD IS CONNECTED TO ROLL DISCONNECT ARM. IF INSTALLED BACKWARDS, CONTROL WHEEL RIGHT ROTATION CAN BE LIMITED.

(b) Connect Captains interconnecting pushrod to the roll disconnect aft arm with bolt, washer, and nut. Install cotter pin. (Bolt head must face forward so that bolt heads from forward and aft arms are facing each other.)

(c) Remove shield from bottom of both control columns.

(d) Remove shroud from both control column bases. Slide shroud up control column to expose roll output bellcranks.

CAUTION: SUDDEN RELEASE OF THE ROLL DISCONNECT HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(e) Release ROLL DISC handle and allow handle to retract against console.

(f) Insert rig pin (R3) through both disconnect arms and the disconnect. Rig pins (R5) must fit freely through both the Captains and First Officers roll output bellcranks on bottom of control column. If not, adjust interconnecting pushrods. (If an adjustment is made, verify that pushrod lock nuts are tightened and lock-wired.)

(g) Remove all rig pins.

(h) Install shrouds and shields on both control columns.

(6) Connect wires from the roll disconnect handle light switch on top of roll disconnect to the terminal module in forward electronic service center.

(7) Check operation of the handle light switch as follows:

(a) Remove tag and close circuit breaker IND LT - PILOTS (CB2-J2).

(b) Turn on electrical power (Ref. 24-41-00).

CAUTION: SUDDEN RELEASE OF THE ROLL DISCONNECT HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

Oncenter console, pull up the ROLL DISC handle and turn it 90 degrees to the left to lock.

(c) ROLL DISC handle lights must come on. Release ROLL DISC handle and allow handle to retract against console. ROLL DISC handle lights must go out. If handle lights do not operate properly, adjust switch cam (Ref. 27-11-39, Removal and Installation).

(8) Install clear plastic shield over the roll disconnect.

(9) Install the U-channel support on the right side of console.

(10) Verify that roll disconnect area is clear of all tools and equipment.

(11) Install Captains floor plate.

(12) Remove aileron support tool from both inboard ailerons.

(13) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(14) Turn on hydraulic system B (Ref. 29-11-00).

(15) Slowly cycle control column through several full pitch-up to pitch-down cycles. Visually verify that roll disconnect clears all structure and equipment. Verify that roll disconnect switch wires clear shield and that wires are not put under load during extremes of pitch travel.

(16) Slowly cycle control wheel through several full left and right roll cycles. Verify that full aileron control travel is available (use surface position indicator). Visually verify that roll disconnect arms clear all structure and equipment.

CAUTION: SUDDEN RELEASE OF THE ROLL DISCONNECT HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(17) On center console, pull up the ROLL DISC handle and turn it 90 degrees to the left to lock. Verify that roll disconnect handle lights come on and that roll disconnect has separated (hold one control wheel and rotate other control wheel). Release control wheels.

CAUTION: SUDDEN RELEASE OF THE ROLL DISCONNECT HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(18) Release ROLL DISC handle and allow handle to retract against console. Roll disconnect handle light must go out.

(19) Turn off hydraulic pressure.

(20) Install center console forward and aft trim panels on both sides of console.

(21) Install Captains and First Officers seats (Ref. 25-11-01, 25-11-02).

ROLL DISCONNECT MECHANISM AND LOST MOTION DEVICE ADJUSTMENT AND TEST

1. Adjustment/Test

These procedures must be used to perform an operational test (Ref. Para. 4) and a rigging check and adjustment (Ref. Para. 5) of the roll disconnect mechanism and lost motion device.

2. Equipment and Materials

Rig Pin - 5/16-inch diameter by 3 inches long (R3)

Pull Scale, capable of indicating 50 lb. pull

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R R	23-51-09	Headset Stowage and Microphone Selector Console Assembly - Removal and Installation
	24-11-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Test

A. Lost Motion Device

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 210, verify that circuit breaker IND LT - PILOTS (J2) is closed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on electrical power (Ref. 24-41-00).

(3) Turn on hydraulic system B or C (Ref. 29-11-00).

R R (4) Remove headset stowage and microphone selector console assembly in flight station (Ref. 23-51-09), or open access door 112AB to forward electronic service center (Ref. 6-40-00).

(5) Install rig pin R3 through bracket and First Officers torque limiter to lock aileron controls (Ref. Fig. 501) in neutral position. (Position control wheel to allow rig pin installation in torque limiter.)

CAUTION: DO NOT TURN OFF HYDRAULIC POWER WITH RIG PINS INSTALLED IN ANY PART OF FLIGHT CONTROL SYSTEM. REMOVE RIG PINS BEFORE TURNING OFF HYDRAULIC POWER.

(6) Verify that ROLL DISC handle on center console is in the fully retracted position (against console) and that handle lights are out.

(7) Check lost motion device by rotating First Officers control wheel in both directions. Verify that control wheel can rotate approximately 13 degrees left and right from neutral before lost motion device limits are contacted.

(8) Pull up and lock ROLL DISC handle to uncoupled position. Verify that handle lights come on.

NOTE: Pulling up on ROLL DISC handle actuates roll disconnect to uncouple control wheels, and actuates lost motion device to eliminate lost motion.

(9) Check lost motion device by attempting to rotate First Officers control wheel in both directions. Verify that control wheel lost motion is eliminated. Control wheel motion is prevented by rig pin.

(10) Unlock ROLL DISC handle and allow handle to retract against panel. Verify that handle lights go out.

NOTE: The lost motion control system includes an actuation bungee that extends through the torque limiter hollow shaft. The bungee can contact the side of the hollow shaft during mid-stroke of the bungee. This contact is acceptable as long as the lost motion release spring can

release the lost motion device. The next step verifies release of the lost motion device.

(11) Check lost motion device by rotating the First Officers control wheel in both directions. Verify that control wheel can rotate approximately 13 degrees left and right from neutral before lost motion device limits are contacted. Release control wheel.

(12) Remove rig pin from torque limiter.

R (13) Check First Officers control wheel for excessive
R movement during roll disconnect operation as follows:

(a) Cycle ROLL DISC handle through full roll disconnect operations for several cycles.

R (b) Check for First Officers wheel movement during
R ROLL DISC handle operation. If definite rotation
R can be seen or with hands resting on wheel if
R definite rotation can be felt, check rigging of interconnecting pushrods between control columns, and pushrod between First Officers control column and the right torque limiter.

R NOTE: First Officers control wheel rotation will be minimum when, with ROLL DISC handle pulled out and hydro on, above pushrods are adjusted for free fitting R5 rig pins in roll output bellcranks on bottom of both control columns and free fitting R3 rig pin in First Officers torque limiter (Ref. Captains and First Officers Control Wheel Linkage rigging, 27-11-00, Para. 5B).

(14) Install panel or close access door 112AB to forward electronic service center.

(15) If no further checks are to be made, turn off hydraulic and electric power.

B. Roll Disconnect Mechanism

(1) Accomplish Steps 4A(1) through 4A(3).

(2) Verify that ROLL DISC handle is fully retracted (against console). Handle light must be out.

(3) Check that roll disconnect is coupled by holding one control wheel and attempting to rotate other control wheel. Control wheels must be locked together.

(4) Attach a pull scale to the ROLL DISC handle and measure force required to pull handle to the extended position. Maximum allowable force at any point in travel between retracted position and the extended position where handle can be rotated locked is 40 lbs. Lock handle in extended position and verify handle light is on.

(5) Set pitch trim at zero. Check that control wheels are uncoupled by holding one control wheel and rotating the other control wheel. While operating control wheels, verify that clutch teeth are not contacting (no roughness should be felt in control wheels).

(6) Repeat Step 4B(5) with pitch trim at 10. (Roll disconnect cable tension changes as control column is stroked.)

(7) Unlock ROLL DISC handle and allow handle to retract against panel.

(8) Position both control wheels towards neutral. When wheels become symmetrical, a loud thump will indicate engagement of spring-loaded dog clutch on roll disconnect, and handle light must go out. Verify that control wheels are coupled by holding one control wheel and attempting to rotate other control wheel.

(9) Turn off hydraulic power (Ref. 29-11-00).

(10) Turn off electrical power (Ref. 24-41-00).

5. Rigging Check and Adjustment

A. Roll Disconnect Mechanism

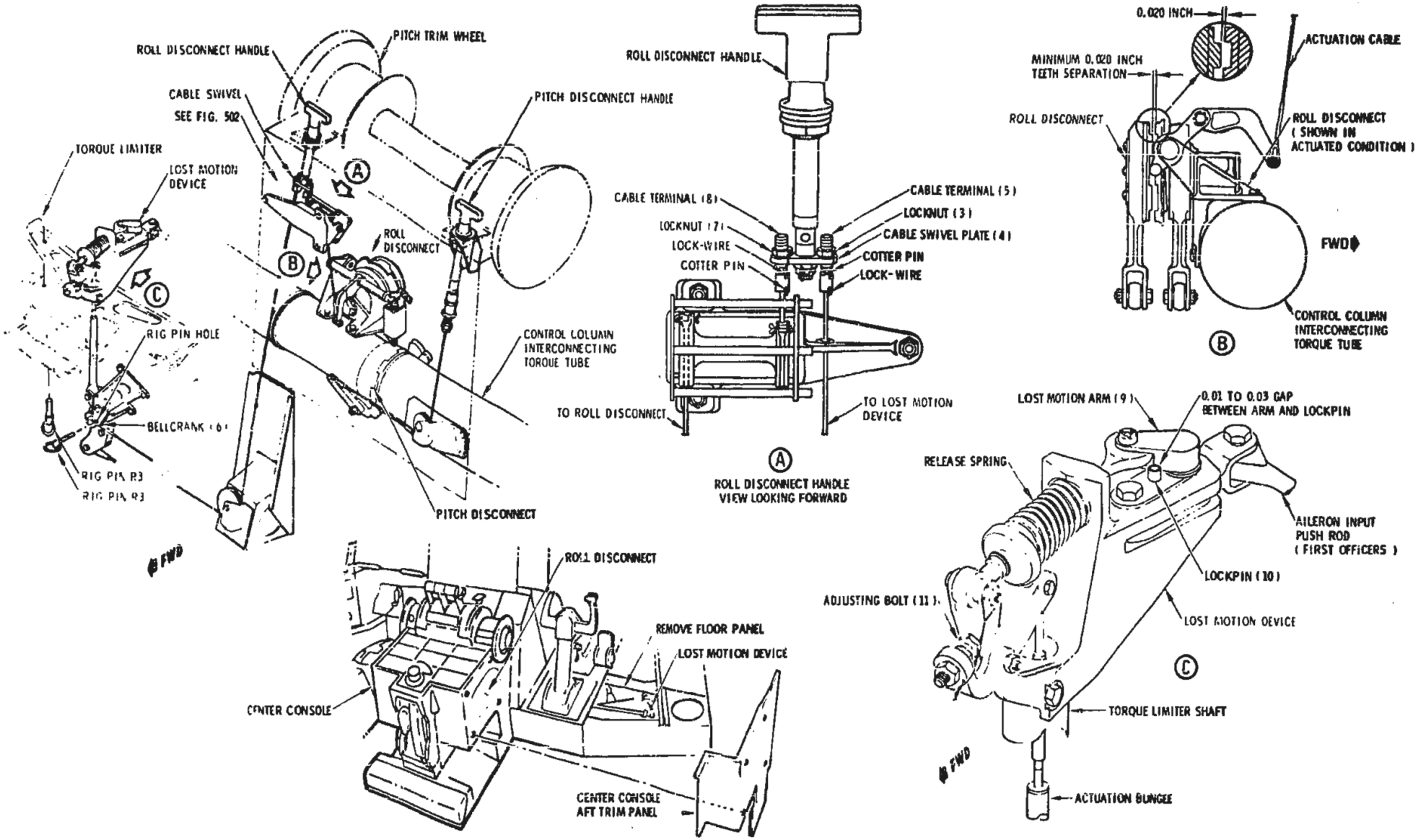
(1) Remove center console right aft trim panel (Ref. Fig 501).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

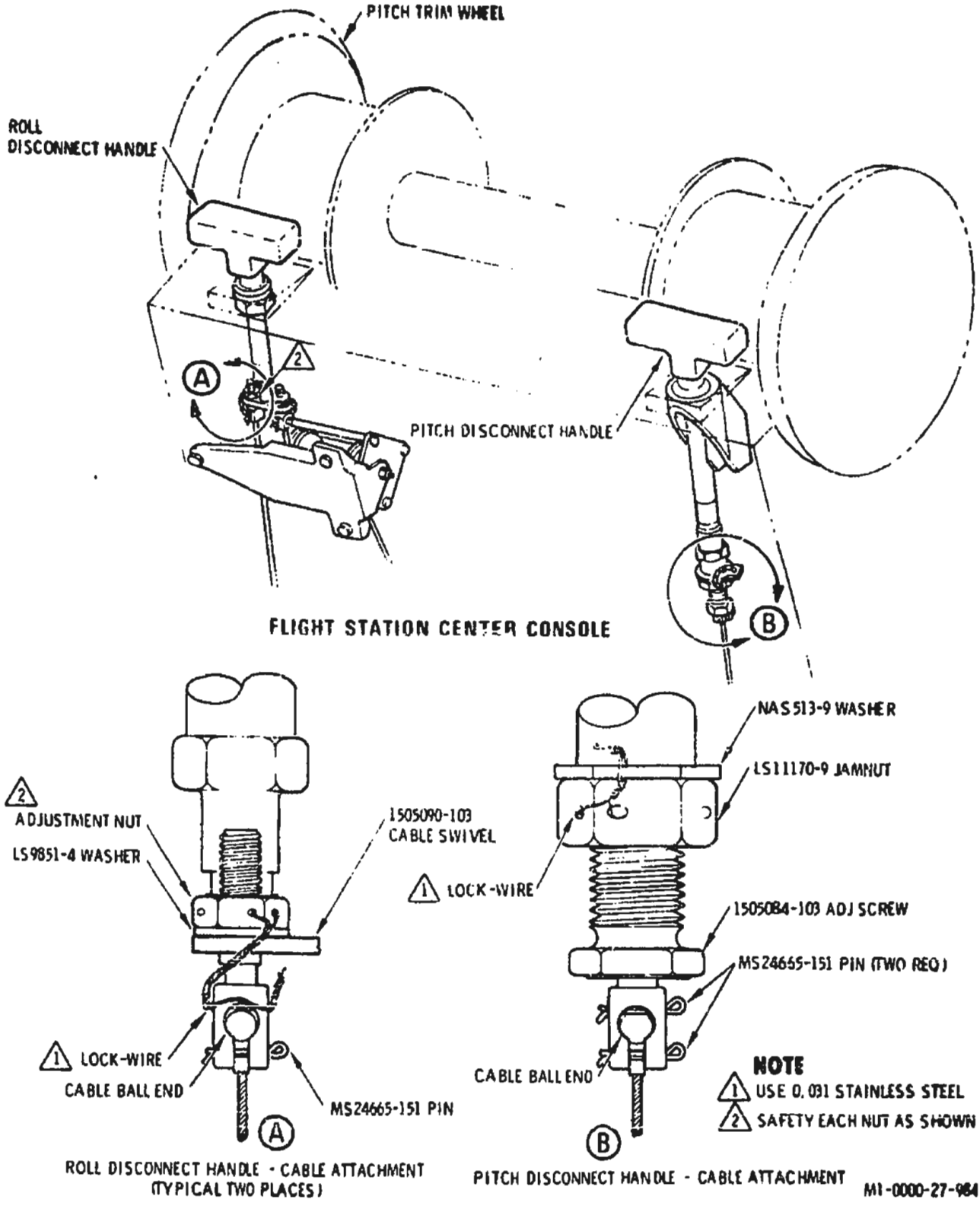


CR Roll Disconnect Mechanism and Lost Motion Device
CR Rigging Check and Adjustment
CR Figure 501

M1-0000-2

EFFECTIVITY: ALL

0018



CR Pitch and Roll Disconnect Handle-Cable Attachment
CR Figure 502

(2) Turn on hydraulic system B or C (Ref. 29-11-00).

(3) Pull ROLL DISC handle and lock in the fully extended position.

(4) Check that the roll disconnect teeth are separated by a minimum of 0.020 inch. Check for minimum 0.020-inch tooth separation while control column is stroked from full forward (pitch down) to full aft (pitch up). If minimum tooth separation is not obtained, adjust as follows:

(a) Release ROLL DISC handle against console to release cable tension.

(b) Loosen locknut (7). Thread cable terminal (8) into cable swivel plate (4).

(c) Recheck cable adjustment [Steps 5A(3) and 5A(4)].

(d) Tighten locknut. Lock-wire locknut to top hole in associated cable anchor.

NOTE: Verify that bottom hole of cable anchor has cotter pin to retain cable ball in cable anchor.

(5) If a cable adjustment is made, perform Operational Test (Para. 4B).

(6) Install center console right aft trim panel if no further rigging checks are to be made.

(7) Turn off hydraulic power (Ref. 29-11-00).

B. Lost Motion Device

(1) Remove center console right aft trim panel (Ref. Fig. 501).

(2) Remove floor panel on step just to right of First Officers control column.

(3) Open access door 112AB to forward electronic service center (Ref. 6-40-00).

(4) Verify that all hydraulic power is turned off (Ref. 29-11-00).

(5) Verify that ROLL DISC handle is in the fully retracted position (against console).

(6) From forward electronic service center, insert rig pin R3 through bracket and bellcrank (6) beneath first officers torque limiter.

CR (7) Apply a 1 to 3 pound tension load to cable by pulling
CR on bellcrank (6) with a spring scale. Apply load in
CR line with the cable. With roll disconnect handle in
CR the down position, adjust bolt (Fig. 502, Detail A) on
CR cable until rig pin R-3 can move freely with the 1 to 3
CR pound tension load on cable. Remove rig pin R-3 and
CR spring scale.

CR (8) At lost motion lockout, adjust bolt (11) on arm until
CR there is a gap of 0.01 to 0.03 inch between lost motion
CR arm (9) and lockpin (10).

CR NOTE: The gap between lost motion arm (9) and lock pin
CR can be up to 0.085 inch, providing system
CR fucntions properly, that all lost motion is
CR removed when handle is pulled and providing less
CR than 40 pounds is required to activate the
CR system thru the roll disconnect handle.

(9) Remove rig pin from bellcrank (6).

(10) If a cable or bolt adjustment is made, cycle ROLL DISC handle a minimum of three times. Reinstall rig pin, and recheck cable tension and lockpin gap. Lock-wire cable swivel locknut to top hole in associated cable anchor. Lock-wire adjusting bolt on lost motion device.

NOTE: Bottom hole of cable anchor has cotter pin to retain cable ball in cable anchor.

(11) If a cable or bolt adjustment is made, perform Operational Test (Para. 4A).

(12) Install floor panel.

(13) Install console trim panel.

(14) Close access door 112AB.

R # ROLL DISCONNECT HANDLE - MAINTENANCE PRACTICES

R 1. General

R This pageblock contains instructions for the relamping of the
R roll disconnect handle.

R 2. Referenced Procedures

R 24-41-00 External Power/Ground Service System - Maintenance
R Practices

R 3. Maintenance Practices

R A. Relamping Roll Disconnect Handle

R (1) Insert small diameter tool (lockwire, ballpoint pen,
R etc.) in hole on either end of T-handle to depress lens
R clip and remove lens.

R (2) Remove reflector and lampholder assembly. Note
R orientation of assembly to T-handle for reassembly.

R (3) Invert assembly and remove metal plate at bottom of
R assembly.

R (4) Press lamps out bottom of assembly.

R (5) Install new lamps.

R (6) Reinstall metal plate. Insure hole in plate is offset
R from center lamp.

R (7) Reinstall reflector and lampholder assembly. Insure
R center lamp is offset from metal spike in T-handle.
R Hole in metal plate should align with spike.

R (8) Reinstall lens. Insure lens clips are seated in holes
R on either end of T-handle.

R (9) Perform functional test of lamps as follows:

R (a) On Flight Engineer/Second Officers overhead
R circuit breaker panel CB2, verify circuit breaker
R IND LT-PILOTS (J2) is closed.

R (b) Turn on electrical power (Ref. 24-41-00).

R R (c) Pull disconnect handle. Lamps should be on with handle extended, and out with handle retracted.

R (d) Return handle to the retracted position.

R R (e) Turn off electrical power if no longer required (Ref. 24-41-00).

R ROLL DISCONNECT HANDLE - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Rig Pin - 5/16-inch diameter by 3 inches long (R3)

R Lock-Wire, Fed. Spec. QQ-W-390, Cond A, 0.032-inch diameter, or
R equivalent

R 2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R R	24-41-00	External Ground/Power System - Maintenance Practices
R R	25-11-02	First Officers Seat Assembly - Removal and Installation
R R	27-11-03	Roll Disconnect Mechanism and Lost Motion Device - Adjustment and Test

R 3. Removal/Installation

R WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC
R SERVICE PANEL, ZONE 147.

R A. Removal (Ref. Fig. 401)

R (1) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, open and tag circuit
R breaker IND LT - PILOTS (J2).

R (2) Remove First Officers seat (Ref. 25-11-02).

R (3) Remove the center console forward and aft trim panels
R on the right side of the console (Ref. Fig. 401).

R (4) Remove the floor panel (on the step) between the First
R Officers control column and the right side console to
R expose the lost motion device (Ref. Fig. 401).

R (5) Verify that ROLL DISC handle on center console is in
R the fully retracted position (against console) and that
R handle lights are out.

R (6) Remove the cotter pin from the swivel plate nut (1). Remove swivel plate nut and washer and retain for re-installation (Ref. Fig. 401, View A).

R (7) Remove cable swivel plate with roll disconnect cables attached and stow until installation of new handle.

R (8) Tag for identification and disconnect the two roll disconnect handle wires from the terminal module at throttle stand. Note location of wire ties and remove ties and clamps.

R (9) Remove lock-wire from locknut (2) and remove locknut and spacer (Ref. Fig. 401, View A).

R (10) Remove roll disconnect handle assembly from throttle stand.

R B. Installation (Ref. Fig. 401)

R (1) Insert roll disconnect handle assembly through mounting hole in throttle stand. Verify that handle assembly tang engages mounting hole slot.

R (2) Install spacer and locknut on handle assembly shaft. Verify that spacer slot engages the handle tang. Tighten nut and lock-wire nut to spacer.

R (3) Verify that roll disconnect handle is released and retracted against the console.

R (4) Install cable swivel plate (3) on handle assembly shaft and retain with swivel plate nut and washer (1). Tighten nut and install cotter pin (Ref. Fig. 401, View A).

R (5) Connect the two roll disconnect handle wires to the throttle stand terminal module and secure as noted during handle removal, Step (8).

R (6) Operate roll disconnect handle through several cycles. Verify normal operation of the handle, (handle rotates and locks in the extended position). Verify that the roll disconnect and lost motion device cables are properly positioned on their pulleys.

R (7) Remove tag and close circuit breaker IND LT - PILOTS (J2).

R (8) Turn on electric power (Ref. 24-41-00).

R (9) Check handle light operation. With handle retracted against console, handle light should be out. With handle extended handle light should be on.

R (10) Check the roll disconnect and lost motion device cable adjustments as follows:

R (a) Open ACCESS door 112AB to forward electronic service center (Ref. 6-40-00).

R (b) Verify the roll disconnect handle is in the fully retracted position (against console), and install rig pin R3 through bracket and bellcrank (6) beneath First Officers torque limiter, (Ref. Fig. 401).

R (c) With handle retracted and rig pin installed, there must be slight tension on the cable between handle and bellcrank and a 0.01 to 0.03 inch gap between lost motion arm (9) and lockpin (10), (Ref. Fig. 401, view C).

R (d) Remove rig pin R3 from bell crank (6).

R (e) Pull roll disconnect handle and lock in the fully extended position.

R (f) With handle extended check that the roll disconnect teeth are seperated by a minimum of 0.20 inch, (Ref. Fig. 401, view B).

R (11) If a cable adjustment is needed refer to 27-11-03 Paragraph 5 of Adjustment Test procedures.

R (12) Verify that the console and lost motion device areas are clear of all tools and equipment.

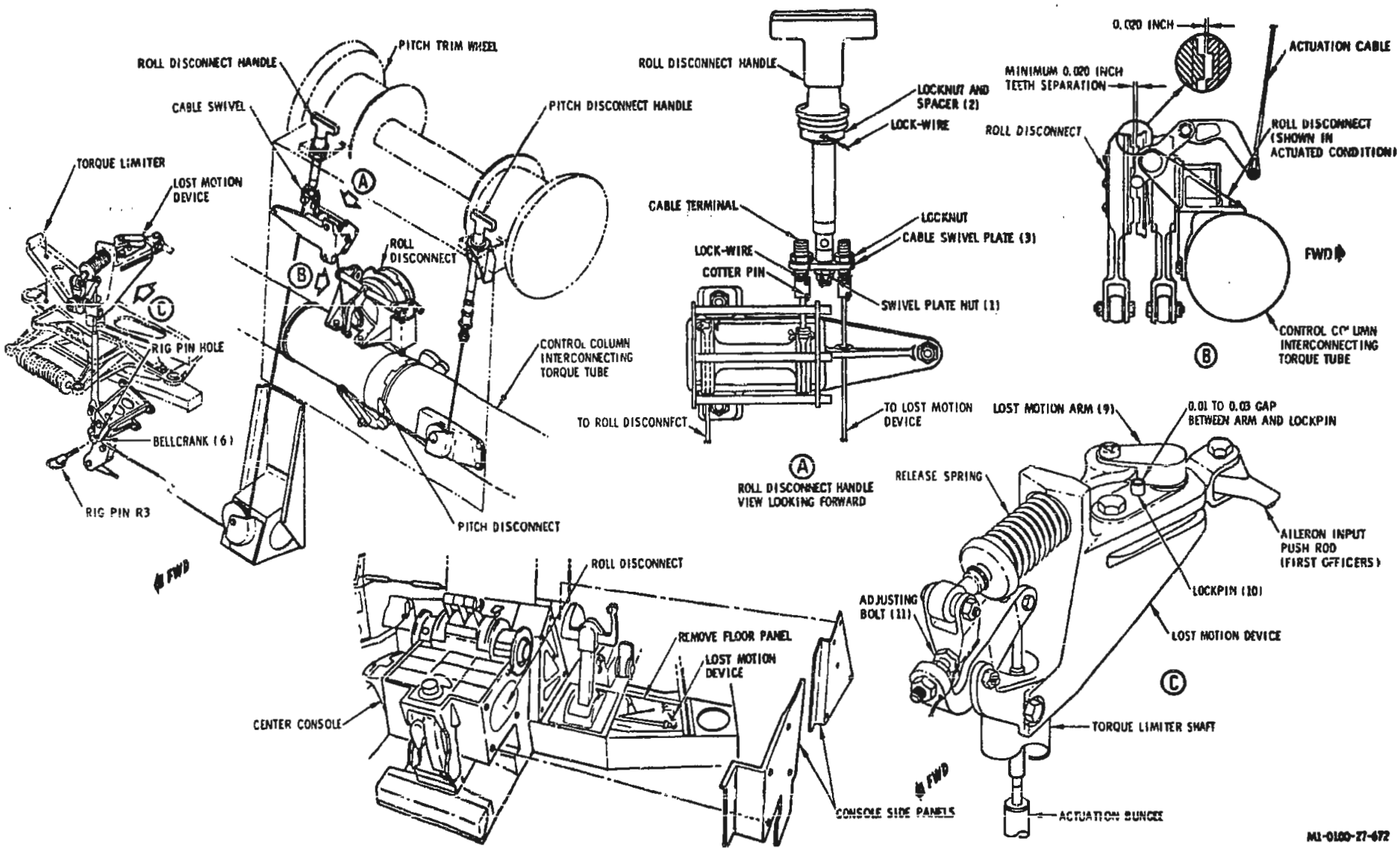
R (13) Install the console forward and aft trim panels and the floor panel between the First Officers control column and the right side console.

R (14) Install the First Officers seat (Ref. 25-11-02).

R (15) Remove tags from hydraulic control panels.

R (16) Turn off electrical power if no longer required (Ref. 24-41-00).

R (17) Close access door 112HB to forward electronic service center.



R R Roll Disconnect Handle - Removal and Installation
Figure 401

R R 001B EFFECTIVITY: ALL

AILERON CONTROL TORQUE LIMITER ASSEMBLY - REMOVAL AND INSTALLATION

1. General

Removal and installation of Captains and First Officers torque limiter are the same unless otherwise noted. First Officers torque limiter includes lost motion device mounted on top of the torque limiter.

2. Equipment and Materials

Cotter Pin, MS24665-153

Aileron Support Tool, PN BF90, or equivalent

Rig pins, 5/16-inch diameter by 3 inches long (R3), 4 inches long (R4), and 5 inches long (R5) (Part of rig pin kit B735)

Lockclad Cable Tensiometer, Pacific Scientific PN 1601009, or equivalent

Lock-Wire, QQ-W-390, Temp A, 0.032 DIA

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	6-50-00	Interior Access Doors and Panels
	24-41-00	External Ground/Power System - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	27-11-34	Aileron Control Torque Limiter Position DFDR Potentiometer - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices
	31-31-00	Digital Flight Data Recorder (DFDR) System - Adjustment and Test

4. Removal/Installation

A. Removal

(1) Open access door 112AB to gain access to forward electronic service center (FESC) (Ref. 6-40-00).

(a) Remove equipment on and around upper self of forward shelf and upper shelf.

(b) Place protective cover on lower shelf of forward rack.

(c) Remove waveguide attached to left side of rack.

(d) Remove left and right stick shaker guard box.

(2) In flight station, accomplish following steps:

(a) Remove Captains and First Officers crew chairs.

(b) Remove both control column shields and shrouds (Ref. 401, Sheet 1).

(c) Remove flight station floor panels 211AB, 211BB, 212AB and 212CB (Ref. 6-50-00).

(3) In main cabin, zone 260, accomplish following steps:

(a) Remove necessary seats.

(b) Remove floor panels 261GB and 262CB (Ref. 6-50-00).

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R (4) Verify all hydraulic power is turned off and tag hydraulic control panels against operation (Ref. 29-11-00).

(5) Manually position both inboard ailerons to neutral (±0.12 inch) and install aileron support tool on both inboard ailerons (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron faired index is a red paint-filled dimple on the No. 3 flap torque box. Align inboard aileron lower surface with faired index.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

R On aircraft without SB27-162,
R inboard aileron neutral is with aileron faired.

R On aircraft with SB27-162,
R inboard aileron neutral is with aileron 1.5
R degrees up from faired.

R Inboard ailerons are positioned to neutral to unload aileron control linkage.

(6) Open and tag following circuit breakers:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

FCES COMP - AC AND L-AOA (B5)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

FLT STA MISC - R AOA (F1)

(c) On Flight Engineer/Second Officers vertical circuit breaker panel CB3, zone 215:

AIDS/FLT RCDR - DC (H10), A (H11), B (H12), C (H13)

(7) From FESC, tag and disconnect DFDR potentiometer wires from terminal boards (Ref. 27-11-34).

(8) From flight station, tag and disconnect jam sensing switch wires from jam sensing switch screw terminals.

(9) From flight station, disconnect roll output pushrod from torque limiter arm by removing bolt, washer, and nut.

NOTE: On First Officers torque limiter, roll output pushrod is connected to lost motion device arm.

(10) Disconnect aileron cables from torque limiter as follows:

(a) Attach bungee cables (shock cord) or apply cable clamp blocks to aileron cables to prevent fouling of slack cables during torque limiter removal.

(b) At the aileron cable turnbuckles next to torque limiter, remove cable tension by removing turnbuckle safety clips and rotating turnbarrels until load is removed from cables.

NOTE: If forward turnbuckles do not have enough adjustment to unload cables, use turnbuckles in galley ceiling for additional adjustment.

(c) Disconnect aileron cables from torque limiter by removing attaching nut, washer, and bolt.

(11) For removal of First Officers torque limiter, disconnect lost motion device actuation bungee from bellcrank below torque limiter by removing bolt and nut (Ref. Fig. 401).

(12) For removal of either torque limiter, remove bolts, washers, and nuts securing torque limiter supports to floor beam.

(13) Remove torque limiter.

(14) For removal of First Officers torque limiter, remove lost motion device from torque limiter by removing clamp bolt and sliding lost motion device off torque limiter spline.

B. Installation

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Verify all hydraulic power is turned off and hydraulic control panels are tagged (Ref. 29-11-00).

(2) Verify correct orientation of torque limiter spring cartridge. Cartridge must be installed with head of internal bolt inboard and internal guide outboard (Ref. Fig. 402). R

(3) For installation of First Officers torque limiter, place lost motion device on torque limiter spline, and align clamp bolt holes, and secure with clamp bolt, washer, and nut.

(4) For installation of either torque limiter, place torque limiter in mounted position between floor beams and install bolts, washers, and nuts.

NOTE: Bolt heads must face outboard.

(5) Connect aileron control cables to torque limiter arms with bolt, washer, and nut, cotter pin. Remove control cable restraints installed by Step 4A(10)(a).

(6) In main cabin, zone 260, install rig pin (R4) through bracket and aft cable bellcrank (13) or (15) (First Officer) to lock aileron cables in neutral (Ref. Figure 401). (6) In main cabin, zone 260, install rig pin (R4) through bracket and aft cable bellcrank (13) (Captains) or (15) (First Officer) to lock aileron cables in neutral (Ref. Figure 401).

NOTE: If aircraft contains roll trim bias (Ref. 27-11-00, Adjustment and Test, Roll Trim Bias Table 501 or decal under alternate landing gear control cover) position roll trim controls in neutral rig (primary control wheel and trim control wheel) to permit installation of the following rig pins:

(7) Rig aileron cables by adjustment of turnbuckes (14) (Captains cables), or turnbuckles (18) (First Officers cables) until following conditions are met (Ref. Fig. 401):

(a) Rig pin (R3) can be freely inserted in torque limiter.

(b) Cable tension conforms to temperature conversion chart (Ref. Fig. 401, Sheet 1).

(c) After rigging cables, safety turnbuckles.

(8) If First Officers torque limiter was replaced, accomplish following:

(a) Connect lost motion actuation bungee to bellcrank (6) below torque limiter with bolt, nut, and cotter pin (Ref. Fig. 401, Sheet 2).

(b) With ROLL DISC handle fully retracted against console, insert rig pin (R3) through bracket and bellcrank (6).

(c) With rig pin (R3) in bellcrank (6), there must be 0.01 to 0.03 inch gap between lost motion arm (9) and lockpin (10).

(d) If not, loosen locknuts on lost motion device and adjust bolt (11) and tighten locknuts and lock-wire (Ref. Fig. 401, Sheet 2, View C).

(e) Remove rig pin from bellcrank (6).

(f) Cycle ROLL DISC handle through several roll disconnect cycles and verify normal operation of roll disconnect and lost motion cable system.

(g) Visually verify normal operation of lost motion device.

(9) Connect and check rig of roll output bellcrank as follows:

(a) Pull up and lock ROLL DISC handle in extended position.

(b) Insert rig pin (R5) through roll output bellcranks and control column at bottom of control column (Ref. Fig. 401, Sheet 1).

(c) With rig pin (R3) in torque limiter, connect roll output pushrod to torque limiter arm with bolt, washer, nut and cotter pin.

NOTE: If connecting bolt cannot be freely inserted, adjust length of roll output pushrod.

(d) Lock-wire rod-end locknut after adjustment, and verify that lock-wire tab is on aft side of pushrod.

(e) Release ROLL DISC handle and allow handle to retract against console.

(10) Connect DFDR potentiometer wires to terminal boards in accordance with Fig. 401, Sheet 2.

(11) Connect jam sensing wires to jam sensing switch screw terminals.

(12) Remove all rig pins from aileron control system.

(13) Remove aileron support tool from both inboard ailerons.

(14) Remove tags from hydraulic control panels.

(15) Remove tags and close circuit breakers opened in Step 4A(6).

C. Adjustment and Test

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic system B and C (Ref. 29-11-00).

CAUTION: CYCLING AILERONS AT A HIGH RATE CAN DAMAGE OUTBOARD AILERON DAMPER SEALS. OPERATE CONTROL WHEELS SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(3) Cycle control wheel slowly from stop-to-stop, and verify aileron controls operate normally, and verify that control wheel breakout force appears normal (approximately 3 pounds).

NOTE: "Breakout" force is the force necessary to overcome system friction and start aileron movement.

(a) Check for normal control wheel centering.

NOTE: If control wheels do not center (return to neutral when control wheel is released), check for possible cable interference.

(b) While cycling control wheels, visually verify normal operation of roll output pushrod, torque limiter, and aileron control cables in the forward electronic service center.

CAUTION: DO NOT TURN OFF HYDRAULIC POWER WITH RIG PINS INSTALLED IN ANY PART OF AILERON CONTROL SYSTEM.

(4) With control wheel released, check rig pin R3 fits freely through torque limiter, do not remove rig pin.

NOTE: If rig pin R3 is not a free fit, recheck cable rig in accordance with Steps 4B(6) and 4B(7).

(5) Rotate control wheel 40 or more degrees in either direction to exercise spring cartridge, than center control wheel.

NOTE: It requires a force of approximately 33 pounds at control wheel rim to overcome spring cartridge.

(6) Remove rig pin from torque limiter.

(7) Cycle control wheel slowly from sto-to-stop and verify aileron controls operate normally and verify control wheel breakout force appears normal (approximately 3 pounds).

(8) If First Officers torque limiter wasreplaced, accomplish following to check lost motion device:

(a) Install rig pin (R3) through bracket and First Officers torque limiter to lock aileron controls in neutral position.

(b) Verify ROLL DISC handle on center console is in fully retracted position (against console).

(c) Check lost motion device by rotating First Officers control wheel in both directions.

(d) Verify control wheel can rotate approximately 13 degrees left and right from neutral before lost motion device limits are contacted.

(e) Pull up and lock ROLL DISC handle.

NOTE: Pulling up on ROLL DISC handle actuates roll disconnect to uncouple control wheels and actuates lost motion device to eliminate lost motion.

(f) Check lost motion device by attempting to rotate First Officers control wheel in both directions, and verify control wheel lost motion is eliminated.

NOTE: Control wheel motion is prevented by rig pin.

(g) Cycle roll disconnect handle several times, and check noticeable First Officers wheel "kick" when roll disconnect operated.

NOTE: If wheel "kick" is noticeable, check for correct rigging of pushrods between Captains and First Officers control column and between First Officers control column and torque limiter.

(h) Rig pins R5 should fit freely in roll output bellcranks on bottom of both control columns, and remove rig pins.

(i) Release ROLL DISC handle and allow handle to retract against console, remove rig pin from torque limiter.

(9) Check jam warning switch operation as follows:

(a) On PFCS MONITOR panel on pilots overhead panel, verify that ROLL 1 switchlight is depressed (in).

(b) Release (out) ROLL 2 switchlight, and ROLL 2 OFF light must come on.

(c) Install rig pin (R3) in replaced torque limiter.

(d) Rotate control wheel on same side as replaced torque limiter in either direction with approximately 40-pound force.

(e) On PFCS panel on pilots overhead panel, verify following lights come on (do not rotate control wheel any more than necessary to actuate lights):

Captains (left) torque limiter:

Striped portion of AILERON L OUTBD and L INBD switchlights.

PUSH lights on SPOILER L5&6 and L&R4 switchlights

First Officers (right) torque limiter:

Striped portion of AILERON R OUTBD and R INBD switchlights

PUSH lights on SPOILER L&R2, L&R3, and R5&6 switchlight

PULL ROLL DISC light

On Caution and Warning panel the following light comes on:

FLT CONTROL PANTLS

(f) Center control wheel.

(g) Depress (in) PFCS MONITOR ROLL 2 switchlight and release ROLL 1 switchlight, and ROLL 2 OFF light must go out and ROLL 1 OFF light must come on.

(h) Repeat Steps 4C(9) (d) and 4C(9) (e).

(i) On PFCS panel, depress (in) ROLL 1 switchlight, and ROLL 1 OFF ligit must go off.

(j) Release (out) and depress (in) ROLL 2 switchlight on PFCS panel to reset computer and turn off PFCS PUSH lights.

(k) Remove rig pin from torque limiter.

(10) Check DFDRS potentiometer for proper voltage and phase output (Ref. 31-31-00).

(11) Verify all rig pins are removed from aileron control system.

(12) Turn off hydraulic power if no longer required (Ref. 29-11-00).

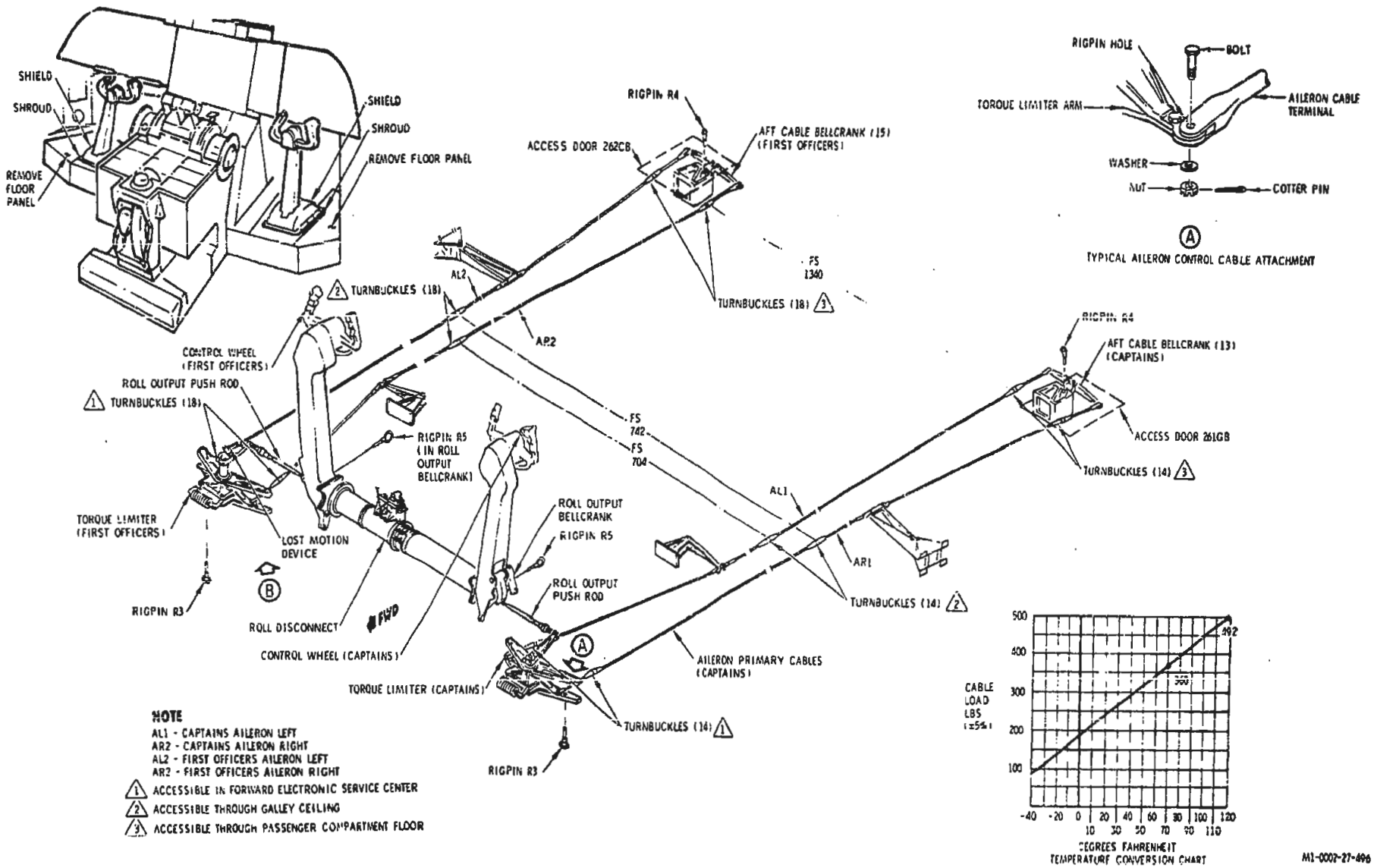
(13) Turn off electrical power if no longer required (Ref. 24-41-00).

(14) In main cabin area, check aileron control aft cable bellcrank area for tools and equipment, and install access panel and install seats.

(15) In flight stations, install floor panels, control column shroud, and shield.

(16) In FESC, install stick shaker guard, and waveguide on left side of rack, and equipment on top of rack.

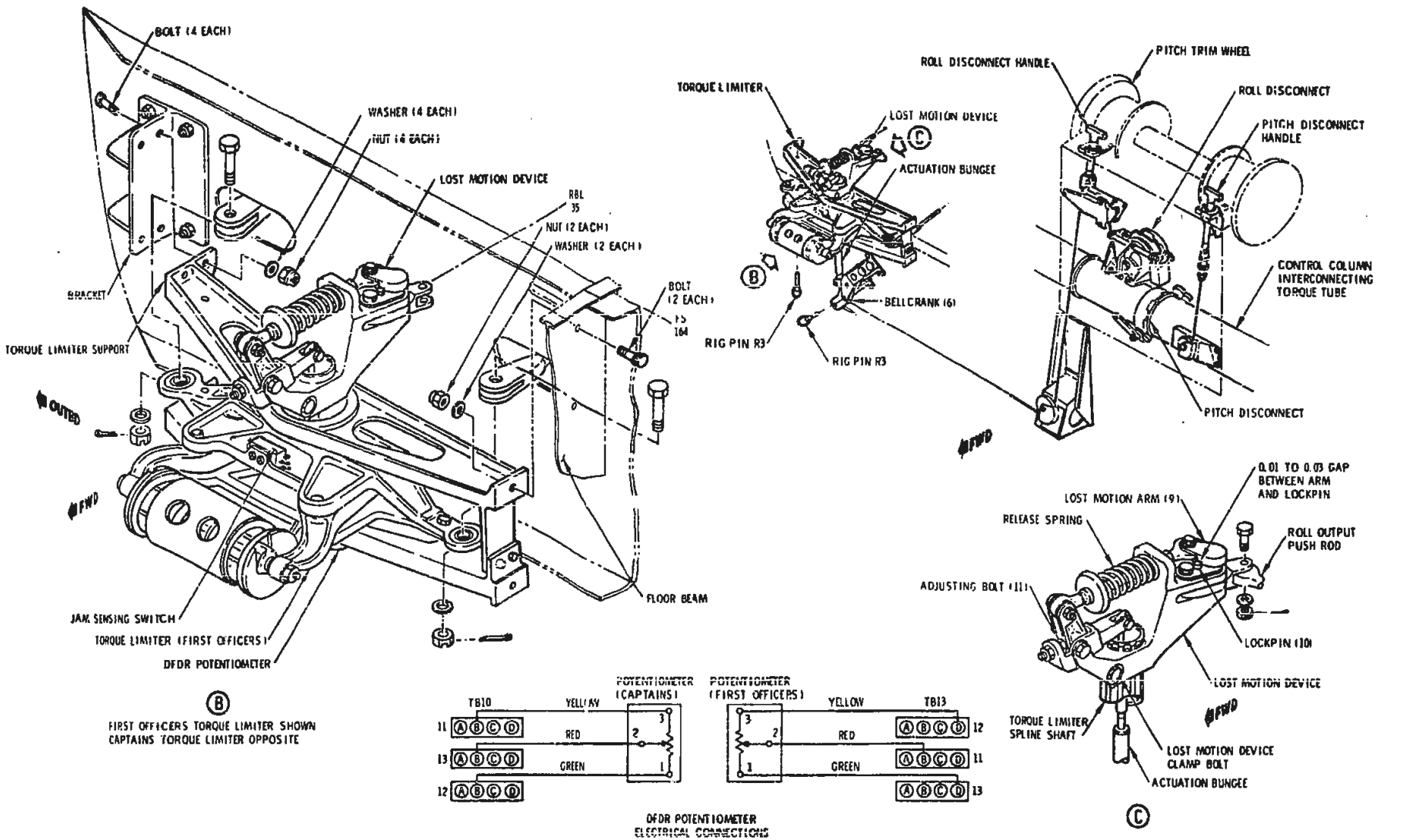
(17) Close access door 112AB to FESC.



R Aileron Control Torque Limiter - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL

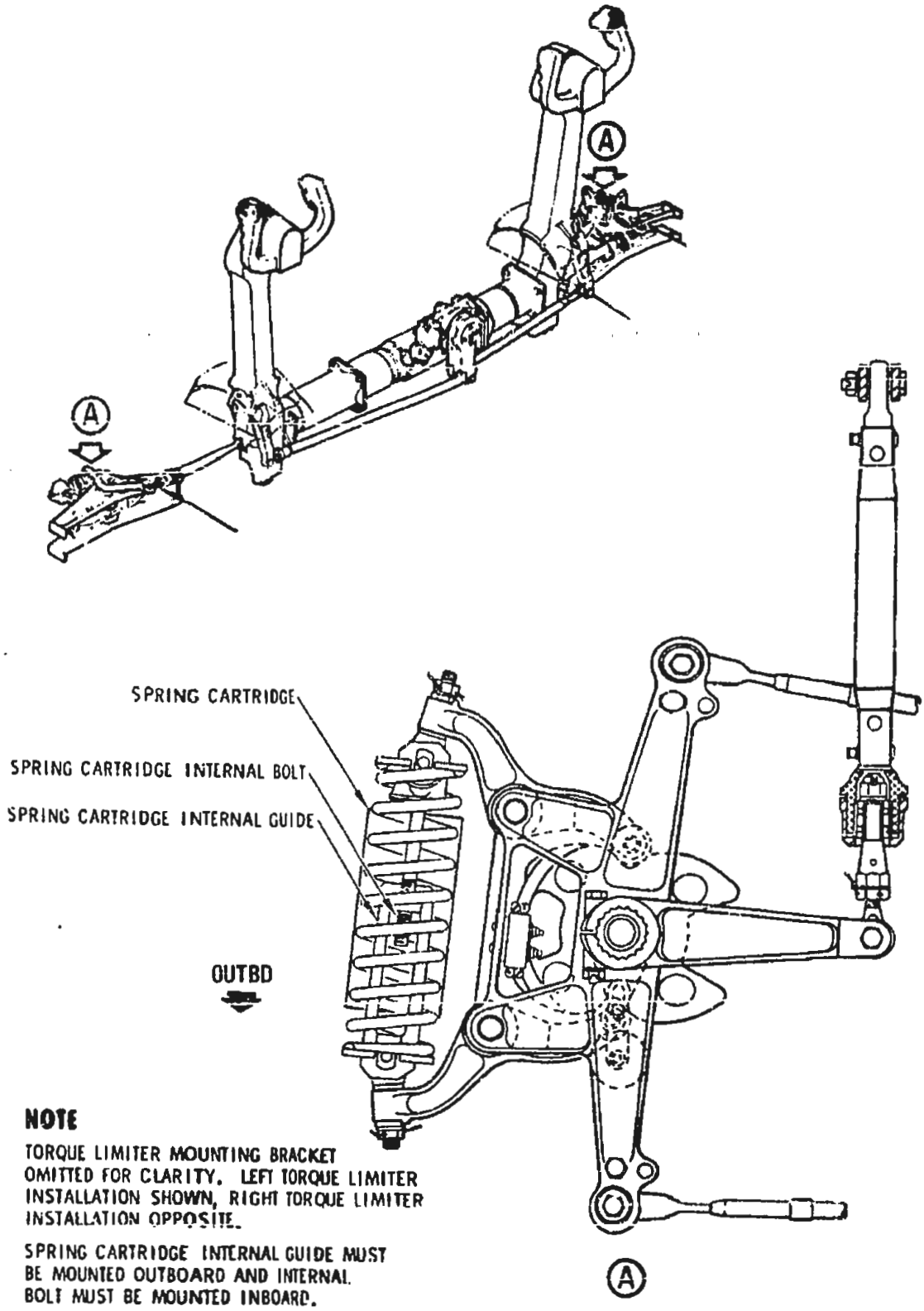
001B



M1-0101-27-497

R Aileron Control Torque Limiter - Removal and Installation
R Figure 401 (Sheet 2)

R EFFECTIVITY: ALL
R
0018



NOTE

TORQUE LIMITER MOUNTING BRACKET OMITTED FOR CLARITY. LEFT TORQUE LIMITER INSTALLATION SHOWN, RIGHT TORQUE LIMITER INSTALLATION OPPOSITE.

SPRING CARTRIDGE INTERNAL GUIDE MUST BE MOUNTED OUTBOARD AND INTERNAL BOLT MUST BE MOUNTED INBOARD.

M1-0000-27-1049

R Aileron Control Torque Limiter Spring Cartridge Installation
R Figure 402

R EFFECTIVITY: ALL
R
001B

TORQUE LIMITER JAM WARNING SWITCH - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin, 5/16-inch diameter, 3-inch long

2. Referenced Procedures

R R	6-50-00	Interior Access Doors and Removable Panels - Description and Operation
	21-00-00	Air Conditioning System - Maintenance Practices
	21-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - FCES - COMPUTERS - AC & L AOA.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker FLIGHT STATION MISC - R AOA.

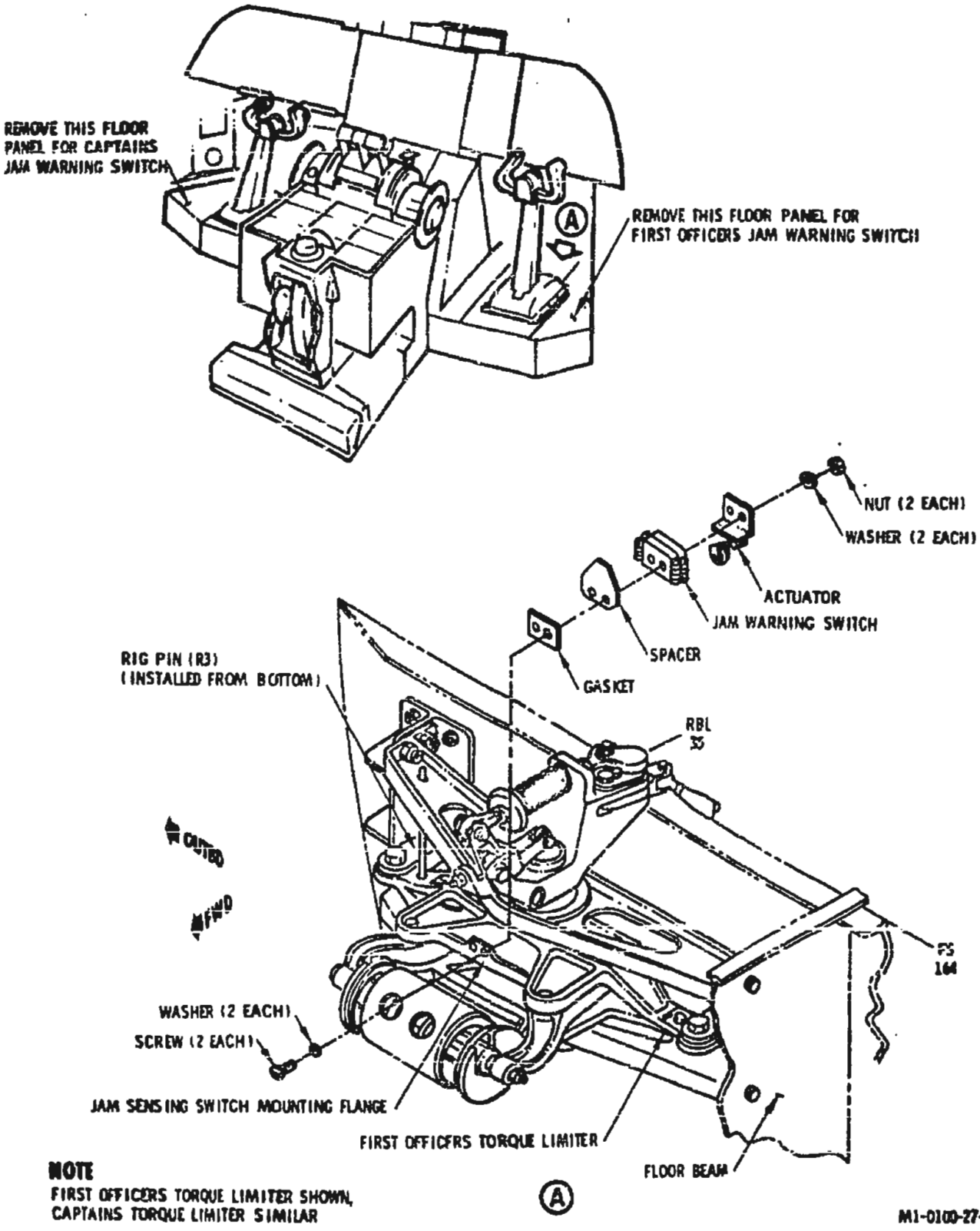
(2) In flight station, zone 210, remove floor panel between control column and side console, on side associated R with torque limiter switch to be removed (Ref. R 6-50-00).

(3) Remove two screws holding switch, switch actuator, gasket, and spacer from cable drive arm (Ref. Fig. 401).

(4) Tag for identification and disconnect interface wires from switch screw terminals. Remove switch.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.



R R Torque Limiter Jam Warning Switch - Removal/Installation
Figure 401

(2) Connect interface wires to switch screw terminals. Remove tags from wires.

(3) Assemble switch, switch actuator, spacer, and gasket, and install mounting screws and washers through assembly from actuator side.

(4) Place assembly on cable drive arm with screws installed through mounting holes. Install washers and nuts.

(5) Remove tags and close circuit breakers opened in Step 3A(1).

(6) Test switch operation as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) Verify that avionics cooling is on (Ref. 21-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(c) Turn on hydraulic systems A and B (Ref. 29-11-00).

CR (d) For testing correct wiring of torque limter
CR switches and associated FCES computer operation
CR open R AOA circuit breaker. Verify that none of
CR the AILERON striped legends or SPOILER PUSH
CR legends are illuminated. Then close R AOA circuit
CR breaker and open L AOA circuit breaker. Again
CR verify that none of the AILERON striped legends or
CR SPOILER PUSH legends are illuminated.

CR NOTE: Many fail lights associated with FCES
CR computer operation will illuminate but are
CR not being checked as a part of this test.
CR These lights may be reset and test
CR continued.

(e) For testing Captains torque limiter switch, install rig pin (R3) in Captains torque limiter

and turn Captains control wheel with approximately 40-pound force.

On PFCS panel, verify the following lights come on:

Striped portion of AILERON L OUTBD and L INBD switchlights

PUSH legend on SPOILER L5&6 and L&R4 switchlightsPULL ROLL DISC light

On caution and warning panel the following light comes on:

FLT CONTROL PANELS

(f) Release control wheel.

(g) For testing First Officers torque limiter switch, install rig pin in First Officers torque limiter and turn First Officers control control wheel with approximately 40-pound force.

On PFCS panel, verify the following lights come on:

Striped portion of AILERON R OUTBD and R INBD switchlights

PUSH legend on SPOILER L&R2, L&R3 and R5&6 switchlights

PULL ROLL DISC light

On caution and warning panel the following light comes on:

FLT CONTROL PANELS

(h) Release control wheel.

(i) Release (for two seconds or more) and depress ROLL 1 switchlight to reset computer and turn off striped AILERON legends and SPOILER PUSH legends.

(j) Depress PFCS MONITOR ROLL 2 switchlight to on, and release ROLL 1 switchlight to OFF.

(k) Repeat Steps (e) through (h) for ROLL 2 channel.

(l) On PFCS panel, depress ROLL 1 switchlight.

(m) Release (for two seconds or more) and depress ROLL 2 switchlight to reset computer and turn OFF striped AILERON legends and SPOILER PUSH legends.

(n) Remove rig pin from torque limiter.

(o) Turn off hydraulic power (Ref. 29-11-00).

(p) Turn off electrical power (Ref. 24-41-00).

(7) Install floor panel removed in Step 3A(2).

R # LOST MOTION DEVICE - REMOVAL AND INSTALLATION

R 1. General

R One lost motion device is installed in the flight control system
R and is attached to the top of the First Officers torque limiter.

R 2. Equipment and Materials

R Aileron Support Tool, PN BF90, or equivalent

R Rig pins, 5/16-inch diameter by 3 inches long (R3) and 5 inches
R long (R5) (Part of rig pin kit B735)

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032 inch diameter, or
R equivalent

R 3. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	24-41-00	External Ground/Power System - Maintenance Practices
R	25-11-02	First Officers Seat Assembly - Removal and Installation
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 4. Removal/Installation

R WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC
R SERVICE PANEL, ZONE 147.

R A. Removal

R (1) Manually position both inboard ailerons to
R approximately neutral and install aileron support tool
R (Ref. 27-11-00, Fig. 513). (This step unloads aileron
R control system.)

R (2) In right wheel well, remove bolt connecting First
R Officers aft bellcrank output pushrod (1) to bellcrank
R (2) (Ref. Fig. 401) to disconnect First Officers

R primary aileron control cable system from pushrod
R system. (Do not tamper with pushrod adjustment.)

R (3) Remove First Officers seat assembly (Ref. 25-11-02).

R (4) Remove the floor panel (on the step) between the First
R Officers control column and the right side console to
R expose the lost motion device (Ref. Fig. 401).

R (5) Remove shroud from bottom of First Officers control
R column. Remove screws attaching control column shield
R to floor.

R (6) Verify that the ROLL DISC handle on right side of
R center console is not actuated (handle should be
R retracted against console).

R (7) On the lost motion device, disconnect bolt and remove
R long bushing attaching actuating bungee rod-end (3)
R from actuation lever (4). (Actuation bungee goes
R through hollow torque limiter spline shaft.)

R (8) Remove bolt that connects First Officers roll output
R pushrod (5) to the lost motion input arm (6).

R (9) Remove bolts that connect lost motion device release
R spring cartridge (7) to lost motion forward lever (8)
R and aft arm (9). Spring cartridge will be retained on
R lost motion device.

R NOTE: Spring cartridge is disconnected to provide
R vertical clearance for removing lost motion
R device.

R (10) Remove bolt that clamps lost motion device to torque
R limiter spline shaft.

R (11) Rotate lost motion device to clear floor structure and
R pull up to disengage from torque limiter spline shaft.
R Remove lost motion device.

R (12) Reinstall bolts connecting lost motion device spring
R cartridge to forward lever and aft arm.

R B. Installation

R (1) On replacement lost motion device, remove bolts
R attaching spring cartridge (7) to forward lever (8) and
R the aft arm (9). Leave spring cartridge loose on lost
R motion device.

R NOTE: Do not attempt to disassemble and remove spring
R cartridge from lost motion device. Spring
R cartridge is adjusted in shop to provide a
R specific preload.

R (2) Position lost motion device on torque limiter spline
R shaft so that clamp bolt holes in lost motion device
R are aligned with bolt slot in the torque limiter
R spline. Rotate torque limiter clockwise so that lost
R motion device can clear floor structure.

R (3) Slide lost motion device down on torque limiter spline
R and install clamp bolt, washer, and nut.

R (4) Verify that short bushing is installed in the lost
R motion device forward lever and the aft arm, then
R connect spring cartridge (7) to the forward lever (8)
R and aft arm (9) with attaching bolt, washer, and nut.
R Install cotter pins.

R (5) Connect actuating bungee rod-end (3) to actuating lever
R (4) with long bushing, bolt, washer, and nut. Install
R cotter pin.

R (6) Adjust and connect First Officers roll output pushrod
R (5) as follows:

R (a) From forward electrical service center (FESC),
R install rig pin R3 through First Officers torque
R limiter bracket and torque limiter to lock
R controls in neutral (Ref. Fig. 401).

R (b) In flight station, lift up First Officers control
R column shroud and install rig pin R5 in roll
R output bellcrank and control column to lock
R control wheel in neutral.

R (c) On right side of center console, pull up and lock
R ROLL DISC handle to actuate lost motion device.

R (d) Connect First Officers roll output pushrod (5) to
R the lost motion device input arm (6) with
R attaching bolt, washer, and nut. Install cotter
R pin. If attaching bolt cannot be inserted freely,
R adjust length of roll output pushrod (5).

R NOTE: If pushrod rod-end is adjusted, verify that
R lockwasher tang is engaged in pushrod slot
R before tightening locknut. Then lock-wire
R lockwasher to locknut.

R (e) Remove rig pins from torque limiter and roll output bellcrank.

R (7) Check adjustment of lost motion device as follows (Ref. Fig. 401):

R (a) Verify that ROLL DISC handle is retracted against console.

R (b) From FESC, install rig pin R3 in bellcrank (10) to lock lost motion actuating system in the off rig position.

R (c) With rig pin installed [Ref. Step (b)], verify 0.010 to 0.030 inch gap between lost motion aft arm (9) and lockpin stop (11). If not, remove lock-wire, loosen locknuts and adjust stop bolt (12). Tighten locknuts and lock-wire.

R (d) Remove rig pin from bellcrank (10).

R (8) In right main wheel well, verify that bushing is installed in bellcrank forked tang, then reconnect first officers aft cable bellcrank output pushrod (1) to bellcrank (2) with attaching bolt, washer and nut. Install cotter pin.

R (9) Remove aileron support tool from both inboard ailerons.

R (10) Verify that all rig pins are removed from aileron control system.

R (11) Verify that torque limiter and control column area are clear of all tools and equipment.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (12) Turn on electrical power (Ref. 24-41-00).

R (13) Turn on hydraulic system B and C (Ref. 29-11-00).

R (14) Slowly cycle First Officers control wheel through several full left to full right roll inputs. Verify that roll control system operates smoothly without binding.

CAUTION: OUTBOARD AILERON DAMPERS CAN BE DAMAGED BY RAPID CYCLING OF ROLL CONTROLS. CYCLE CONTROL WHEEL SLOWLY (MINIMUM OF 4 SECONDS STOP-TO-STOP).

R (15) While cycling control wheel, visually verify following:

(a) Pushrod (1) and bellcrank (2) in main wheel well operate smoothly without binding.

(b) First Officers control column roll control linkage, lost motion device, and torque limiter operate smoothly without binding and clear all structure and equipment.

R (16) Operate ROLL DISC handle through several cycles and visually verify normal operation of lost motion device linkages.

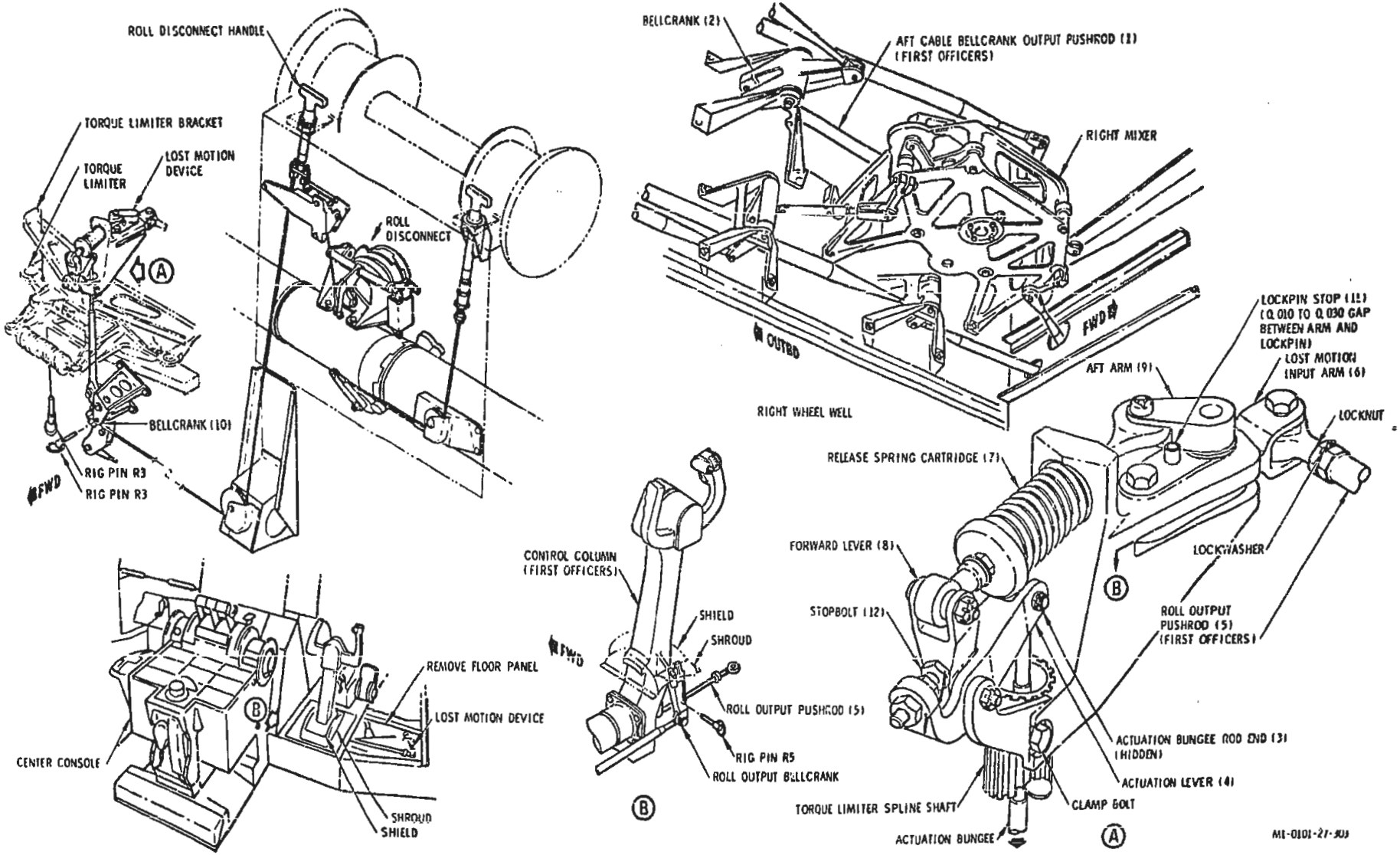
R (17) Turn off hydraulic power (Ref. 29-11-00).

R (18) Turn off electrical power (Ref. 24-41-00).

R (19) Install First Officers floor panel.

R (20) Install First Officers control column shroud and shields.

R (21) Install First Officers seat (Ref. 25-11-02).



R R Lost Motion Device - Removal and Installation
Figure 401

R R 0018 EFFECTIVITY: ALL

AILERON TRIM AND FEEL BUNGEE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pins, 5/16-inch diameter, 3 inches long (2 each)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Grease, MIL-G-23827, or equivalent

Aileron Support Tool, BF90, or equivalent (2 each)

2. Referenced Procedure

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) Verify that all four hydraulic systems are shut off (Ref. 29-11-00).

(2) Tag Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147.

(3) Open hydraulic service center access door 147AB.

(4) Unload aileron trim and feel bungee by manually moving both left and right inboard ailerons to faired position and installing aileron support tools (Ref. 27-11-00, Fig. 513). R R

(5) On center console, zone 210, rotate roll trim control to zero position.

(6) In hydraulic service center, zone 147, release lock nut and key washer unlocking bungee from control rod (Ref. Fig. 401).

(7) Remove cotter pins, nuts, sleeves, and bolts connecting trim and feel bungee frame to trim actuator output bellcranks.

R (8) Unscrew trim and feel bungee from control rod and
R remove key washer and nut.

R B. Installation

R (1) Verify that all hydraulic systems are turned off.

R (2) Verify that both inboard ailerons are supported in
R faired position.

R (3) Install lock nut and key washer on trim and feel bungee
R and turn bungee into control rod.

R (4) In the left wheel well compartment, zone 149, aft
R outboard corner on bracket assembly, insert 5/16-inch
R diameter by 3-inch long rig pin through bracket and
R bellcrank.

R NOTE: Pinning either of the two bellcranks that are
R pushrod-connected to the Captains aft cable
R bellcrank will lock the control system in
R neutral so the feel and trim bungee can be
R rigged.

R (5) In the hydraulic service center, zone 147, insert
R 5/16-inch diameter by 3-inch long rig pin through trim
R actuator mounting bracket and trim actuator output
R bellcrank.

R (6) Apply grease to sleeves and bolts; install sleeves in
R bungee frame.

R (7) Screw trim and feel bungee into control rod until bolts
R connecting bungee to the trim actuator output
R bellcranks can be installed easily. Install nuts and
R tighten; install cotter pins.

R NOTE: Do not compress bungee to install bolts.

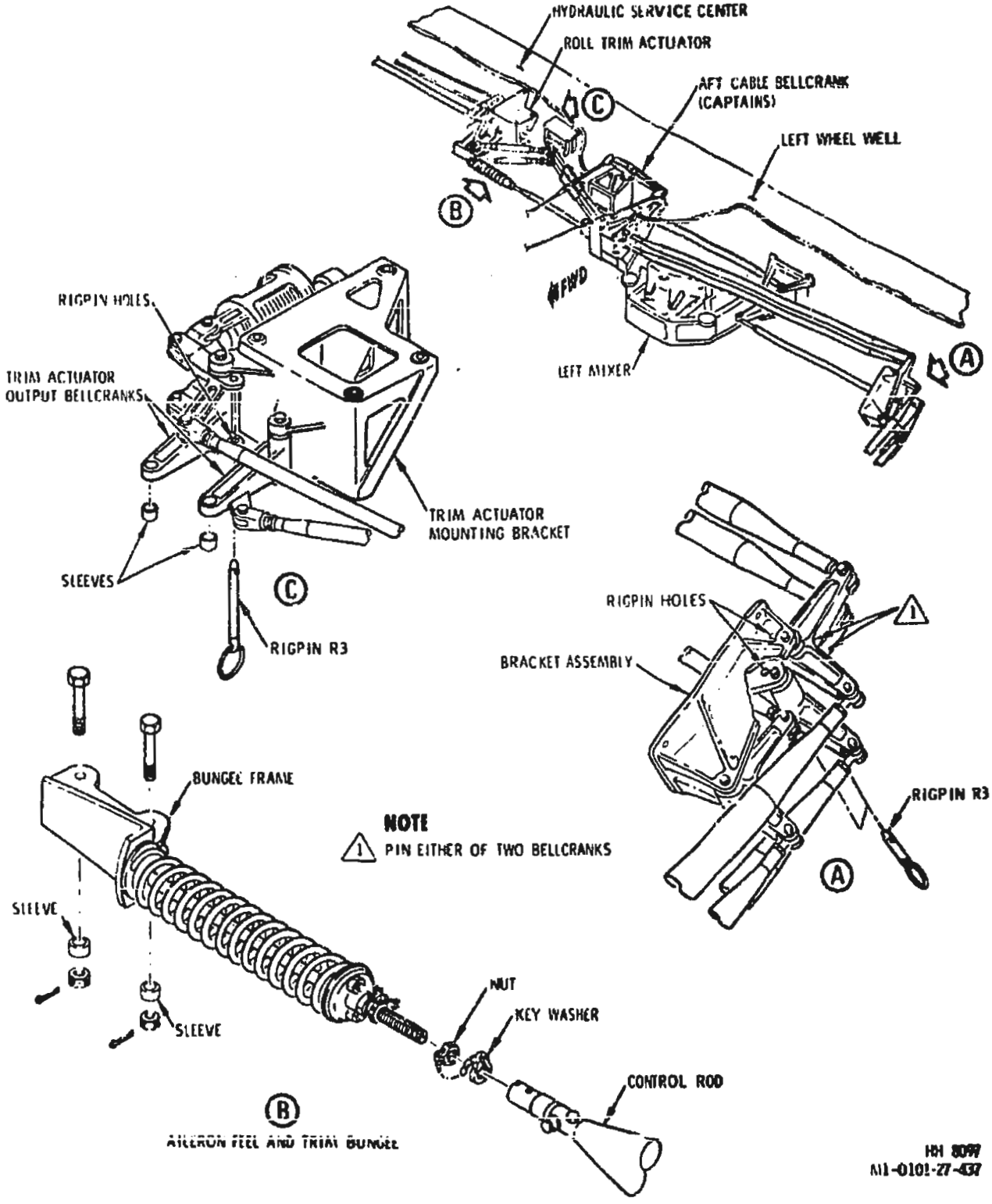
R (8) Engage key washer with control rod key, tighten lock
R nut, and lock-wire.

R (9) Remove rig pins installed in Steps B(4) and (5).

R (10) Remove both inboard aileron support tools.

R (11) Remove tags from hydraulic panels.

R (12) On pilots overhead circuit breaker panel CB1, zone 210,
R verify that circuit breaker SURF POS IND (J23) is
R closed.



R Aileron Trim and Feel Bungee - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(13) Turn on electrical power (Ref. 24-41-00).

(14) Turn on hydraulic systems A and B (Ref. 29-11-00).

(15) Operate ROLL trim control wheel from full left to full right three times. Verify that trim control system operates smoothly (no binding).

(16) Position ROLL trim wheel to full left (No. 10). Verify the following:

(a) Both aileron control wheels rotate left approximately 30 degrees.

(b) AIL pointers on surface position indicator show left aileron up 7 degrees and right aileron down 7 degrees.

(17) Apply full left and right roll with aileron control wheel and release wheel. Verify that control wheels return to approximately trim position.

(18) Position ROLL trim wheel to full right (No. 10). Verify the following:

(a) Both aileron control wheels rotate right approximately 30 degrees.

(b) AIL pointers on surface position indicator show right aileron up 7 degrees and left aileron down 7 degrees.

(19) Apply full left and right roll with aileron control wheel and release wheel. Verify that control wheels return to approximately trim position.

(20) Position ROLL trim wheel to zero.

(21) Turn off hydraulic power (Ref. 29-11-00).

(22) Turn off electrical power (Ref. 24-41-00).

R # STACKED BELLCRANKS - APPROVED REPAIRS

R 1. General

R The following procedure can be used to repair the upper Stacked
R Bellcrank. This Bellcrank is subject to damage from the
R adjacent Lockclad cable. Service Bulletin 27-195 adds a
R fairlead assembly to prevent further damage. In event of damage
R to the Stacked Bellcrank, the Lockclad cable should also be
R inspected for damage (Ref. 20-00-02).

R 2. Equipment and Materials

R Cleaning Fluid, MIL-T-81533, 1, 1, 1

R (Trichloroethane), or equivalent.

R Chemical Film, Alodine 1200S, Amchem Products Inc., or
R equivalent.

R Primer, Epoxy, P/N 02-GN-28 Deft Chemical Coatings, or
R equivalent.

R 3. Referenced Procedures

R 6-40-00 Exterior Access Doors and Panels

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Approved Repairs

R A. Repair to Upper Stacked Bellcrank.

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT
R OFF (REF. 29-11-00). PLACARD FLIGHT
R ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL,
R ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE
R 147. PLACARD AILERON CONTROL WHEELS AGAINST
R MOVEMENT.

R (1) Open lower wing access panel 551AB (left wing) or 651AB
R (right wing).

R (2) Remove upper bellcrank by disconnecting the two
R pushrods from bellcrank and then removing bellcrank
R from mounting bracket (Ref. Fig. 801).

R CAUTION: DO NOT TAMPER WITH PUSHROD ROD-END ADJUSTMENTS OR
R RIGGING OF THE AILERON CONTROLS WILL BE REQUIRED.

R (3) Inspect Bellcrank. If damage exceeds permitted repair
R depth (0.2 inches at midpoint between bearings) (Ref.
R Fig. 801), reject Bellcrank.

R (4) Using hand tools, blend out damage to make a smooth
R surface with a slope of at least 5 to 1.

R (5) Clean reworked surfaces with MIL-T-81533, 1, 1, 1
R (Trichloroethane) Cleaning Fluid, or equal.

R (6) Coat surfaces with Alodine 1200S and allow to stand 5
R minutes. Do not allow alodine to dry, recoating as
R necessary.

R (7) Wash with clean water and dry with clean cloths.

R (8) Allow Alodine to dry two hours.

R (9) Paint surfaces with Epoxy Primer P/N 02-GN-28.

R (10) Reinstall Bellcrank and safety.

R (11) Reinstall pushrods and safety.

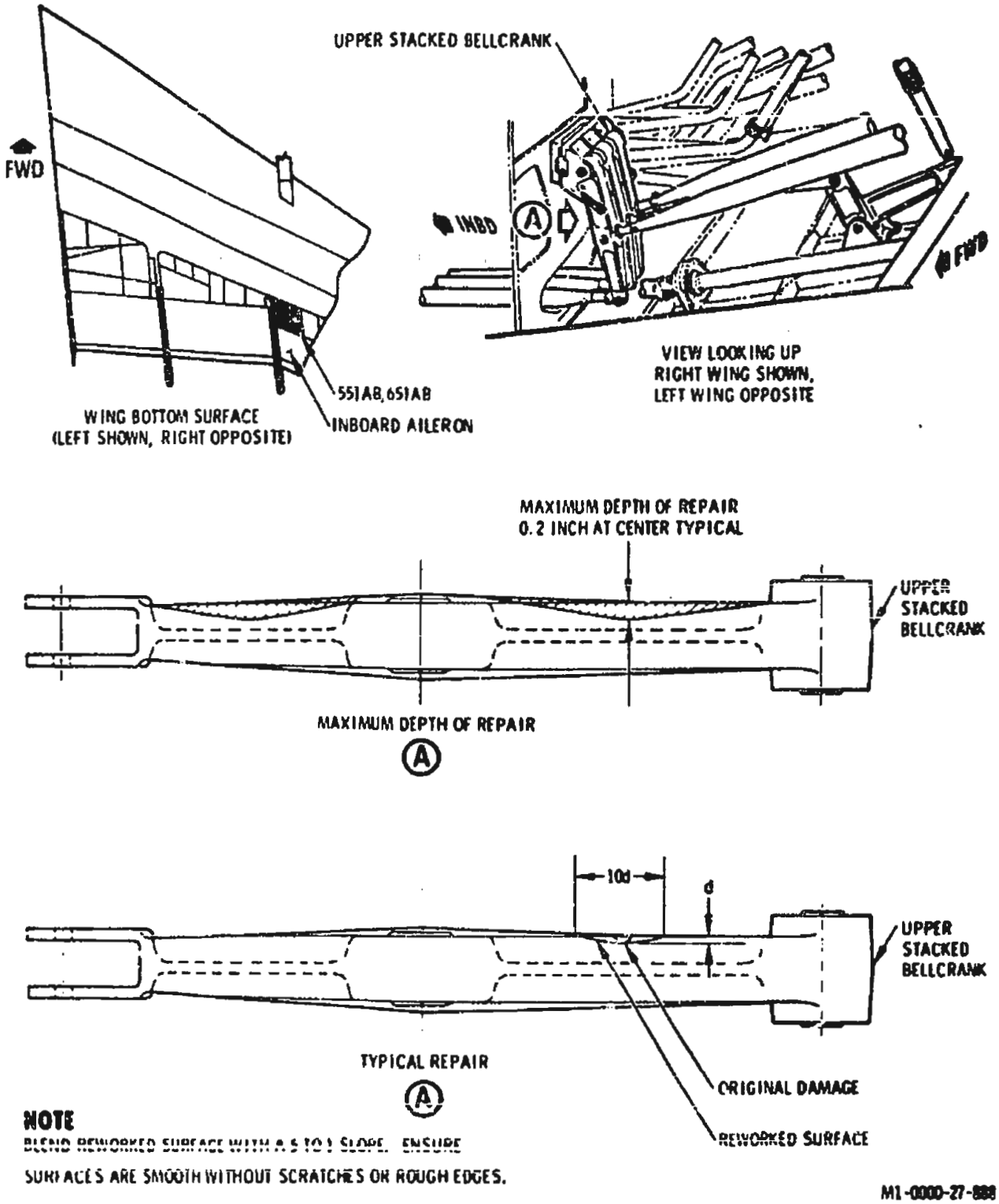
R (12) Remove tags from FE/SO Hydrualic panel, from panel in
R Hydraulic Service Center and from Flight Controls.

R (13) Turn on Hydraulic power (Ref. 29-11-00).

R (14) Operate Aileron controls from left to right stops.
R Visually verify that upper stacked bellcrank operates
R freely with no binding or interference.

R (15) Turn off Hydraulic power if no longer required (Ref.
R 29-11-00).

R (16) Close wing access panel.



NOTE

BLEND REWORKED SURFACE WITH A 5 TO 1 SLOPE. ENSURE SURFACES ARE SMOOTH WITHOUT SCRATCHES OR ROUGH EDGES.

M1-0000-27-888

R
R Stacked Bellcrank Locator
Figure 801

R EFFECTIVITY: ALL
R
R
0018

AILERON INTERCONNECT OVERRIDE BUNGEE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin kit, PN B735, or equivalent

Aileron Support Tool, PN BF90, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

2. Referenced Procedure

R 6-40-00 Exterior Access Doors and Panels

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

R (1) Open hydraulic service center access door 147AB (Ref.
R 6-40-00).

R (2) Unload aileron interconnect override bungee spring by manually moving both left and right inboard aileron support tool (Ref. 27-11-00, Fig. 513).

(3) Remove bolt connecting right aileron pushrod (40) to bungee arm (Ref. Fig. 401).

(4) Remove bolt connecting left aileron pushrod (36) from bungee arm.

(5) Remove bolts and washers attaching override bungee to support fittings and remove override bungee.

CR (6) Remove clips 41 and 42 and keep for installation on
CR interconnect to be installed.

B. Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE PANEL.

(1) Verify ailerons are secured in faired position [Step A(2)].

(2) In hydraulic service center, zone 147, position override bungee to support fittings and attach with washers and bolts.

(3) Install rig pin (R3) through idler bellcrank (38) and aileron trim actuator bracket.

(4) Install rig pin (R3) through override bungee bracket and left aileron arm (35).

(5) Connect left aileron pushrod (36) to override bungee arm (35). Adjust pushrod (36) to fit. Verify that slip-fit bushing is installed in arm fork. Install
CR bolt, washer, nut, cotter pin and clip 41.

(6) In right wheel well, install rig pin (R5) through bracket and bellcrank (39). Bellcrank located above and outboard of right mixer.

(7) Connect right aileron pushrod (40) to override bungee arm. Adjust pushrod (40) to fit without applying force to bungee spring. Verify that slip-fit bushing is
C installed in arm fork. Install bolt, washer, nut,
C cotter pin and clip 42.

(8) Remove all rig pins.

(9) Remove aileron support tools.

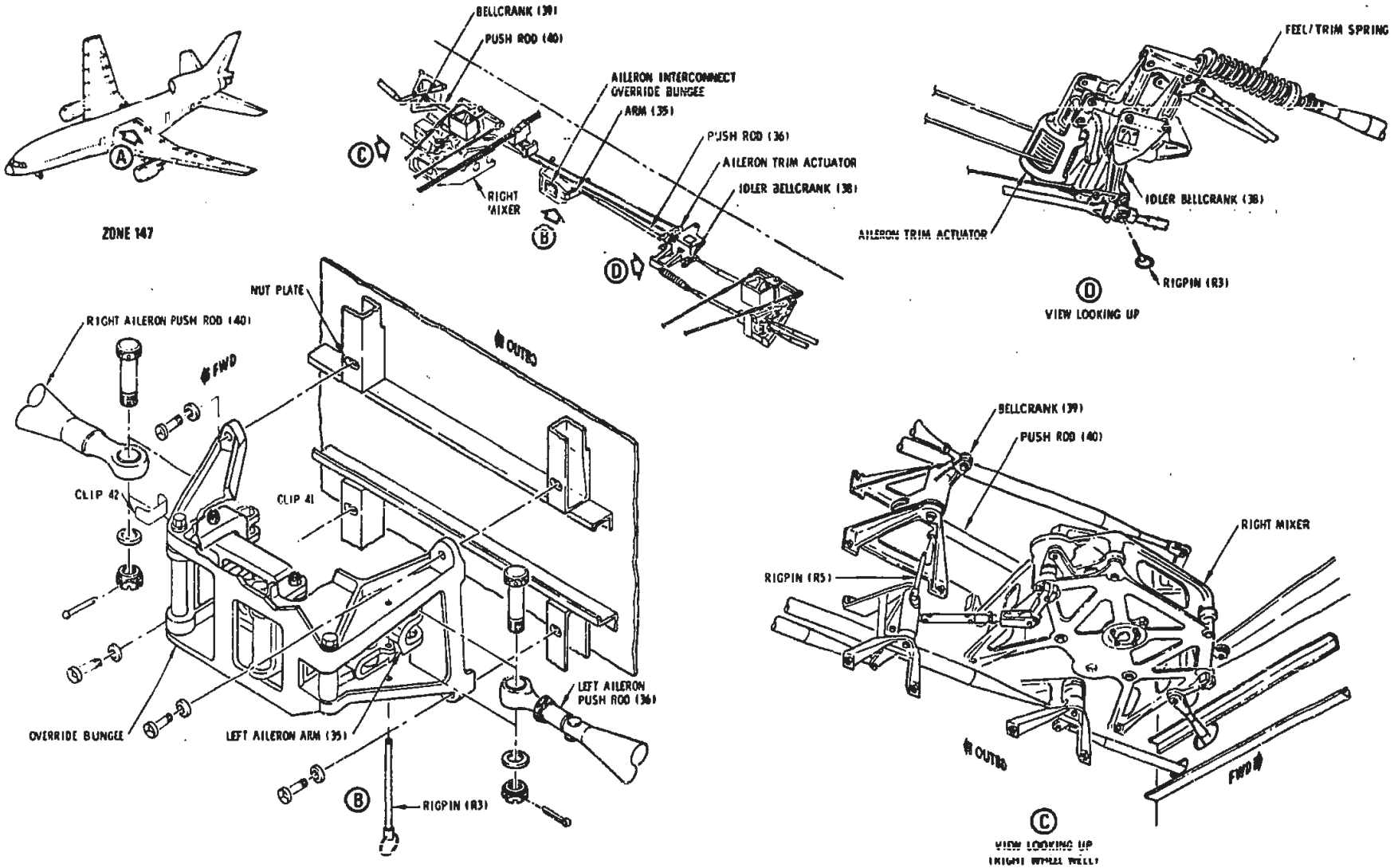
(10) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM: PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.



M1-0000-27-985

CR Aileron Interconnect override Bungee - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

0018

(11) Turn on hydraulic system B (Ref. 29-11-00).

(12) Slowly cycle aileron control wheel (minimum four seconds stop-to-stop) through three full roll cycles. Verify that aileron controls operate smoothly. Visually verify normal operation of override bungee.

(13) Turn off hydraulic power (Ref. 29-11-00).

R R (14) Close hydraulic service center door opened in Step 3A(1).

INBOARD AILERON SERVO CONTROL MODULE - REMOVAL AND INSTALLATION

1. General

NOTE: When returning to dual system operation from single system operation, fluid flow up to 7.0 cc is normal from the left inboard aileron servo cavity relief valve.

CR NOTE: Before changing an aileron servo that is leaking from the
CR static cavity relief valve, first replace the valve (TWA
CR Stk. Nbr. 73-6866) (Drain line is attached to relief
CR valve).

CR If, after replacing the relief valve, leakage is still
CR excessive, contact MCIMD to have correction to leakage
CR setup.

CR Aircraft dispatch is permissible providing hydraulic
CR fluid servicing has not been required on previous flight
CR legs with associated hydraulic systems.

The following is a list of inboard aileron servo line replaceable units (LRU's):

Solenoid Shutoff Valve, 27-11-20

Electrohydraulic Servo Valve, 27-11-21

Filter Element, 27-11-22

Pressure Switch (left inboard aileron servo), 27-11-37

Static Cavity Relief Valve, 27-11-42

2. Equipment and Materials

Container, 1-gallon capacity

Hydraulic fitting protective caps

Hydraulic line plugs

Rig Pin (2 each) - 5/16-inch diameter by 2 inches long (R2)

Hoist and Sling Adapter, Inboard Aileron Servo, PN B900, or equivalent

Aileron Support Tool, BF90, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Hydraulic line fitting plugs and caps

3. Referenced Procedures

12-13-01	Hydraulic Bootstrap Reservoir - Servicing
20-29-01	Fluid Lines and Fittings Assembly - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) Open and tag the following circuit breakers:

On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

For left wing: AILERON SERVO A, B, and C (J19, J20, J21)

For right wing: AILERON SERVO B, C, and D (J19, J21, J22)

On pilots overhead circuit breaker panel CB1, zone 210:

For left wing only: NO. 1 SYSTEMS PITCH & ROLL, NO. 2 SYSTEMS PITCH & ROLL (A6, A24)

(2) Remove pylon fairing and open following inboard aileron servo access panels:

For left wing lower surface - pylon fairing 453H, access panel 551BB

For left wing upper surface - access panel 551AT

For right wing lower surface - pylon fairing 463H, access panel 651BB

For right wing upper surface - access panel 651AT

(3) Manually position inboard aileron surface of servo to be removed to approximately neutral position to unload servo input linkage. Install aileron support tool (Ref. 27-11-00, Fig. 513).

NOTE: If aileron support tool is not available, manually position aileron to full up position and hold while disconnecting feedback pushrods. Release aileron and guide pushrods to prevent hanging up on structure.

NOTE: On aircraft without SB27-083, (clamp blocks installed on servo hydraulic actuation lines), carefully tag hydraulic lines to prevent crossing lines during reinstallation.

(4) Disconnect hydraulic lines from servo, install protective caps on servo fittings and pressure plugs on hydraulic lines.

(5) Disconnect electrical connectors from servo (Ref. Fig. 401). Install dust caps and plugs.

(6) Disconnect the upper and lower servo feedback pushrods at the servo feedback arms.

(7) Disconnect the two servo input pushrod/bungee links at idler arms.

(8) Position hoist adapter on wing and clamp adapter to wing upper surface.

NOTE: Two men can manually remove SERVO if hoist is not available.

(9) Attach hoist to adapter swivel fitting.

(10) Connect sling to servo module by threading three sling screws into threaded fittings on servo upper surface.

(11) Attach sling to hoist hook. Operate hoist to take up all slack in sling cables until cables support servo.

(12) While one man supports servo module, remove servo attaching bolts: two bolts on the servo forward

mounting bracket, and two bolts that attach servo to gate link.

NOTE: Left servo weighs approximately 105 pounds; the right servo weighs approximately 65 pounds.

(13) Using hoist, carefully lower servo module on cart.

B. Installation (Ref. Fig. 401)

(1) Verify circuit breakers opened in Step 4A(1) are open and tagged.

(2) Verify all hydraulic power is turned off and hydraulic panels tagged.

(3) Attach sling to servo by threading sling screws into servo upper surface.

(4) With hoist adapter attached to wing upper surface, connect sling to hoist.

(5) Using hoist, raise servo into position. Orient servo so servo inboard mounting lugs are resting on support bracket lugs. Install inboard mounting bolts but do not tighten. Bolts should be slip fit. There should be a gap between servo upper lug and upper bracket.

(6) Swing gate link between servo outboard mounting lugs and install bolts. Bolts should be a slip fit. If gate link does not fit between mounting lugs, or gap between lower servo lug bushing and gate link lower lug bushing exceeds 0.020 inch, accomplish following:

(a) Loosen four bolts that attach gate link support bracket to wing rib.

(b) Raise or lower support bracket to allow gate link to fit between servo lugs. Install but do not tighten servo-to-gate link bolts.

NOTE: Support bracket mounting holes are 1/32 inch oversize to allow support bracket positioning.

Servo-to-gate link bolts must be installed as a push fit. If undue force is required, washers may be added (0.032 inch maximum) between upper or lower lugs of gate link support braket and rib.

(c) Tighten support bracket-to-rib attach bolts.

(7) Torque servo two lower mounting bolts 70 to 100 lb. in. Torque two upper servo mounting bolts 30 to 40 lb in. Lock-wire bolts.

NOTE: With servo properly installed, there should be no vertical freedom at the two lower servo attachments. Gaps at the two upper servo attachments are eliminated by slip fit bushings in the inboard bracket upper lug and gate link upper lug.

(8) Disconnect servo sling adapter from servo. Remove sling from hoist. Remove hoist from hoist adapter.

(9) Unclamp hoist adapter from wing and remove adapter from wing.

(10) Connect the two servo input pushrod/bungee links to their respective idler arms by installing the attaching bolts, washers, nuts and cotter pins.

(11) Connect the two servo feedback pushrods to their respective servo feedback arms by installing the attaching bolts, washers, and nuts.

(12) Torque nuts 30 to 40 lb in.

(13) Install cotter pins and lock-wire bolts (Ref. Fig. 402). (If there are no provisions for securing lock-wire, lock-wire bolt to adjacent fork tang on the servo feedback arm.)

NOTE: Hold aileron in full up position or install aileron support tool while installing feedback pushrods to remove load.

(14) Verify servo feedback pushrods are installed with triple safties (self locking nuts, cotter pins and lock-wire) at servo, bellcranks and aileron fittings.

(15) Verify electrical connectors on servo and wire harness is not contaminated with hydraulic oil. If they are, clean with approved solvent. Install electrical connectors and lock-wire.

NOTE: Use care when connecting hydraulic lines to insure lines are not crossed (Ref. Fig. 401, Sheet 3).

(16) Remove caps from servo hydraulic fittings and plugs from hydraulic lines. Connect hydraulic lines to servo. Torque hydraulic fittings (Ref. 20-29-01).

(17) If aileron support tool is used, support aileron while removing aileron support tool. Aileron will droop to full down position.

(18) Remove tags and close circuit breakers opened in Step 4A(1).

(19) Remove tags from hydraulic control panels.

(20) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(21) Turn on hydraulic systems A, B, and C for left inboard servo, or systems B, C, and D for right inboard servo (Ref. 29-11-00).

CAUTION: CYCLING AILERONS AT A HIGH RATE CAN DAMAGE THE OUTBOARD AILERON DAMPER ROD SEALS. CYCLE AILERONS SLOWLY (MINIMUM FOUR SECONDS STOP-TO-STOP).

(22) Bleed servo by slowly operating flight station control wheels through 10 full roll cycles, or until control operates smoothly.

NOTE: Bleed hydraulic reservoirs after bleeding servo. See reservoir servicing instruction placard (Ref. 12-13-01).

(23) Accomplish the following for right inboard aileron servo replacement (servo PN 671669-137 or higher dash number only):

NOTE: Later-production right inboard aileron servos incorporate a bleed screw to bleed linkage cavity of any entrapped air.

(a) Remove bleed screw from top inboard end of servo (Ref. Fig. 401, Sheet 1).

(b) Slowly cycle ailerons until air free oil flows from bleed port (one drop per cycle minimum).

(c) Install bleed screw and lock-wire. Wipe up spilled oil with rags.

(24) Check for leaks at the servo module hydraulic fittings.

(25) Check aileron neutral rig as follows:

(a) Position ROLL trim wheel on center console to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of the alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on the decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

The inboard aileron neutral index mark is a red paint-filled dimple on the No. 3 flap torque box. Align aileron lower surface with index mark. (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft without SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(b) Install a rig pin (R2) in both the aileron servo upper and lower input arms and servo. The aileron must be in neutral (±0.12 inch). If not, adjust upper and lower feedback pushrods individually to fair aileron. (Lengthening pushrod raises aileron, shortening pushrod lowers aileron.)

WARNING: DO NOT DISCONNECT BOTH FEEDBACK PUSHRODS WITH HYDRAULIC POWER ON. SERVO WILL BE UNCONTROLLABLE.

CAUTION: DO NOT SHUTOFF HYDRAULIC POWER WITH RIG PINS IN THE SERVO. THE SERVO CAN BE PERMANENTLY DAMAGED.

NOTE: On the left inboard aileron servo, rig pins (R2) should fit freely through both the upper and lower input arms and the servo without causing aileron deflection from neutral. If not, adjust input pushrods in accordance with Aileron Control System, Adjustment and Test, Para. 5G.

On the right inboard aileron servo, the rig pins (R2) will not fit freely through the servo input arms and servo due to the deslop bungee. When only upper rig pin is installed, aileron will droop slightly. When only lower rig pin is installed, aileron will rise slightly. Droop and rise should be nearly equal. When both rig pins are installed in the servo, the aileron should assume mid-position between droop and rise and be in neutral (±0.12 inch).

(c) After adjusting feedback pushrods tighten and lock-wire rod-end adjusting nut.

(d) Remove rig pins from servo.

(e) Cycle control wheel through several full left and right roll cycles to verify normal operation of aileron if the feedback pushrods were adjusted.

(26) Perform the following tests and check (Ref. 27-11-00 Adjustment/Test):

CAUTION: REPLACEMENT OF THE AILERON SERVO MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL USING INDIVIDUAL HYDRAULIC SYSTEMS AS APPLICABLE TO SERVO BEING REPLACED. THIS IS REQUIRED TO ASSURE THE HYDRAULIC LINES TO THE SERVO HAVE NOT BEEN CROSSED DURING INSTALLATION.

VERIFY THAT THE HYDRAULIC INTEGRITY TEST IS ACCOMPLISHED. HYDRAULIC SYSTEMS APPLICABLE TO THE INBOARD AILERON SERVOS ARE SHOWN BELOW:

LEFT INBD SERVO - A, B, AND C

RIGHT INBD SERVO - B, C, AND D

(a) Aileron Servo Shutoff Valve Test (Para. 4B). Accomplish only steps necessary to check out replaced aileron servo (left inboard aileron, or right inboard aileron).

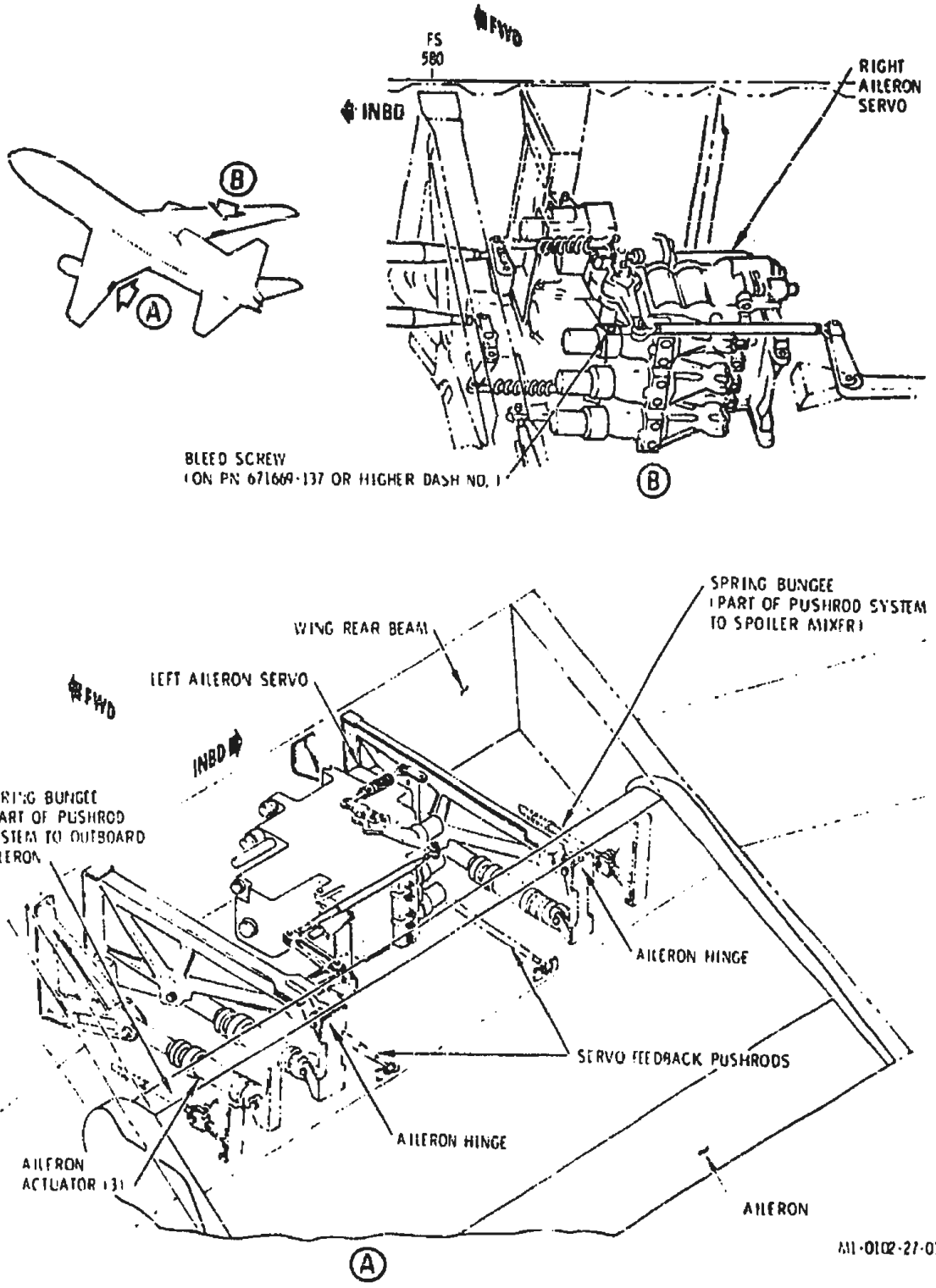
(b) Aileron Servo Hydraulic Integrity Test (Para. 4C).

(c) Left Inboard Aileron Servo Autopilot Test (Left Servo only) (Para. 4D).

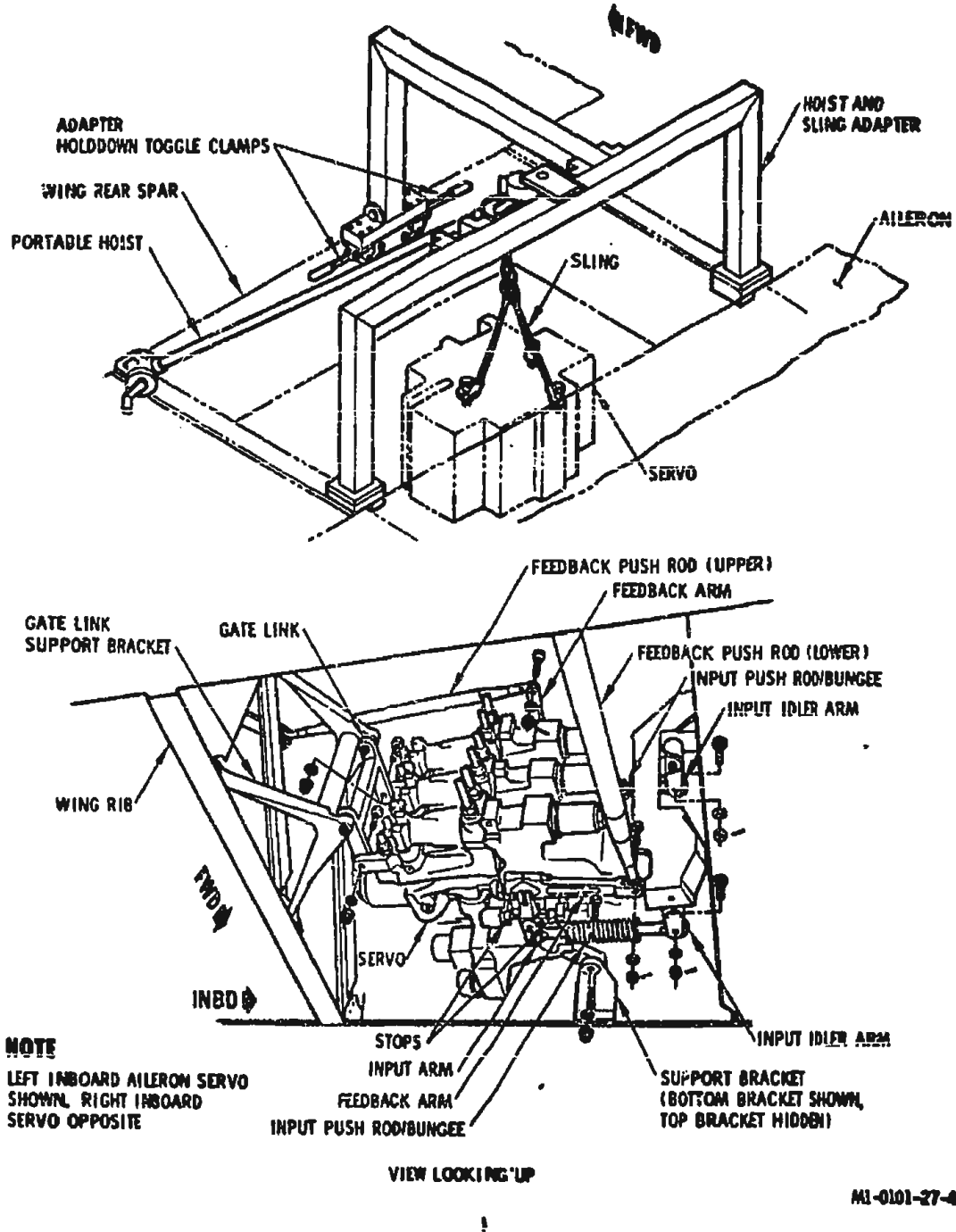
(27) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(28) Turn off electrical power if no longer required (Ref. 24-41-00).

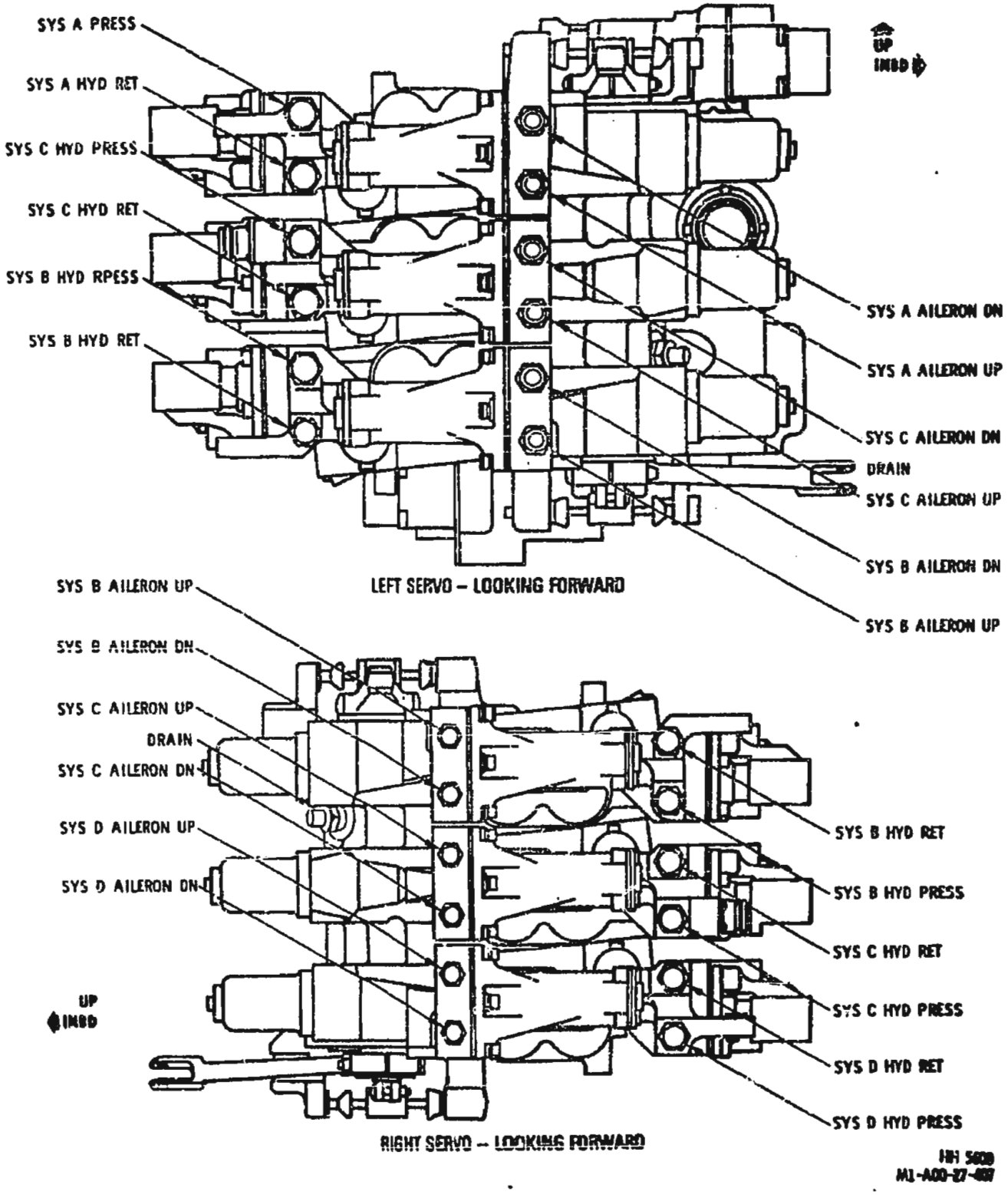
(29) Close access panels opened in Step 4A(2).



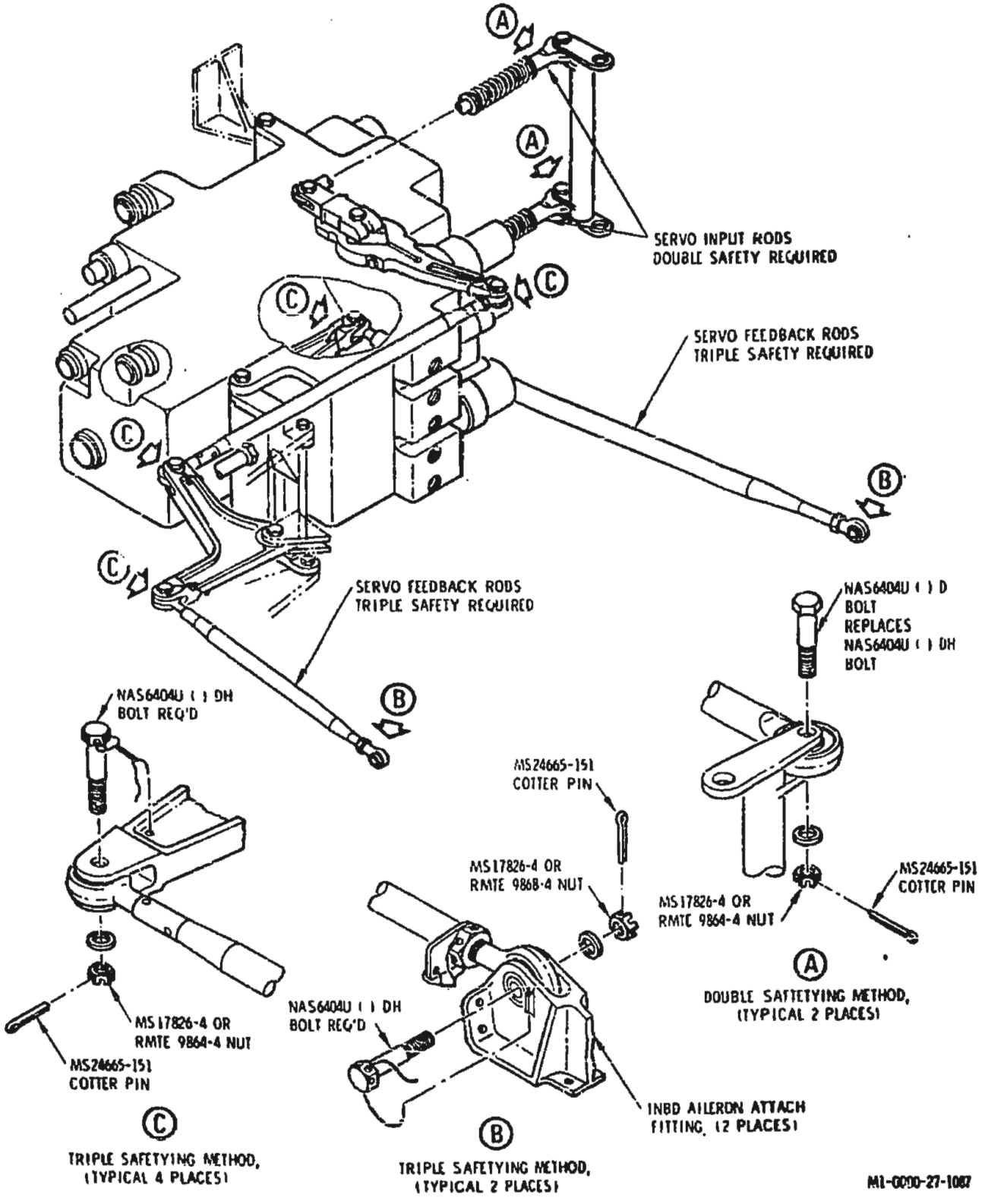
Inboard Aileron Servo - Removal and Installation
Figure 401 (Sheet 1)



Inboard Aileron Servo - Removal and Installation
Figure 401 (Sheet 2)



Inboard Aileron Servo - Removal and Installation
Figure 401 (Sheet 1)



R R **Aileron Servo Pushrod Safties**
Figure 402

R R 001B EFFECTIVITY: ALL

OUTBOARD AILERON SERVO CONTROL MODULE - REMOVAL AND INSTALLATION

1. General

CR NOTE: Before changing an aileron servo that is leaking from the
CR static cavity relief valve, replace the static cavity
CR relief valve (TWA Stk. Nbr. 73-6866) (Drain line is
CR attached to relief valve).

CR If, after replacing the relief valve, leakage is still
CR excessive, contact MCIMD to have correction for leakage
CR setup.

CR Aircraft dispatch is permissable providing hydraulic
CR fluid servicing has not been required on previous flight
CR legs with associated hydraulic systems.

The following is a list of outboard aileron servo line replaceable units (LRU'S).

Solenoid Shutoff Valve, 27-11-20

Filter Element, 27-11-22

Static Cavity Relief Valve, 27-11-42

2. Equipment and Materials

Container, 1-gallon capacity

Plastic protective hydraulic fitting plate and caps

Hydraulic line protective plate and plugs

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

3. Referenced Procedures

12-13-01	Reservoir Air Bleed Check - Servicing
20-29-01	Fluid Lines and Fittings Assembly - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Maintenance Practices

27-11-00	Aileron Control System - Adjustment & Test
27-11-20	Solenoid Shutoff Valve - Removal and Installation
27-11-22	Filter Element - Inboard and Outboard Aileron Servo Control Module - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND ACCUMULATORS ARE DEPRESSURIZED (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) Open and tag the following circuit breakers:

On Flight Engineers/Second Officers overhead circuit breaker panel CB2, zone 215:

For left wing: AILERON SERVO A and B (J20, J21)

For right wing: AILERON SERVO B and D (J21, J22)

(2) Open the following access panels:

For left wing upper surface - 571AT

For left wing lower surface - 571CB

For right wing upper surface - 671AT

For right wing lower surface - 671CB

NOTE: Carefully tag hydraulic lines to prevent crossing lines on reinstallation.

(3) Place container underneath servo to catch hydraulic fluid.

(4) Disconnect hydraulic lines and hydraulic line plate attachment from servo module (Ref. Fig. 401, Sheet 1).

(5) Install protective plugs, caps, and plates on hydraulic lines and fittings.

(6) Disconnect electrical connector from servo module.

R CAUTION: DO NOT LIFT SERVO BY ANY OF OF THE INPUT OR
R FEEDBACK ARMS OR USE EXCESSIVE FORCE ON ARMS AT
R ANY TIME. INTERNAL DAMAGE MAY RESULT FROM AS
R LITTLE AS 12 LBS. FORCE ON SECONDARY FEEDBACK ARM.

(7) Disconnect servo input pushrod from servo input arm by removing attaching bolt.

(8) Disconnect upper and lower feedback pushrods from their respective servo feedback arms by removing attaching bolts.

(9) While one man supports servo (servo weighs 30 pounds) remove servo mounting bolts: two bolts on servo inboard mounting bracket, and two bolts that attach servo to gate link. Remove servo.

B. Installation (Ref. Fig. 401)

C CAUTION: DO NOT SUPPORT SERVO BY SECONDARY FEEDBACK ARM.

(1) Verify circuit breakers opened in Step 4A(1) are open and tagged.

(2) Place servo in mounting position, (with SERVO lugs on top of bracket lugs) and install mounting bolts, washers, and nuts. Lock-wire bolts.

(3) Connect servo input pushrod to servo input arm by installing bolt, washer, and nut. Install cotter pin and lock-wire bolt.

(4) Connect the two feedback pushrods to their respective servo feedback arms by installing bolts, washers, and nuts. Install cotter pins and lock-wire bolts.

(5) Check electrical connector on servo and wire harness for contamination with hydraulic oil. If electrical connectors are contaminated, clean with approved solvent. Attach electrical connector to servo and lock-wire.

(6) Remove protective caps, plugs, and plates from servo and hydraulic lines. Inspect mating surfaces of plate attachment for nicks, burrs, and cleanliness.

NOTE: Use care when connecting hydraulic lines to ensure lines are not crossed (Ref. Fig. 401, Sheet 3).

(7) Connect hydraulic lines and hydraulic plate fitting to servo. Use new plate gasket seal. Torque hydraulic

lines (Ref. 20-29-01). Install screws in plate fitting and lock-wire screws.

(8) Remove tags and close circuit breakers opened in Step 4A(1).

(9) Remove tags from hydraulic control panels.

(10) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(11) Turn on hydraulic systems A and B for left servo, or C systems B and D for right servo (Ref. 29-11-00). (Do C not use A/C electric pumps).

CAUTION: CYCLING AILERONS AT A HIGH RATE CAN DAMAGE OUTBOARD AILERON DAMPER SEALS. OPERATE CONTROL WHEEL SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

DO NOT OPERATE CONTROL WHEEL AT FULL THROWS AT THIS TIME UNTIL SERVO FEEDBACK RIGGING IS VERIFIED.

(12) Bleed servo by slowly operating flight station control wheel through five half-throw left and right roll cycles, or until control operates smoothly with no binding.

(13) Check for leaks at servo hydraulic fittings.

(14) Check outboard aileron neutral rigging as follows:

(a) Position control wheel so inboard aileron on same wing as replaced servo is in the neutral position (±0.125 inch).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with

a red dimple index mark on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(b) With inboard aileron in neutral, outboard aileron should be in neutral within ±0.125 inch. If not, adjust Outboard Aileron Servo (Ref. 27-11-00, Adjustment/Test, Para. 5I for left servo or 5M for right servo).

C NOTE: On aircraft 001-017, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

C On aircraft 018-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(c) If outboard aileron neutral rig was out of tolerance and was adjusted per 27-11-00, Adjustment and Test, ignore Step (d). If outboard aileron neutral is in tolerance, accomplish Step (d) to verify correct adjustment of secondary feedback pushrod.

(d) Disconnect secondary feedback pushrod connecting aileron surface and idler bellcrank at bellcrank. With outboard aileron in neutral, verify secondary feedback pushrod is adjusted to mid-point of free play in the secondary control when the pushrod is connected to the bellcrank. If not, adjust length

of secondary feedback pushrod to meet above requirement and connect to bellcrank. Install bolt, washer, nut. Install cotter pin and lockwire bolts.

NOTE: The secondary feedback pushrod is the outboard pushrod on both left and right outboard aileron servos.

R (15) Complete bleeding procedure:

R (a) Slowly operate control wheel through five full
R left and right roll cycles or until controls
R operate smoothly.

R (b) While cycling control wheels, visually verify bolt
R that connects top feedback pushrod to idler
R bellcrank clears idler bellcrank support bracket.
R (A long bolt at this location can contact top of
R support bracket).

R (c) After bleeding servo, bleed associated hydraulic
R reservoir (Ref. AIR BLEED check on reservoir
R service instruction placard, Ref. 12-13-01).

CR (16) Check operation of servo internal fairing spring as
C follows:

C NOTE: The servo internal fairing spring serves to
C position the servo control valve to neutral in
C the event of a disconnected servo input control.

C (a) Disconnect servo input bungee from servo input
C arm.

C WARNING: USE CAUTION WHEN OPERATING SERVO INPUT ARM.

C (b) Manually position servo input arm in one direction
C and release arm. Verify aileron returns to within
CR 2 degrees of neutral but not past neutral.

C (c) Manually position servo input arm in opposite
C direction and release arm. Verify aileron returns
CR to within 2 degrees of neutral but not past
CR neutral.

C (d) If aileron does not return to approximately
CR neutral or if it returns past neutral after arm is
C released, a damaged or broken fairing spring is
C indicated. Replace outboard aileron servo (Ref.
C 27-11-19).

C NOTE: If a PCU fails the fairing spring test, do not change the PCU until the primary and secondary feedback rod adjustment is checked and verified to be correct.

(17) Verify the following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1:

FCES COMPUTERS - DC (B4) and AC & L AOA (B5)

SURF POS IND (J23)

(b) On Flight Engineer/Second Officeers overhead circuit breaker panel CB2: AILERON SERVO C, A, B, D (J19, J20, J21, J22).

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3: IND LT - PFCS ADS/DH (G8).

(18) Verify all four AILERON switchlights on PFCS panel are in the normal position (flush with panel).

NOTE: To eliminate unnecessary spoiler operation, flaps can be positioned to full up.

(19) If left outboard aileron servo was replaced, check left outboard aileron servo shutoff valve function as follows:

(a) Release (out) AILERON L OUTBD switchlight on PFCS panel to deactivate servo. The switchlight OFF light must come on and left outboard aileron must droop to full down.

NOTE: Use surface position indicator to verify surface position. Depress OUTBD AIL PUSH switch on surface position indicator to read outboard ailerons.

(b) Rotate Captains control wheel left and right. Verify outboard aileron is inactive. Center control wheel.

(c) Open AILERON SERVO A circuit breaker to deenergize the channel A shutoff valve and activate the A servos. Left outboard aileron must move to neutral. (System A hydraulic system supplies both left ailerons.)

(d) Rotate Captains control wheel left and right. Verify left outboard aileron follows left inboard aileron movement.

(e) Close AILERON SERVO A circuit breaker. The left outboard aileron must droop. Open AILERON SERVO B circuit breaker. The left outboard aileron must move to neutral. (System B hydraulic system supplies all four ailerons.)

(f) Rotate Captains control wheel left and right. Verify left outboard aileron follows left inboard aileron movement. Center control wheel.

(g) Depress (in) AILERON L OUTBD switchlight. The switchlight OFF light must go off. The left outboard aileron must remain in neutral.

(h) Close AILERON SERVO B circuit breaker.

(20) If right outboard aileron servo was replaced, check right outboard aileron servo shutoff valve function as follows:

(a) Release AILERON R OUTBD switchlight on PFCS panel. The switchlight OFF light must come on and right outboard aileron must droop to full down.

(b) Rotate Captains control wheel left and right. Verify right outboard aileron is inactive.

(c) Open AILERON SERVO B circuit breaker. Right outboard aileron must move to neutral.

(d) Rotate Captains control wheel left and right. Verify right outboard aileron follows right inboard aileron movement.

(e) Close AILERON SERVO B circuit breaker. Right outboard aileron will droop. Open AILERON SERVO D circuit breaker. Right outboard aileron must move to neutral.

(f) Rotate Captains control wheel left and right. Verify right outboard aileron follows inboard aileron movement. Center control wheel.

(g) Depress AILERON R OUTBD switchlight on PFCS panel. Switchlight OFF light must go off. Right outboard aileron must remain in neutral.

(h) Close AILERON SERVO D circuit breaker.

(21) Check for proper connection of hydraulic lines as follows:

CAUTION: REPLACEMENT OF AILERON SERVOS MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL USING INDIVIDUAL HYDRAULIC SYSTEMS AS APPLICABLE TO SERVO UNIT BEING REPLACED. THIS IS REQUIRED TO ASSURE HYDRAULIC LINES TO UNIT BEING REPLACED HAVE NOT BEEN CROSSED DURING INSTALLATION. HYDRAULIC SYSTEMS APPLICABLE TO LOCATIONS ARE SHOWN BELOW:

LEFT OUTBD AILERON - A AND B

RIGHT OUTBD AILERON - B AND D

(a) Position ROLL trim wheel to zero to position ailerons to neutral.

(b) Verify all four AILERON switchlights on PFCS panel are depressed and latched (flush with panel).

CAUTION: PRESSURIZE ONLY THOSE HYDRAULIC SYSTEMS SPECIFIED FOR EACH TEST, AND USE ONLY THOSE HYDRAULIC SOURCES SPECIFIED.

(c) Pressurize only hydraulic system B. (Hydraulic system B supplies all four ailerons.)All ailerons must move to neutral. Use ground test cart, ATM, or AC pumps for hydraulic source.

(d) Rotate Captains control wheel full left. Left outboard aileron must move to full up. (Use surface position indicator; press OUTBD AIL PUSH switch on surface position indicator to read outboard ailerons.)Right outboard aileron must move to full down.

(e) Rotate Captains control wheel full right. Left outboard aileron must move to full down. Right outboard aileron must move to full up.

(f) Turn off hydraulic system B.

(g) Pressurize only hydraulic systems A and D. (System A supplies both left ailerons; system D supplies both right ailerons.) All ailerons must move to neutral. Use ground test cart or engine-driven pump only. Do not use AC pumps or ATMs for hydraulic source.

(h) Rotate Captains control wheel full left. Left outboard aileron must move to full up. Right outboard aileron must move to full down.

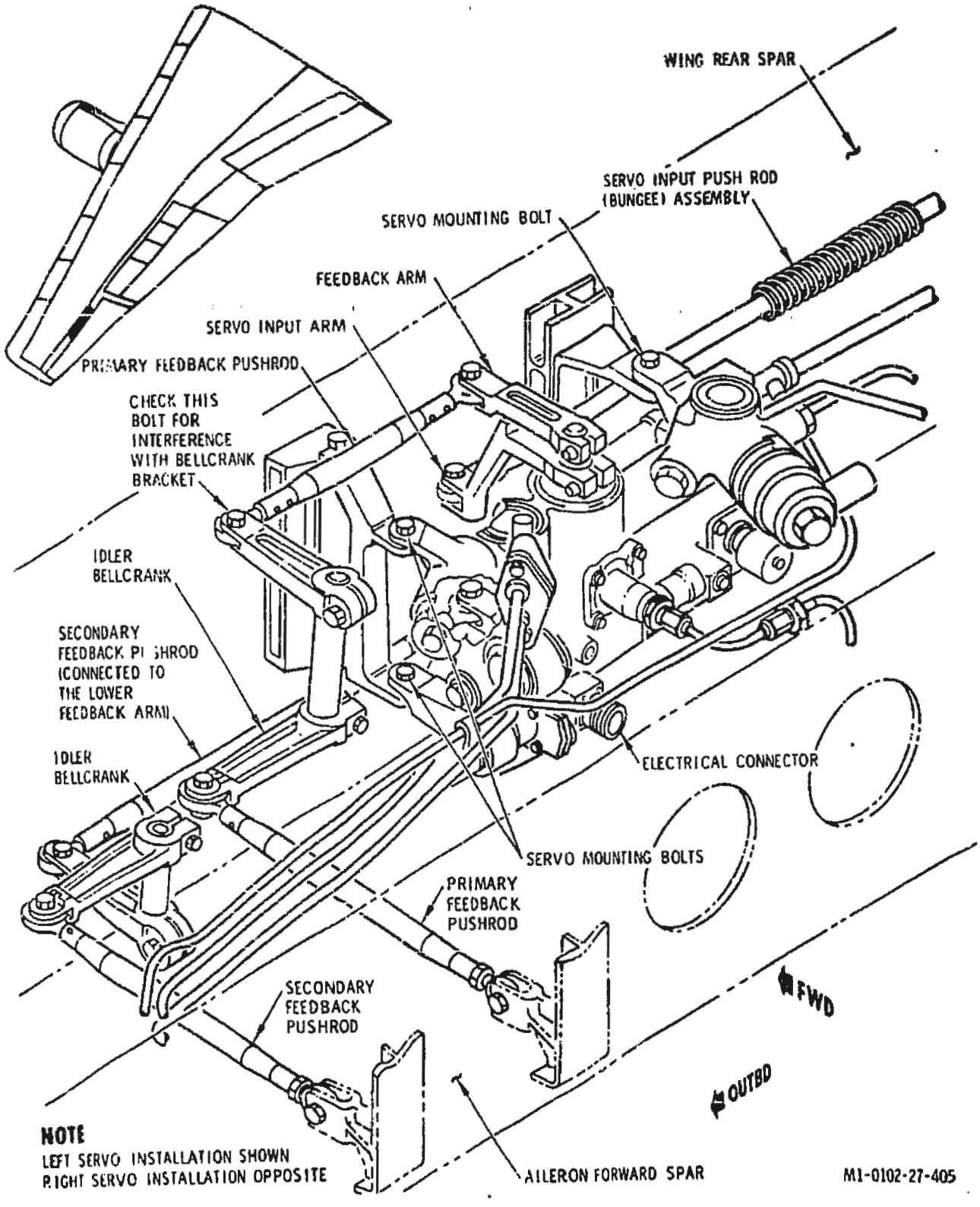
(i) Rotate Captains control wheel full right. Left outboard aileron must move to full down. Right outboard aileron must move to full up.

(j) Center control wheel.

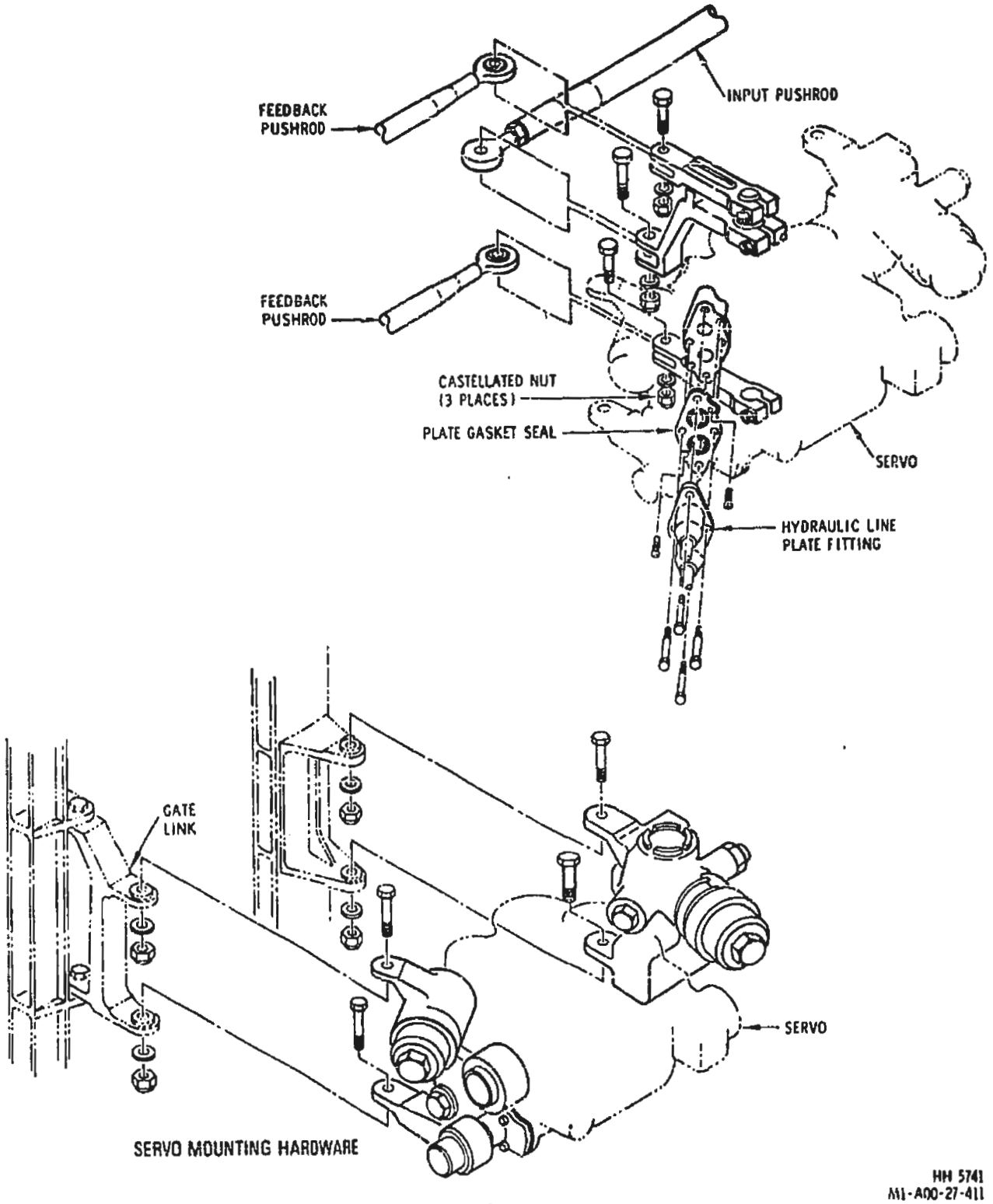
(22) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(23) Turn off electrical power if no longer required (Ref. 24-41-00).

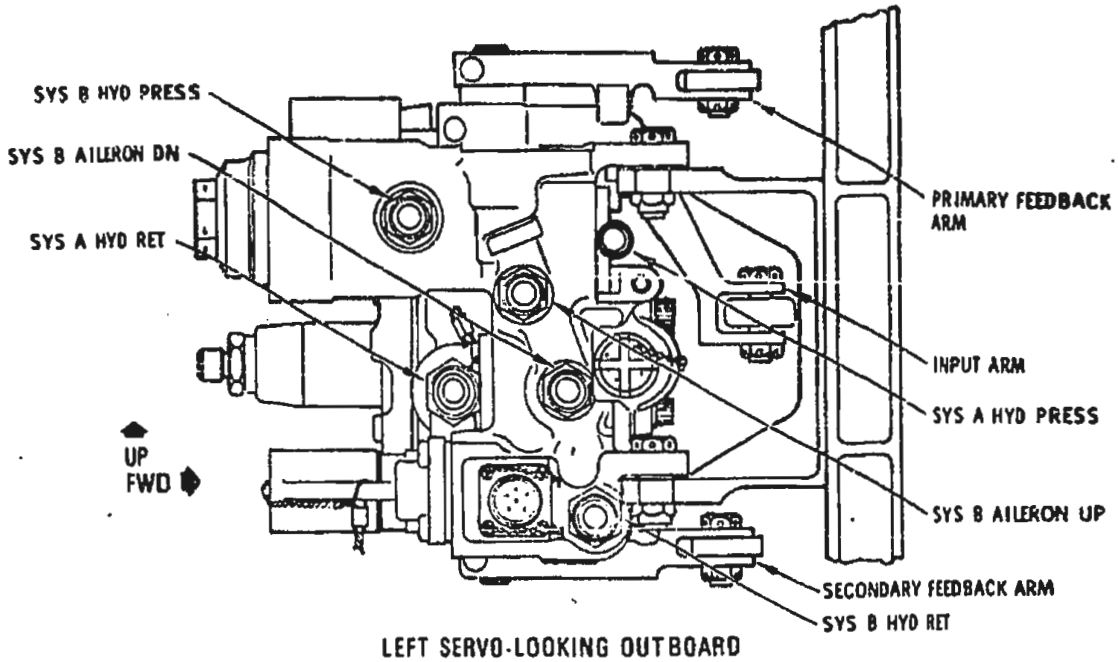
(24) Close access panels.



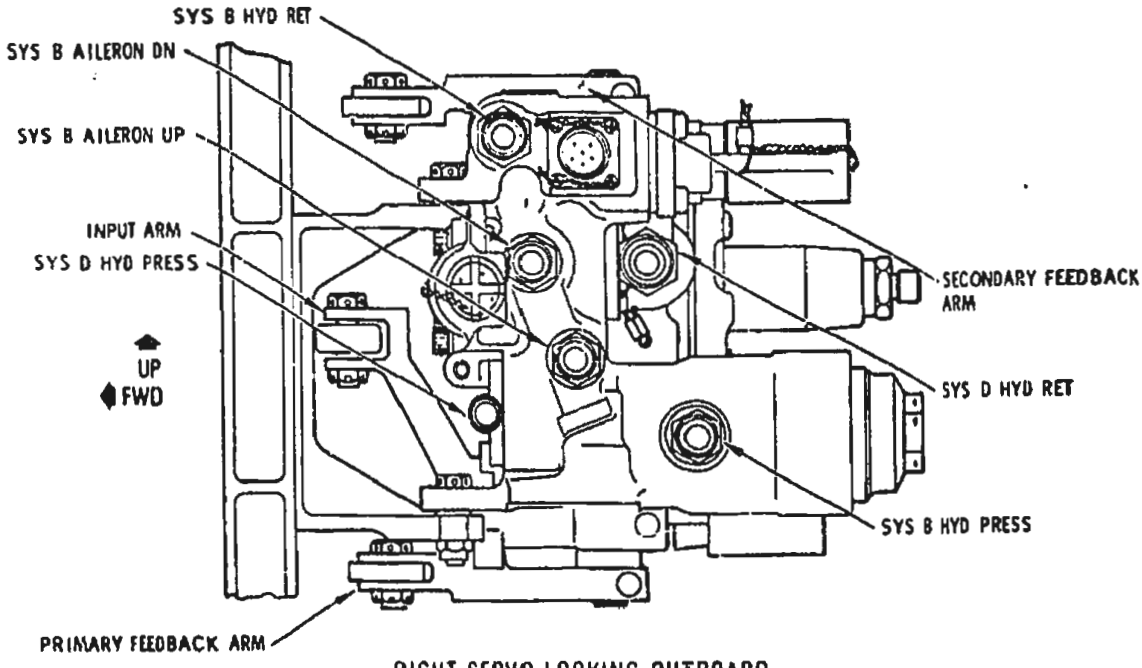
Outboard Aileron Servo Module - Removal and Installation
Figure 401 (Sheet 1)



Outboard Aileron Servo Module - Removal and Installation
Figure 401 (Sheet 2)



LEFT SERVO-LOOKING OUTBOARD



RIGHT SERVO-LOOKING OUTBOARD

HH 5601
MI-0101-27-412

Outboard Aileron Servo Module - Removal and Installation
Figure 401 (Sheet 3)

AILERON SERVO SOLENOID SHUTOFF VALVE - REMOVAL AND INSTALLATION

1. General

The solenoid shutoff valve can be replaced as an assembly, or, the solenoid coil can be replaced separately without disturbing the hydraulic portion of the shutoff valve assembly or the valve-to-servo interface. Replace the coil if the valve malfunction appears to be an electrical problem. The removal and installation procedure for all solenois shutoff valves is the same.

2. Equipment and Materials

Container, 1 quart (If replacing the entire valve assembly)

Gasket plate (Ref. Fig. 401) (If replacing the entire valve assembly)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

3. Referenced Procedures

12-13-01	Reservoir Air Bleed Check
22-12-00	APFDS Modes of Operation - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Preparation

R WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R R R BEFORE DISCONNECTING ANY HYDRAULIC LINE OR COMPONENT, VERIFY ZERO RESERVOIR PRESSURE ON SERVICE PANEL IN HYDRAULIC SERVICE CENTER.

(1) Open and tag the following applicable AILERON SERVO circuit breaker.

(a) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, for inboard ailerons only:

C - INBD L & R (J19)

For inboard and outboard ailerons:

A - INBD & OUT'BD - L (J20)

B - INBD & OUT'BD - L & R (J21)

D - INBD & OUT'BD - R (J22)

(2) Open applicable wing lower surface servo access panel:

Inboard Aileron: panel 551BB and pylon fairing 453H or 651BB and pylon fairing 463H

Outboard Aileron: panel 571CB or 671CB

R B. Removal of Solenoid Coil Assembly

R (1) Verify steps in Paragraph 4A Preparation have been R completed.

R (2) Remove lock-wire and remove screw on top of shutoff R valve assembly (Ref. Fig. 401).

R (3) Disassemble coil from valve assembly as follows:

(a) Remove stepped washer and spacer.

(b) Pull coil assembly to disengage electrical connector from servo and remove coil assembly from the valve housing.

R C. Installation of Solenoid Coil Assembly

R (1) Verify steps in Paragraph 4A Preparation have been R completed.

R (2) Verify that a spacer is installed on valve housing R (Ref. Fig. 401).

R (3) Verify that electrical connectors on servo and shutoff R valve are not contaminated with hydraulic fluid. If R they are, wash out with approved solvent.

R (4) Slide coil assembly on valve housing while positioning
R coil assembly electrical connector through hole in
R valve washer. Verify that electrical connectors are
R properly engaged.

R (5) Install spacer and stepped washer on valve housing.

R (6) Install screw through stepped washer and into end of
R valve housing. Tighten screw and lock-wire.

R (7) Check solenoid valve operation in accordance with
R Paragraph 4F.

R D. Removal of Solenoid Shutoff Valve

R (1) Verify steps in Paragraph 4A Preparation have been
R completed.

R (2) Place container under servo to catch hydraulic fluid
R spillage.

R (3) Remove mount screws and remove valve from servo (Ref. Fig. 401).

R E. Installation of Solenoid Shutoff Valve

R (1) Verify steps in Paragraph 4A Preparation have been
R completed.

R (2) Verify that the appropriate circuit breaker opened in
R Step 4A(1) is open and tagged.

R (3) Install preformed O-ring packing on valve electrical
R connection groove (Ref. Fig. 401).

R (4) Verify that electrical connector on servo and on
R shutoff valve is not contaminated with hydraulic fluid.
R If they are, wash out with approved solvent.

R (5) Verify that new gasket plate is installed on valve. Install shutoff valve on servo; secure with mount screws and lock-wire.

NOTE: Tri-wing mount screws can be replaced with NAS 1351 socket-head cap screws.

R (6) Check solenoid valve operation in accordance with
R Paragraph 4F.

F. Checkout of Solenoid Shutoff Valve

(1) Remove tag and close circuit breaker opened in Step 4A(1).

(2) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HUDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on only hydraulic system supplying affected aileron servo shutoff valve (Ref. 29-11-00). (See Fig. 401 to determine shutoff valve hydraulic supply.)

NOTE: If the right wing inboard or outboard aileron servo D system shutoff valve is replaced, also turn on hydraulic system A to supply left inboard aileron (master) servo.

(4) Verify that all four AILERON switchlights on PFCS panel are depressed (in).

(5) If entire solencid shutoff valve assembly was replaced, bleed servo by slowly cycling control wheel through left and right roll inputs.

CAUTION: RAPID OPERATION OF AILERONS CAN DAMAGE OUTBOARD AILERON DAMPER SEALS. CYCLE CONTROLS SLOWLY, MINIMUM 4 SECONDS STOP-TO-STOP.

NOTE: After bleeding control system, bleed hydraulic reservoir. Perform reservoir Air Bleed Check (Ref. 12-13-01).

(6) Check aileron servo shutoff valve operation as follows:

(a) Release (out) AILERON switchlight on PFCS panel for aileron servo with replaced shutoff valve. Verify that shutoff valves have energized to shut off servo. (The aileron must droop to full down and aileron must not respond to control wheel movements.)

NOTE: Switchlight will energize all shutoff valves on servo. Ignore movement of other ailerons.

(b) Open AILERON SERVO circuit breaker that controls replaced shutoff valve, to deenergize the shutoff valve and activate that servo channel. Verify that aileron is activated (aileron will move to trim position and will respond to control wheel movements).

NOTE: Circuit breakers are identified by hydraulic system that circuit breakers control.

R (c) Depress AILERON switchlight released in Step
R 4F(6)(a).

R (d) Close AILERON circuit breaker opened in Step
R 4F(6)(b).

(7) If left inboard aileron autopilot shutoff valve was
R replaced (A/PA or A/PB, Ref. Fig. 401), accomplish
R following:

R (a) Accomplish the Autopilot Setup (Ref. 22-12-00).

(b) On the APFDS ENGAGE panel, position applicable autopilot lever switch to CWS.

(c) Verify that autopilot lever switch remains in the CWS position (this verifies that shutoff valve has energized open).

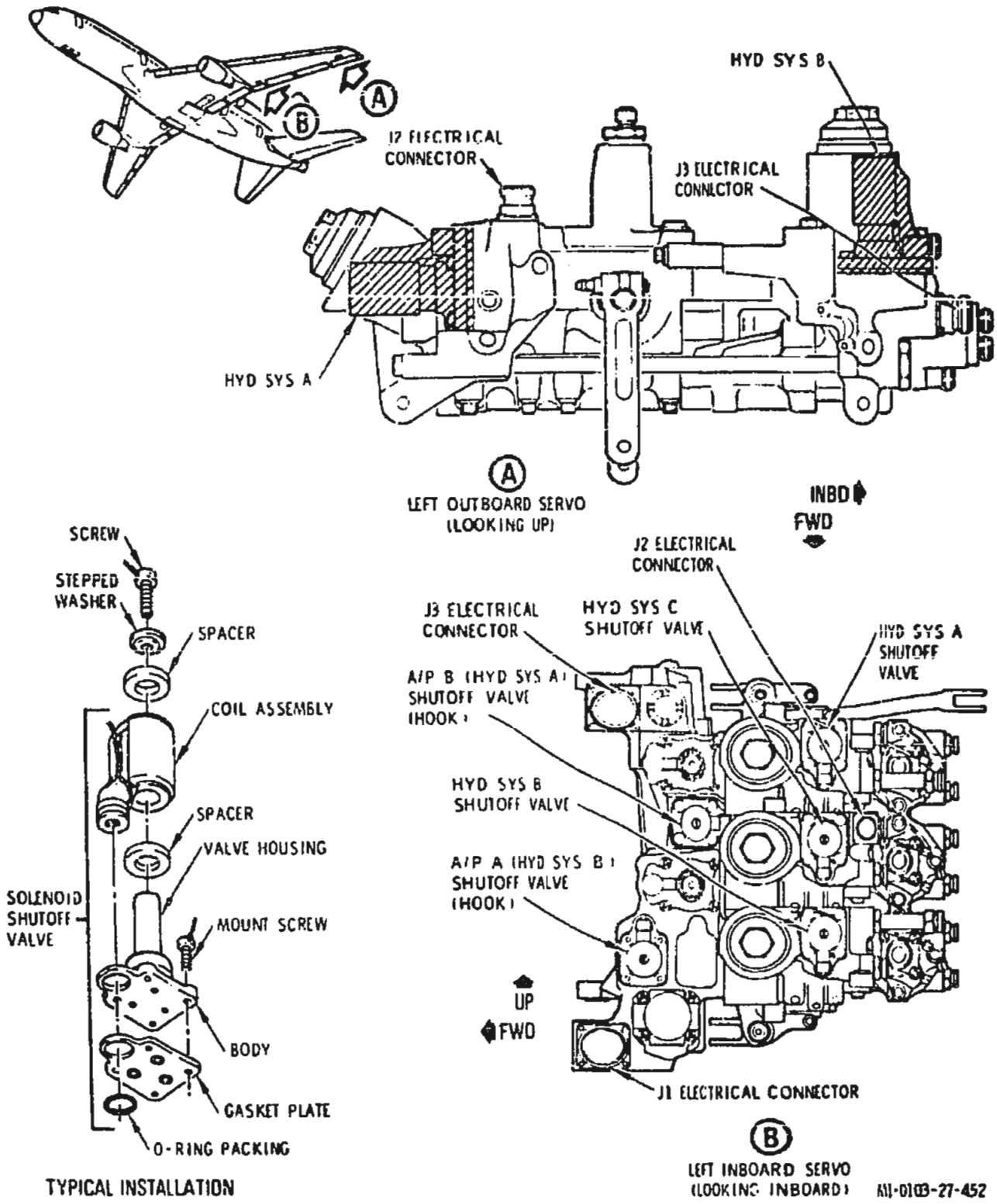
(d) Position autopilot lever switch to OFF.

(8) If solenoid shutoff valve assembly was replaced, check shutoff valve for hydraulic leakage at mounting joint.

(9) Turn off hydraulic power if no longer required (Ref. 29-11-00).

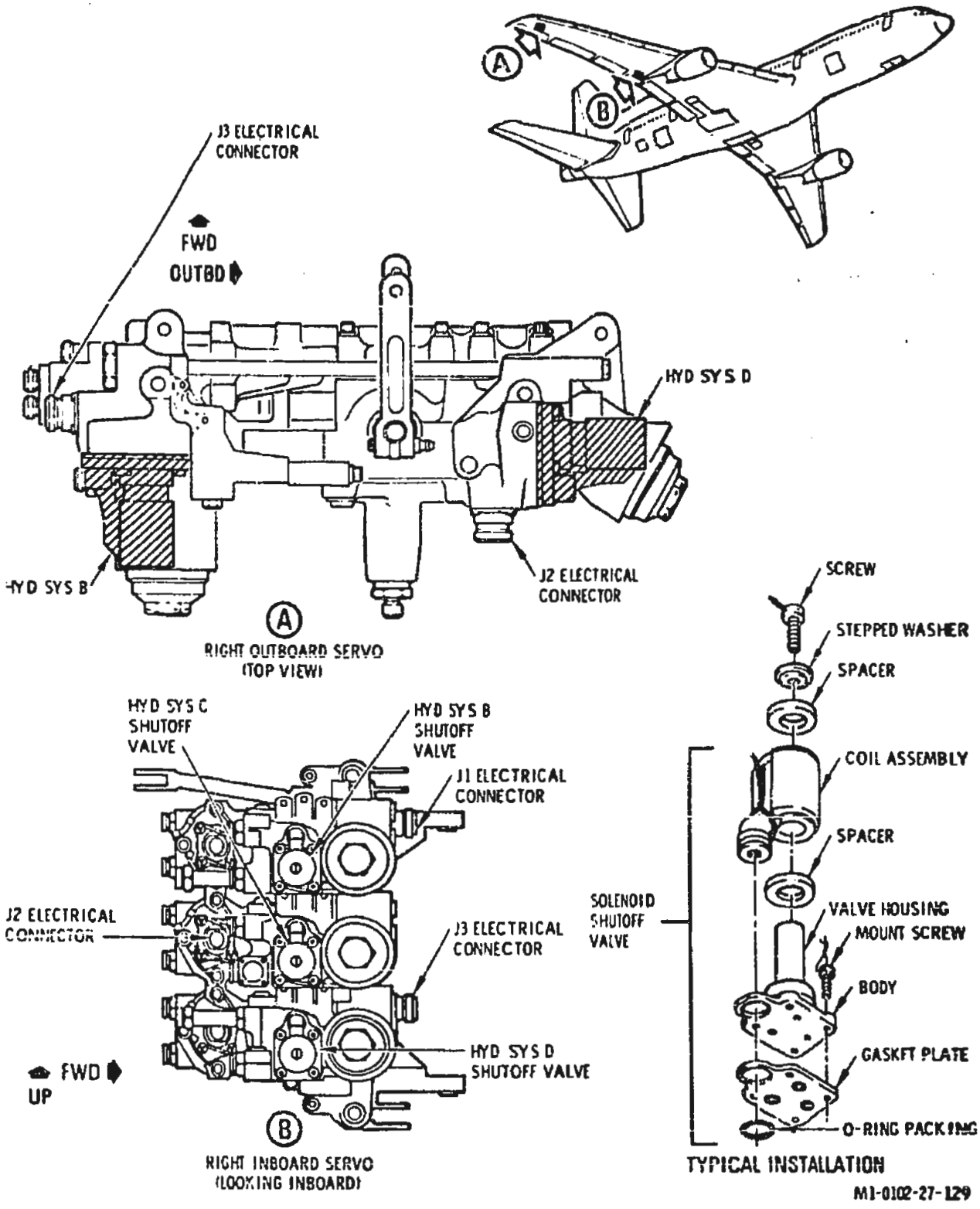
(10) Turn off electrical power if no longer required (Ref. 24-41-00).

(11) Install access panel and pylon fairing.



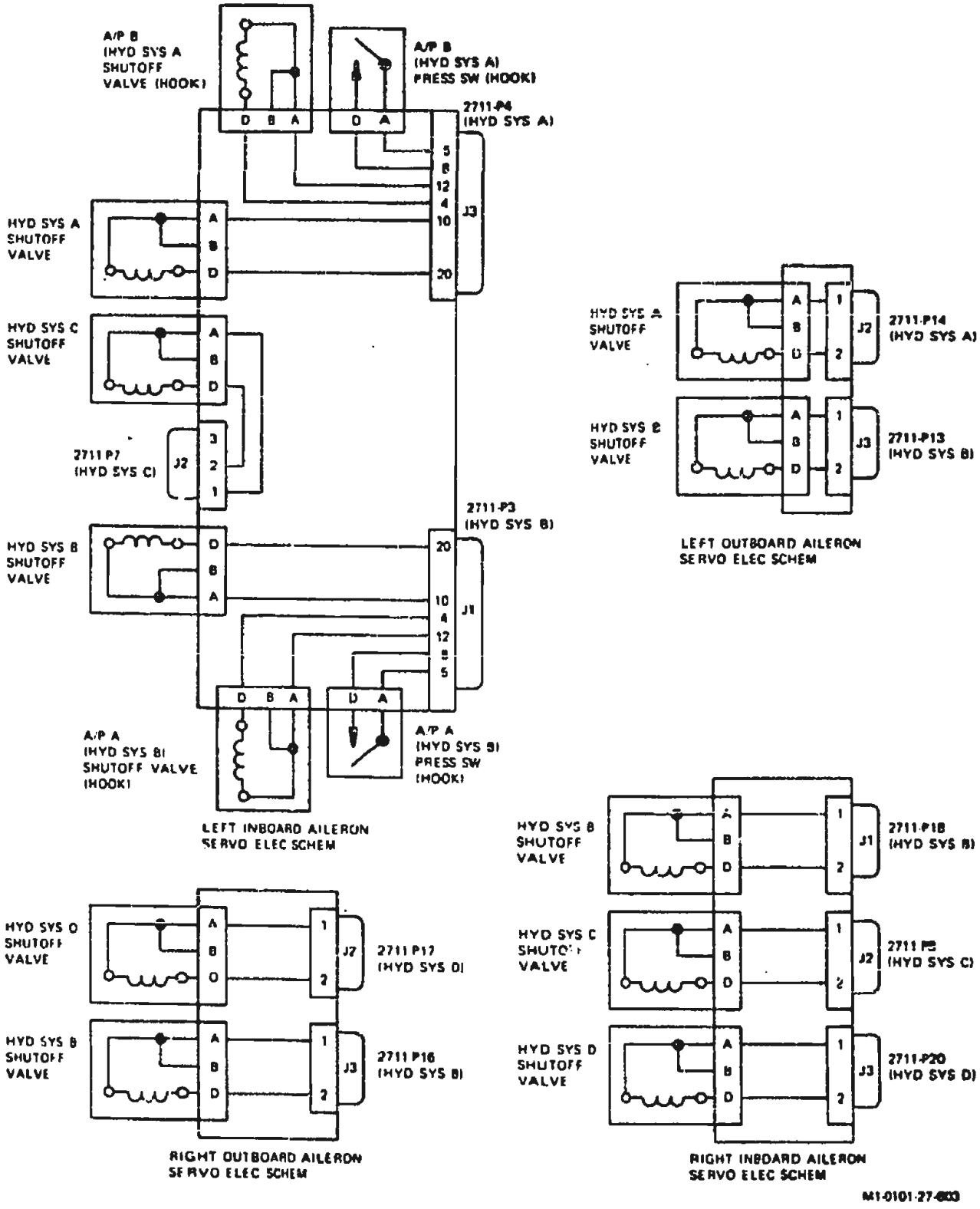
R Aileron Servo Solenoid Shutoff Valve - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL



R Aileron Servo Solenoid Shutoff Valve - Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: ALL



R R Aileron Servo Solenoid Shutoff Valve - Removal and Installation
Figure 401 (Sheet 3)

EFFECTIVITY: ALL

001B

AILERON SERVO ELECTROHYDRAULIC SERVO VALVE (EHV) REMOVAL AND INSTALLATION

1. General

There are two electrohydraulic valves mounted on the left inboard aileron servo.

2. Equipment and Materials

Container, 1 quart

R Gasket, P/N 704858-101, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

R O-ring, P/N NAS 1611-112, or equivalent

3. Referenced Procedures

22-12-00 APFDS Modes of Operation - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

4. Removal/Installation

R A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (hydraulic system B), or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (hydraulic system A).

(2) Open applicable left wing inboard aileron servo access panel:

Upper wing: panel 551AT (avionics system No. 2, hydraulic system A)

Lower wing: panel 551BB (avionics system No. 1, hydraulic system B)

(3) Place container under servo valve.

(4) Remove mount screws and remove EHV valve from aileron servo.

R B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

(2) Install new preformed O-ring packing on EHV valve electrical connection groove.

(3) Verify electrical connectors on EHV valve and aileron servo are not contaminated with oil. If they are, clean with approved solvent.

(4) Verify that plate gasket is installed on the EHV valve. Install valve on aileron servo. Secure with mount screws and lock-wire.

NOTE: Tri-wing screws can be replaced by NAS 1351 socket-head cap screws.

(5) Remove tag and close circuit breaker opened in Step 3A(1).

(6) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic system A (autopilot system No. B) or B (autopilot system No. A) as applicable (Ref. 29-11-00).

(8) Accomplish autopilot setup, Paragraph 4B of 22-12-00.

(9) On APFDS ENGAGE panel, position applicable autopilot lever switch to CWS.

(10) Rotate either control wheel (left, right, then center). Verify following:

(a) Aileron control surfaces follow control wheel as indicated on the surface position indicator.

(b) No warnings come on.

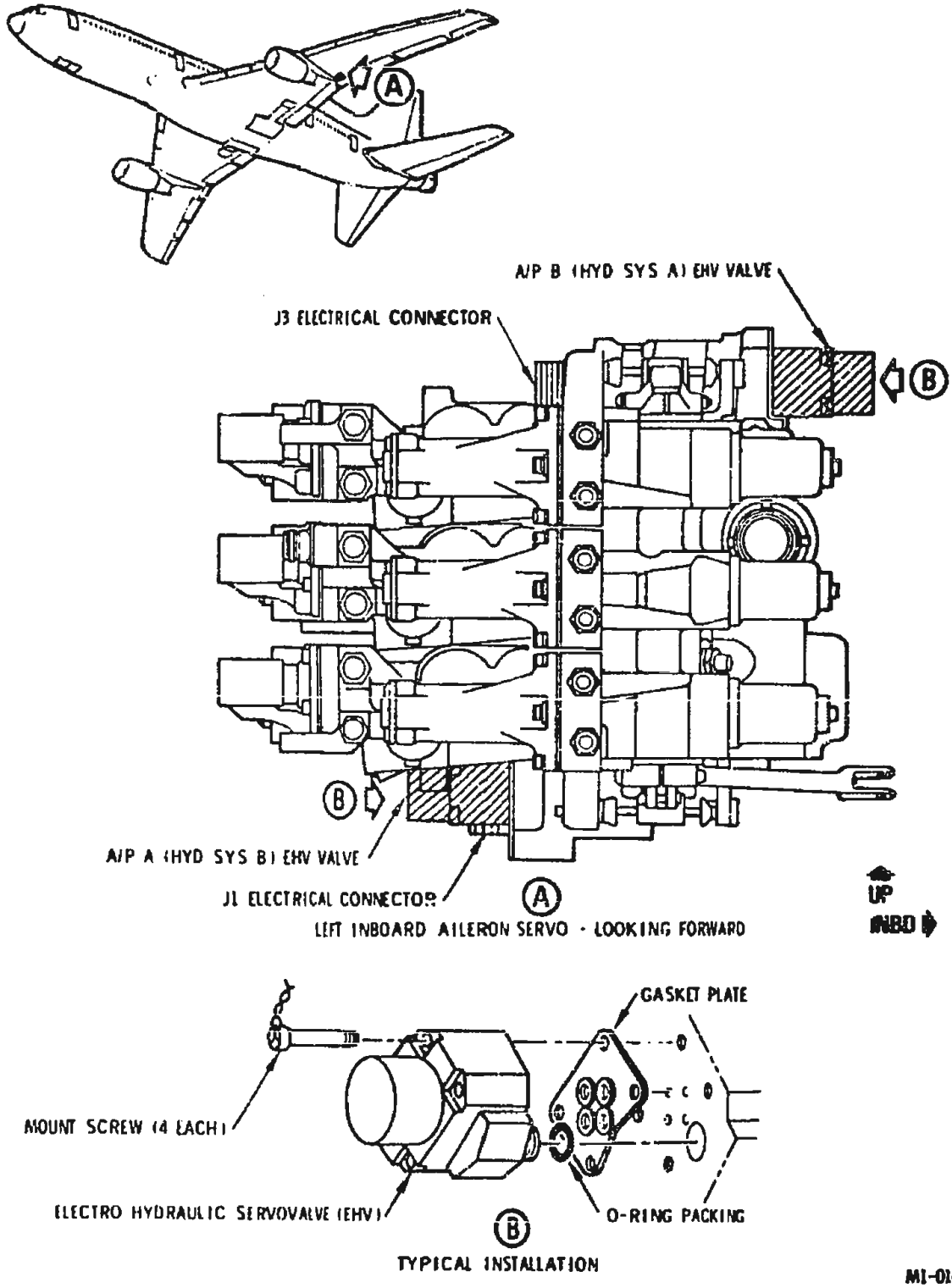
(c) The autopilot lever switch remains in the CWS position.

(11) Position autopilot lever switch to OFF.

(12) Check EHV valve for any indication of hydraulic leakage.

(13) Turn off hydraulic system if no longer required (Ref. 29-11-00).

(14) Close access panel.



Aileron Servo Electrohydraulic Servo Valve (EHV)
Removal and Installation
Figure 401

FILTER ELEMENT, INBOARD AND OUTBOARD AILERON SERVO CONTROL MODULE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Drip pan, 1-gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

2. Referenced Procedures

R 12-13-01 Hydraulic Bootstrap Reservoir - Servicing

29-11-00 Hydraulic System Power - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Remove applicable access panel, left wing inboard panel 551BB, outboard panel 571CB, right wing inboard panel 651BB, outboard panel 671CB, for access to inboard and outboard aileron servo control module.

(2) Place drip pan under aileron servo control module to catch hydraulic fluid.

(3) Remove filter cover from servo control module (Ref. Fig. 401).

(4) Remove and discard backup ring, preformed packing, and backup ring from filter cover.

(5) Pull filter element from servo control module. Remove and discard backup ring, preformed packing, and backup ring from filter element.

B. Installation

(1) Wet preformed packings and backup rings with hydraulic fluid before installation.

(2) Install backup ring, preformed packing, and backup ring on filter element.

(3) Install filter element in servo control module.

(4) Install backup ring, preformed packing, and backup ring in groove on filter cover.

CAUTION: DO NOT EXCEED 55 LB FT WHEN TIGHTENING FILTER COVER.

(5) Install filter cover over filter element and torque 50 to 55 lb ft. Attach lock-wire to filter cover and manifold.

(6) Remove tags installed at beginning of Paragraph 3.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN-LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

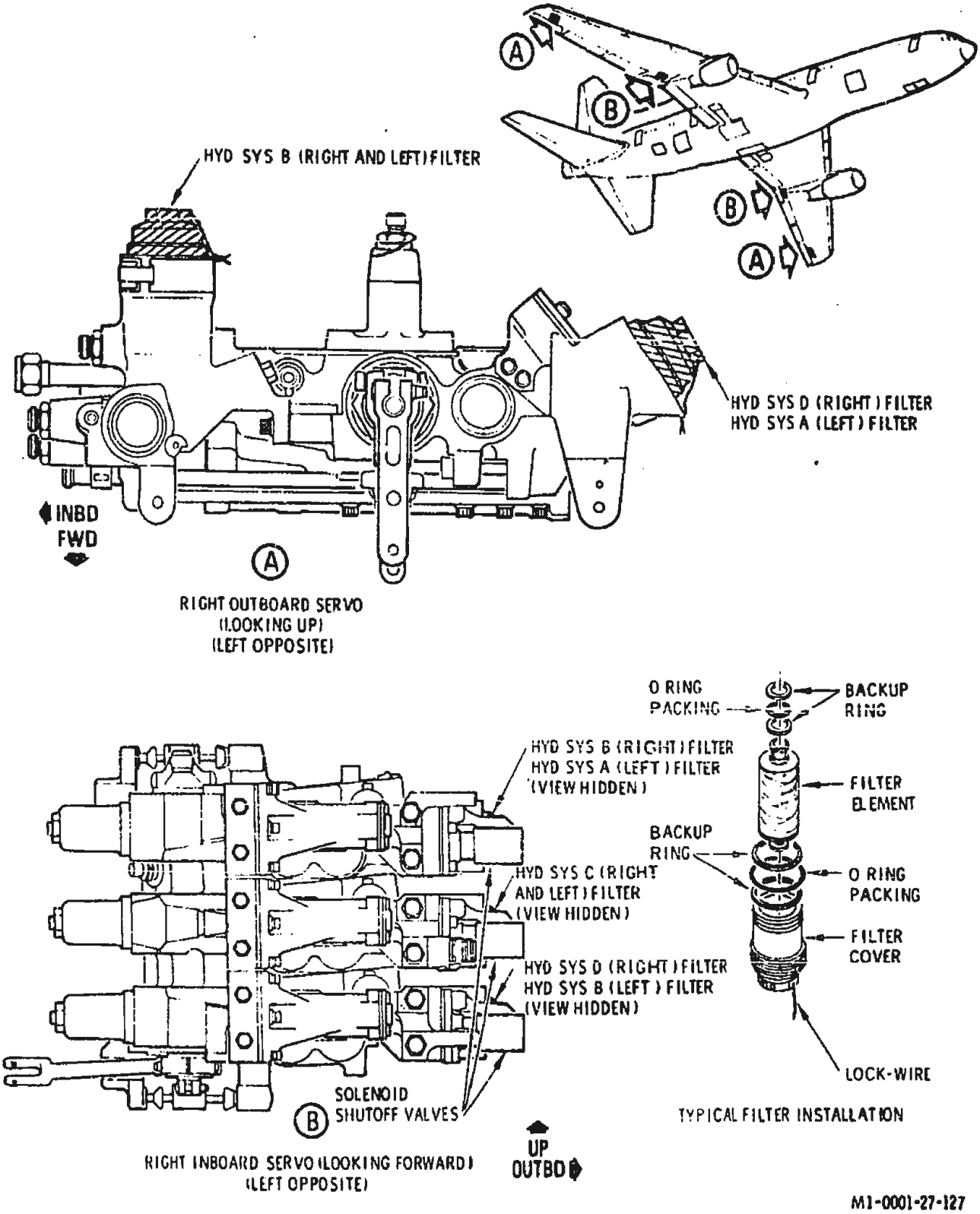
(7) Turn on hydraulic system (Ref. 29-11-00) associated with filter element being installed (Ref. Fig. 401).

(8) Bleed servo control module by cycling pilots control wheel in flight station, zone 210, from full up to full down position five times. Visually determine that filter cover is not leaking.

NOTE: After bleeding servo perform a hydraulic reservoir air bleed check for the associated hydraulic system (Ref. 12-13-01).

(9) Turn off hydraulic power (Ref. 29-11-00).

(10) Install and secure access panel opened in Step 3A(1).



M1-0001-27-127

R Filter Element, Inboard and Outboard Aileron Servo Control Module
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

INBOARD AILERON HYDRAULIC ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Container, 1-gallon capacity

Actuator hydraulic fitting protective plate

Hydraulic line fitting protective plate

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Grease, Aircraft and Instrument - MIL-G-23827A, or equivalent

2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
	12-23-00	Flight Controls Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

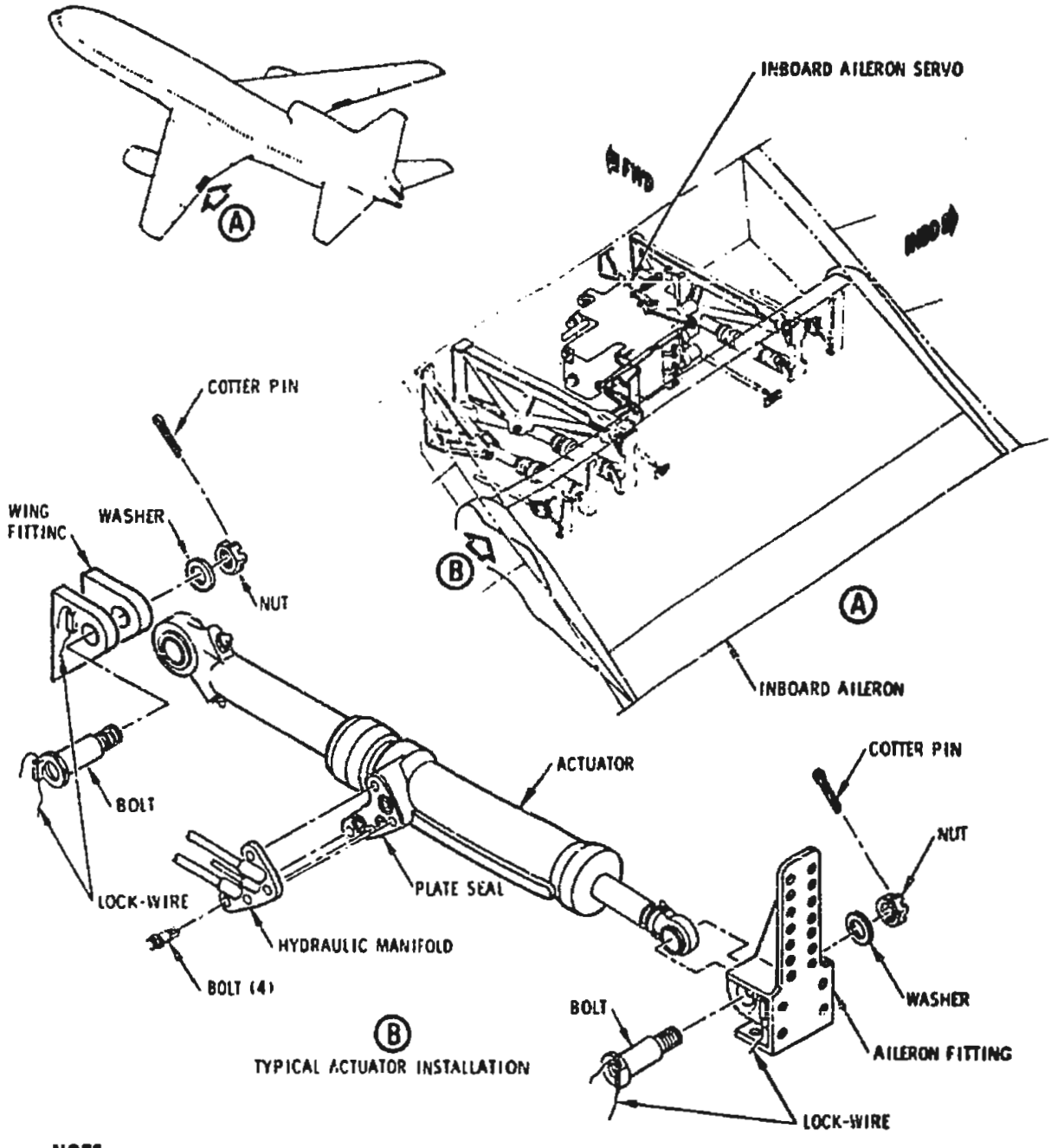
WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Open access door 551BB for left wing or 651BB for right wing. Remove small access plate on aileron leading
R edge shroud below actuator attachment to aileron (Ref.
R 6-40-00).

(2) Remove bolts attaching hydraulic manifold plate fitting to actuator (Ref. Fig. 401).

(3) Install protective plates on actuator fitting pad and on hydraulic line manifold plate.



NOTE
LEFT WING INSTALLATION SHOWN
RIGHT WING IS SIMILAR

MH 6234
M1-0101-27-413

R Inboard Aileron Hydraulic Actuator - Removal and Installation
R Figure 401

(4) Remove actuator hinge bolts. Remove actuator.

B. Installation

(1) Install actuator with piston rod attached to aileron. Butter-lube both attaching bolts with grease, MIL-G-23827A. Install attaching bolts, washers, and nuts. Install cotter pins, and lock-wire bolts.

(2) Remove protective plates from actuator fitting pad and the hydraulic line manifold plate.

R (3) Inspect mating surfaces of actuator and hydraulic line
R manifold for nicks, burrs, and cleanliness. Inspect
R hydraulic line manifold for flatness.

R CAUTION: USE NEW BOLTS AND PLATE GASKET SEAL WHEN
R REINSTALLING HYDRAULIC LINE MANIFOLD PLATE.
R INSTALL SEAL PLATE DRY (NO LUCBRICANT), WITH
R MINIMUM RESIDUAL HYDRAULIC FLUID ON ACTUATOR AND
R MANIFOLD SURFACES.

R (4) Attach hydraulic line manifold plate to actuator with
R bolts. Torque bolts 100 to 110 lb. in. and install
R lock-wire.

(5) Lubricate the actuator bearing fittings (Ref. 12-23-00).

(6) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on electrical power (Ref. 24-41-00).

(8) Turn on hydraulic power systems A, B, and C for left wing actuators or systems B, C, and D for right wing actuators (Ref. 29-11-00).

CAUTION: RAPID CYCLING CAN DAMAGE OUTBOARD AILERON DAMPER SEALS. CYCLE CONTROL WHEEL SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(9) Bleed actuator by operating the flight station control wheel until controls operate smoothly without roughness.

(10) Check actuator installation during bleeding procedure for proper clearance between actuator and surrounding equipment and structure.

(11) Check actuator hydraulic connections for leakage.

CAUTION: REPLACEMENT OF AILERON ACTUATORS MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL USING INDIVIDUAL HYDRAULIC SYSTEMS AS APPLICABLE TO THE ACTUATOR BEING REPLACED. THIS IS REQUIRED TO ASSURE HYDRAULIC LINES TO UNIT BEING REPLACED HAVE NOT BEEN CROSSED DURING INSTALLATION. HYDRAULIC SYSTEMS APPLICABLE TO LOCATIONS ARE SHOWN BELOW:

LEFT INBD AILERON - A, B, AND C

RIGHT INBD AILERON - B, C, AND D

R (12) Perform test to verify actuator hydraulic lines are not crossed (Ref. 27-11-00).

(13) Turn off hydraulic power (Ref. 29-11-00).

(14) Turn off electrical power (Ref. 24-41-00).

R (15) Close access door and plate opened in Step 3A(1).

AILERON ACTUATORS - ADJUSTMENT AND TEST

1. General

R R This procedure provides an operational test of the four aileron servos to determine that the individual aileron actuation channels are responding properly to control inputs.

2. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

3. Adjustment/Test

A. Operational Test

(1) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that all four AILERON SERVO circuit breakers (J19, J20, J21, J22) are closed.

(2) Turn on electrical power (Ref. 24-41-00).

(3) On PFCS panel, verify that all four AILERON switchlights are released (out). Switchlight OFF lights must be on. This action energizes all aileron servo solenoid shutoff valves to deactivate the servos.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on all four hydraulic systems. Energize B and C AC pump, B to A PTU (Power Transfer Unit), and C to D PTU (Ref. 29-11-00). All four ailerons must droop and be inoperative.

R R

(5) Open AILERON SERVO B circuit breaker to deenergize system B solenoid valves and pressurize the system B servos.

(6) Rotate control wheel left and right. Verify that all four ailerons operate when commanded by the control
R wheel. Verify correct direction of travel: left roll
R positions left ailerons up, right ailerons down; right
R roll positions right ailerons up, left ailerons down.

NOTE: Use surface position indicator to verify surface movement. Depress and hold indicator OUTBD AIL PUSH switch to read outboard aileron movement.

(7) Close AILERON SERVO B circuit breaker and open AILERON SERVO A circuit breaker.

(8) Rotate control wheel left and right. Verify that both left ailerons operate when commanded by control wheel.
R Verify correct direction of travel. Both right ailerons must be inoperative.

(9) Close AILERON SERVO A circuit breakers and open AILERON SERVO C circuit breaker.

(10) Rotate control wheel left and right. Verify that left and right inboard ailerons operate when commanded by control wheel. Left and right outboard ailerons must
R be inoperative. Verify correct direction of travel.

(11) Close AILERON SERVO C circuit breakers; open AILERON SERVO A and AILERON SERVO D circuit breaker.

NOTE: System A is turned on to provide hydraulic power to the left inboard (master) servo.

(12) Rotate control wheel left and right. Verify that all four ailerons operate when commanded by control wheel.
R Verify correct direction of travel.

(13) Release control wheel.

(14) Close all four AILERON SERVO circuit breakers.

(15) Depress (latched in) all four AILERONS switchlights on PFCS panel. Verify that all four switchlight OFF lights go out.

(16) Turn off hydraulic power (Ref. 29-11-00).

(17) Turn off electrical power (Ref. 24-41-00).

OUTBOARD AILERON HYDRAULIC ACTUATOR - REMOVAL AND INSTALLATION

1. General

If the outboard aileron actuator is being replaced due to a cracked and leaking cylinder, accomplish the outboard aileron actuator bottoming check (Ref. 27-11-24, Inspection and Check).

CR CR C NOTE: Bottoming check is not required if improved actuator, P/N 2179000-7 or -9 (Ref. IPC 27-11-43), is installed. (See Fig. 402).

2. Equipment and Materials

Container, 1-gallon capacity

Actuator hydraulic fitting protective plate

Hydraulic line fitting protective plate

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Cotter Pin - MS24665-374, or equivalent

Grease, Aircraft and Instrument - MIL-G-23827A, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-00	Flight Control Lubrication
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

C C C C C If the actuator is being replaced due to a crack in the cylinder wall, the L.H. and R.H. Aileron Actuator Bottoming check in this section must be accomplished. Notify MCIMD specifying airplane number and M/M 27-11-24 if time does not permit immediate accomplishment.

C WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
C (REF 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
C HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC
C SERVICE PANEL, ZONE 147.

C A. Removal (Ref. Fig. 401)

(1) Open the following access door: for left wing: 571CB; for right wing: 671CB. Remove small access plate on aileron leading edge shroud below actuator attachment to aileron (Ref. 6-40-00).

(2) Place container below actuator to catch fluid.

(3) Remove bolts attaching the hydraulic line manifold plate fittings to the actuator (Ref. Fig. 401).

(4) Install protective plates on actuator fitting pads and on hydraulic line manifold plates.

(5) Remove actuator rod end bolts.

(6) Remove actuator.

B. Installation

CR CAUTION: TO PREVENT INSTALLATION OF THE INCORRECT ACTUATOR,
CR THE HYDRAULIC LINE BOSS HAS A ROLL PIN AND
CR ADDITIONAL HOLE WHICH MATES WITH THE MODIFIED
CR HYDRAULIC TUBE (REF. Fig. 403).

(1) Install actuator with piston rod towards aileron.

(2) Butter lube both actuator rod end bolts with grease.

(3) Install rod end bolts, washers and nuts.

(4) Install cotter pin.

(5) Lockwire bolt head.

(6) Remove hydraulic line manifold plates and hydraulic lines from aircraft.

(7) Remove protective plates from actuator and hydraulic line manifold plate fittings.

(8) Inspect mating surfaces of actuator and hydraulic line manifold for nicks, burrs, and cleanliness. Inspect hydraulic manifolds for flatness.

WARNING: WHEN REINSTALLING HYDRAULIC LINE MANIFOLD PLATE, USE NEW BOLTS AND PLATE GASKET SEAL. INSTALL SEAL PLATE DRY (NO LUBRICANT), WITH MINIMUM RESIDUAL HYDRAULIC FLUID ON ACTUATOR AND MANIFOLD SURFACES.

(9) Place new plate gasket on actuator mating surface and attach hydraulic line manifolds to actuator with new bolts. Torque to 80 to 100 lb in.

(10) Lock-wire bolts.

(11) Attach hydraulic lines to aircraft and tighten B-nuts.

(12) Lubricate actuator bearing fittings (Ref. 12-23-00).

(13) Remove tags installed at beginning of Paragraph 4.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

THE PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(14) Turn on electrical power (Ref. 24-41-00).

(15) Pressurize hydraulic systems A and B for left wing, or systems B and D for right wing (Ref. 29-11-00).

CAUTION: RAPID CYCLING OF AILERONS CAN DAMAGE THE OUTBOARD AILERON DAMPER SEALS. CYCLE AILERONS SLOWLY; MINIMUM 4 SECONDS STOP-TO-STOP.

(16) Bleed actuator by slowly operating the flight station control wheel through 10 full roll cycles. Bleed until control operates smoothly with no binding.

(17) Check actuator installation during bleeding procedure for proper clearance between actuator and surrounding equipment and structure.

(18) Check actuator hydraulic connections for leakage.

CAUTION: REPLACEMENT OF AILERON ACTUATORS MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL USING INDIVIDUAL HYDRAULIC SYSTEMS AS APPLICABLE TO THE ACTUATOR BEING REPLACED. THIS IS REQUIRED TO ASSURE THE HYDRAULIC LINES TO THE UNIT BEING REPLACED HAVE NOT BEEN CROSSED DURING INSTALLATION. HYDRAULIC SYSTEMS APPLICABLE TO THE LOCATIONS ARE SHOWN BELOW:

LEFT OUTBD AILERON - A AND B

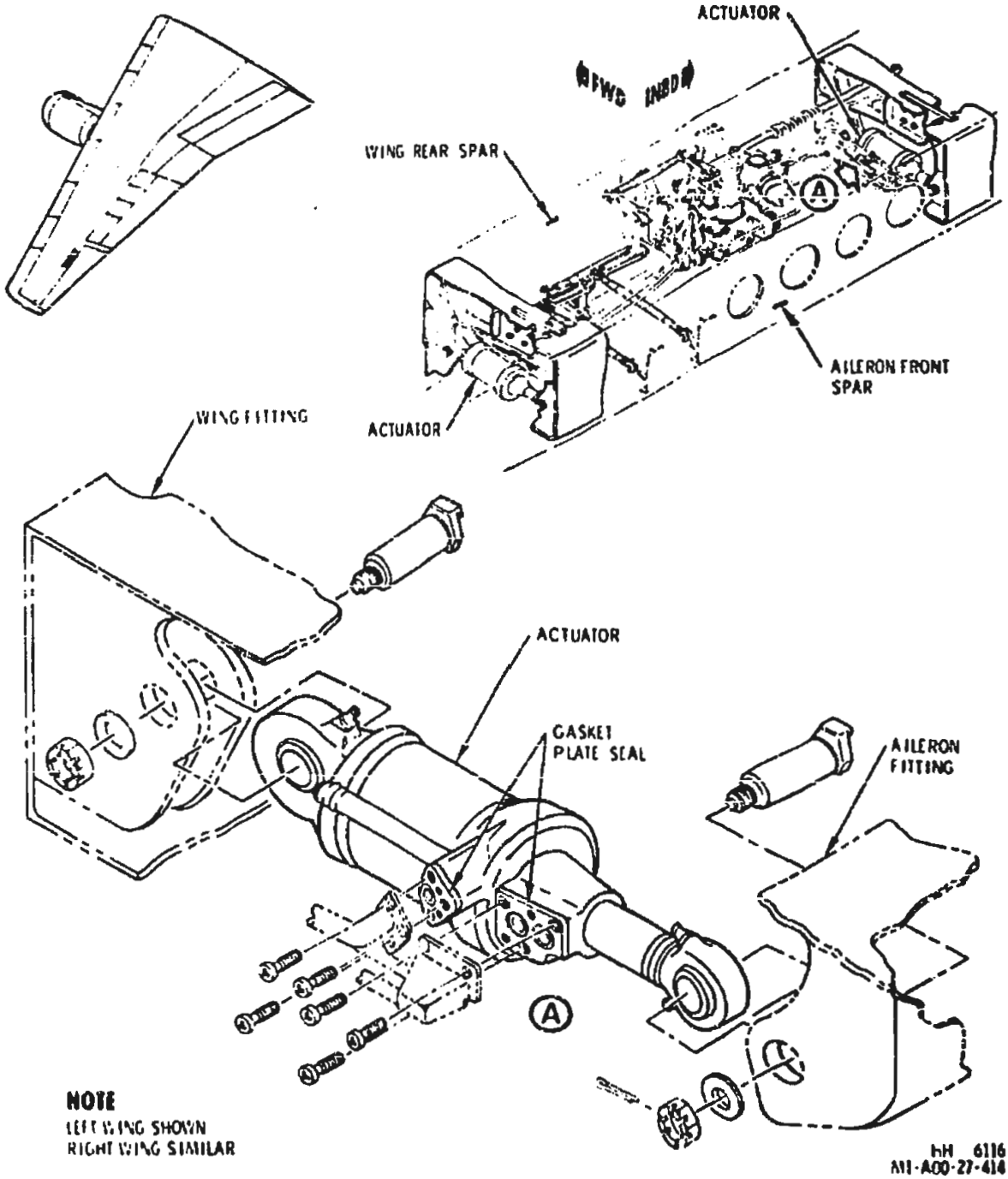
RIGHT OUTBD AILERON - B AND D

R C C C (19) Perform test to verify actuator hydraulic lines are not crossed (Ref. 27-11-00). Perform aileron bottoming check if actuator was cracked (Ref. 27-11-24 Inspection/Check).

R (20) Turn off hydraulic power if no longer required (Ref. 29-11-00).

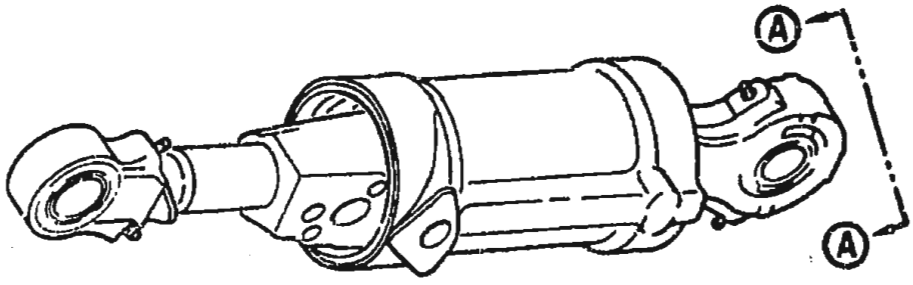
R (21) Turn off electrical power if no longer required (Ref. 24-41-00).

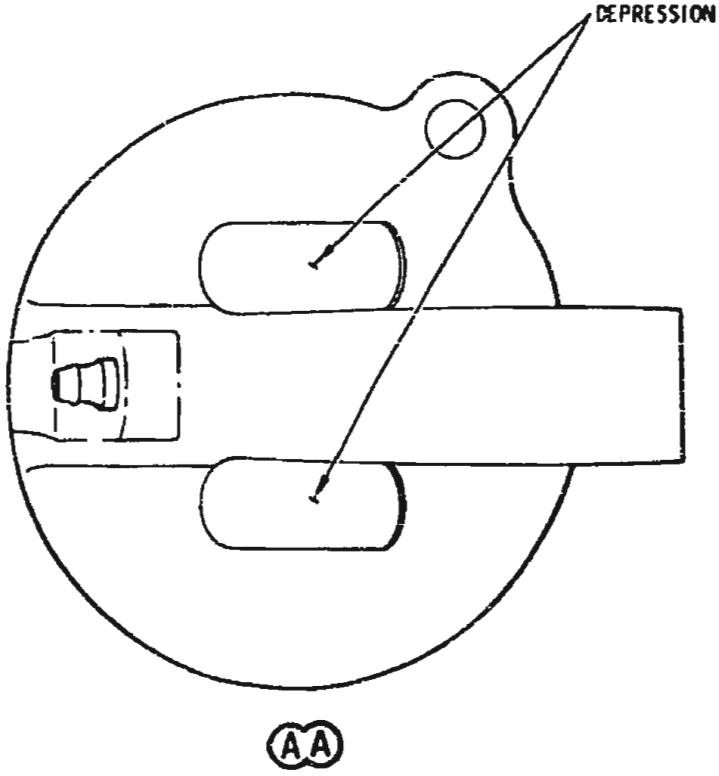
R (22) Close access doors and panels opened in Step 4A(1) (Ref. 6-40-00).



R Outboard Aileron Actuator - Removal and Installation
R Figure 401

THE IMPROVED OUTBOARD AILERON ACTUATOR DOES NOT REQUIRE THE BOTTOMING CHECK. THE ACTUATOR CAN BE IDENTIFIED BY THE DEPRESSIONS IN THE HEAD. SEE VIEW A-A.





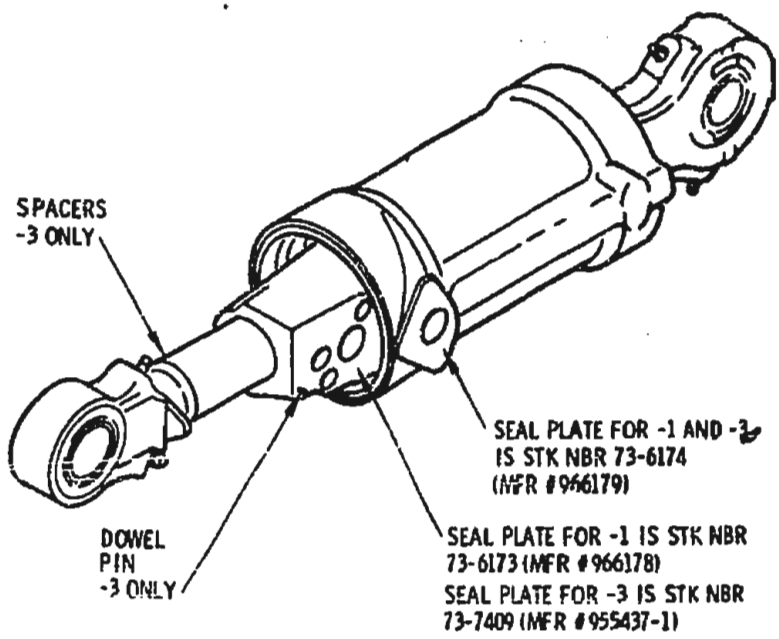
M1-0000-27-963

CR
CR

Improve Outboard Aileron Actuator
Figure 402

R
R
001B

EFFECTIVITY: ALL



NOTE

1 ACTUATOR, MFR. P/N 2179000-1, TWA STK. NBR. 18129, IS USED ON DOMESTIC AIRCRAFT 11001-11017.

2 ACTUATOR, MFR. P/N 2179000-3, TWA STK. NBR. 18134, IS USED ON INTERNATIONAL AIRCRAFT 21018-31036.

M1-0000-27-1190

CR
CR

Outboard Aileron Hydraulic Actuator
Figure 403

R EFFECTIVITY: ALL
R
001B

OUTBOARD AILERON HYDRAULIC ACTUATOR - INSPECTION AND CHECK

1. General

If an outboard aileron actuator is replaced due to a cracked and leaking cylinder, the problem can be due to the actuator piston bottoming within the cylinder. This procedure checks if the outboard aileron piston is bottoming and provides corrective
CR action. Not required if improved actuator is installed. See
CR Fig. 402 in Removal/Installation.

2. Equipment and Materials

Aileron surface travel measuring ruler. A strip of cardboard or aluminum approximately one-inch wide by 13 inches long will accomplish task.

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
27-11-28	Outboard Aileron - Approved Repairs
29-11-00	Hydraulic Power System - Maintenance Practices

R 4. Inspection/Check

A. Left Outboard Aileron Actuator Bottoming Check

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREE.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on all four hydraulic systems, A, B, C and D (Ref. 29-11-00).

(3) Open access door 571CB under outboard aileron servo (Ref. 6-40-00).

(4) Verify outboard aileron neutral rig position meets requirements of 27-11-00, Adjustment and Test, Paragraph 5I, Left Outboard Aileron Servo (Ref. SB27-114).

(5) Station one man in the flight station and two men under left outboard aileron on a suitable workstand.

(6) Move control wheel to full left roll position and hold against wheel stop.

WARNING: ANY RAPID OR INADVERTENT MOTION OF CONTROL WHEEL WILL JEOPARDIZE THE SAFETY OF WING-AREA PERSONNEL AND COULD RESULT IN SERIOUS INJURY. FLIGHT STATION MUST COORDINATE ALL CONTROL WHEEL MOVEMENT WITH WING CREW.

(7) Through access door, verify servo input crank is firmly against input stop on servo manifold. When this is not the case, manually hold input crank against stop (push or pull on the input rod).

(8) While in this condition, note aileron position on a strip of cardboard or aluminum sheet relative to neutral index point (Ref. Fig. 601, A DIM). To determine aileron travel, mark the position of inboard edge of outboard aileron at a point 10 inches forward of trailing edge on the strip.

On aircraft 001-018, 021, 022, for the neutral index, mark the adjacent fixed trailing

edge lower surface structure, at a point 10 inches forward of trailing edge on the strip.

On aircraft 019, 020, 023-999, for neutral index, use the red paint-filled index notch adjacent fixed trailing edge structure end rib located 10 inches forward of trailing edge and 1.54 inches up from lower surface.

(9) Mark A DIM on measuring strip.

(10) Check aileron up direction overtravel (0.25 inch minimum) of left wing outboard aileron as follows:

R R (a) With wheel held firmly against left roll wheel stop and servo input crank against its stop, unlatch the OUTBD aileron switchlight on Primary Flight Control System (PFCS) panel while manually holding aileron up.

(b) Push up aileron to obtain maximum position. Mark this position, B DIM, on same strip as previous measurement in a manner to determine overtravel dimension (B minus A).

R (c) Latch OUTBD aileron switchlight on PFCS panel then slowly center control wheel.

R R (d) If up overtravel is more than 0.25 inch, up travel is within tolerance. Check down overtravel in accordance with Step 4A(11).

(e) If up overtravel is 0.0 to 0.25 inch, modify aileron actuator fitting (Ref. 27-11-28).

NOTE: A zero value indicates actuator bottoming, it is not allowable in the up aileron direction.

(11) Check aileron down direction overtravel as follows:

(a) Move control wheel to full right roll position and hold against wheel stop.

WARNING: ANY RAPID OR INADVERTENT MOTION OF CONTROL WHEEL WILL JEOPARDIZE THE SAFETY OF WING-AREA PERSONNEL AND COULD RESULT IN SERIOUS INJURY. THE FLIGHT STATION MUST COORDINATE ALL CONTROL WHEEL MOVEMENT WITH THE WING CREW.

(b) With wheel held firmly against right roll wheel stop, perform Steps 4A(7), 4A(8), and 4A(9).

R (c) Unlatch OUTBD aileron switchlight on PFCS panel. This will allow left outboard aileron to droop full down against fully retracted actuator.

(d) Push down on aileron to obtain maximum down position.

(e) Mark this position, B DIM, on same strip as previous measurement in a manner to determine overtravel dimension (B minus A).

R (f) Latch OUTBD aileron switchlight on FPCS panel, then slowly center control wheel.

(g) If down overtravel is 0.25 inch or more, aileron travel is within tolerance. Proceed to Step 4A(13).

(h) If DOWN - overtravel is less than 0.25 inch, proceed to Step 4A(12).

(12) Under any condition which causes an actuator to bottom in the down direction, it must be determined that a non-bottoming actuator is within 0.12 inch (1.75 degree aileron travel) of its fully retracted position. With wheel held firmly against right roll wheel stop, perform the following steps:

R (a) Unlatch L OUTBD aileron switchlight. Open circuit breakers CB2-(J20) and CB2-(J21) to de-energize channel A and B shutoff valves and actuate the servo.

(b) With control wheel held firmly against right roll wheel stop, close circuit breaker CB2-(J21) to inhibit hydraulic B system to left inboard actuator, while an observer measures springback (upward) at trailing edge of aileron, at approximately center line of inboard actuator, using workstand floor as reference (Ref. Fig. 602).

(c) If (upward) springback is more than 1.17 inches, outboard actuator is bottoming too soon. For correction, modify aileron actuator fitting (Ref. 27-11-28).

(d) If (upward) springback is less than 1.17 inch but more than 0.0, the aileron travel is within
R tolerance. Latch L OUTBD aileron switchlight, close circuit breaker CB2-(J20), slowly center the control wheel. Proceed to Step 4A(13).

(e) If (upward) springback is zero, verify L OUTBD
R aileron switchlight is unlatched, circuit breaker CB2-(J21) is closed and circuit breaker CB2-(J20) is open. Open circuit breaker CB2-(J21) and close circuit breaker CB2-(J20) to inhibit hydraulic system A to left outboard actuator, while an observer measures springback (upward) at trailing edge of the aileron at approximately center line of outboard actuator using workstand floor as reference.

(f) If springback is greater than 1.07 inch, inboard actuator is bottoming too soon. For correction, modify aileron actuator fitting (Ref. 27-11-28).

(g) If springback is less than 1.07 inch, aileron travel is within tolerance. Close circuit breaker
R CB2-(J21) latch L OUTBD aileron switchlight, and slowly center control wheel.

(13) Turn off electrical power if no longer required (Ref. 24-41-00).

(14) Turn off hydraulic power if no longer required (Ref. 29-11-00).

B. Right Outboard Aileron Actuator Bottoming Check

(1) Turn on electric power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREE.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on all four hydraulic systems A, B, C and D (Ref. 29-11-00).

(3) Open access door 671CB under outboard aileron servo (Ref. 6-40-00).

(4) Verify outboard aileron neutral rig positions meet requirements of 27-11-00, Adjustment and Test, Paragraph 5M, Right Outboard Aileron Servo.

(5) Station one man in flight station and two men under right outboard aileron on a suitable workstand.

(6) Move the control wheel to full right roll position and hold against wheel stop.

WARNING: ANY RAPID OR INADVERTENT MOTION OF CONTROL WHEEL WILL JEOPARDIZE THE SAFETY OF WING-AREA PERSONNEL AND COULD RESULT IN SERIOUS INJURY. THE FLIGHT STATION MUST COORDINATE ALL CONTROL WHEEL MOVEMENT WITH WING CREW.

(7) Through access door, verify servo input crank is firmly against input stop on servo manifold. When this is not the case, manually hold input crank against stop (push or pull on the input rod).

(8) While in this condition, note aileron position on a strip of cardboard or aluminum sheet relative to neutral index point (Ref. Fig. 601, A DIM. To determine aileron travel, mark this position of inboard edge of outboard aileron at a point 10 inches forward of trailing edge on strip. (See Step 4A(8) to determine neutral index point).

(9) Mark A DIM on measuring strip.

(10) Check up direction overtravel (0.25 inch minimum) of right wing outboard aileron as follows:

R R (a) With wheel held firmly against right roll wheel stop and servo input crank against its stop, unlatch the R OUTBD aileron switchlight on PFCS panel while manually holding aileron up.

(b) Push up on aileron to obtain maximum up position. Mark this position, B DIM, on same strip as previous measurement in a manner to determine overtravel dimension (B minus A).

R (c) Latch R OUTBD aileron switchlight on the PFCS panel then slowly center control wheel.

R (d) If up overtravel is more than 0.25 inch, check down overtravel in accordance with 4A(11).

(e) If UP overtravel is 0.0 to 0.25 inch, correct by modifying aileron actuator fitting (Ref. 27-11-28).

NOTE: A zero value indicates actuator bottoming, it is not allowable in aileron UP direction.

(11) Check down direction overtravel as follows:

(a) With wheel held firmly against left roll wheel stop, perform applicable Steps 4B(7), 4B(8), and 4B(9).

R (b) Unlatch R OUTBD aileron switchlight on PFCS panel. This will allow right outboard aileron to droop full down against fully retracted actuator(s).

(c) Push down on aileron to obtain maximum DOWN position.

(d) Mark this position, B DIM, on same strip as previous measurement in a manner to determine overtravel dimension (B minus A).

R (e) Latch R OUTBD aileron switchlight on PFCS panel, then slowly center control wheel.

(f) If down overtravel is 0.25 inch or more,check is complete; proceed to Step 4B(13).

(g) If DOWN overtravel is less than 0.25 inch, proceed to Step 4B(12) below.

(12) Under any condition which causes an actuator to bottom in down direction, it must be determined that non-bottoming actuator is within 0.12 inch (1.75 degree aileron travel) of its fully retracted position. With wheel held firmly against left roll wheel stop, perform following steps:

R (a) Unlatch R OUTND aileron switchlight. Open circuit breakers CB2-(J21) and CB2-(J22) to de-energize channel B and D shutoff valves and activate servo.

(b) With control wheel held firmly against left roll wheel stop, close circuit breaker CB2-(J21) to inhibit hydraulic B system to right inboard actuator, while an observer measures springback (upward) at trailing edge of aileron at approximately center line of inboard actuator,

using workstand floor as reference (Ref. Fig. 602)].

(c) If (upward) springback is more than 1.17 inches, outboard actuator is bottoming too soon. For correction, modify aileron actuator fitting (Ref. 27-11-28).

R (d) If (upward) springback is less than 1.17 inch but more than 0.0, check is complete. Latch R OUTBD aileron switchlight, close circuit breaker CB2-(J21), slowly center control wheel and proceed to Step 4B(13).

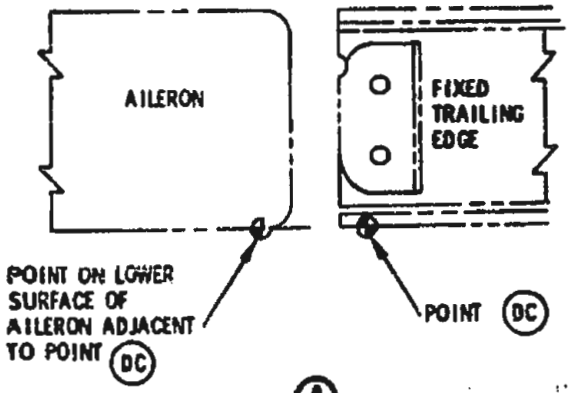
R (e) If (upward) springback is zero, verify R OUTBD aileron switchlight is unlatched, circuit breaker CB2-(J22) is open and CB2-(J21) is closed. Open circuit breaker CB2-(J21) and close circuit breaker CB2-(J22) to inhibit hydraulic system D to right outboard actuator, while an observer measures springback (upward) at trailing edge of aileron at approximately centerline of outboard actuator using workstand floor as a reference.

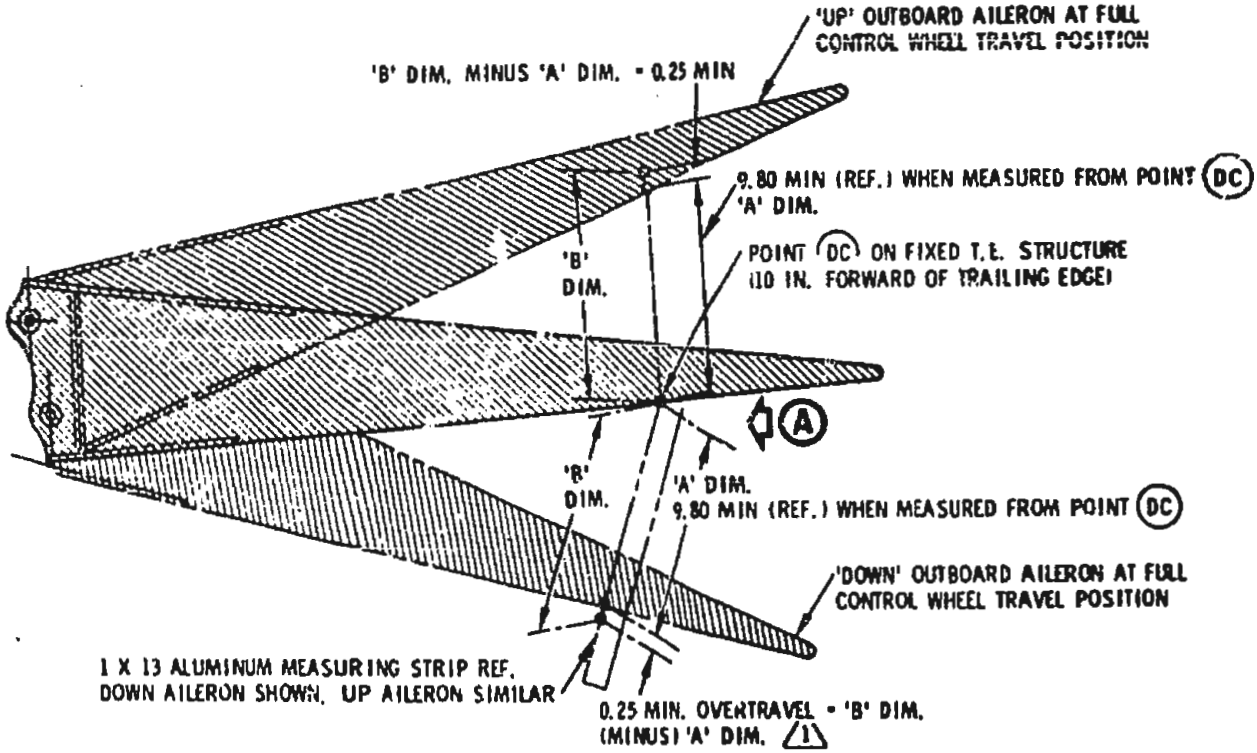
(f) If springback is greater than 1.07 inch, inboard actuator is bottoming too soon. For correction, modify aileron actuator fitting (Ref. 27-11-28).

R (g) If springback is less than 1.07 inch, close circuit breaker CB2-(J21), latch R OUTBD aileron switchlight and proceed to Step 4B(13).

(13) Turn off electrical power if no longer required (Ref. 24-41-00).

(14) Turn off hydraulic power if no longer required (Ref. 29-11-00).




'UP' OUTBOARD AILERON AT FULL CONTROL WHEEL TRAVEL POSITION
'B' DIM. MINUS 'A' DIM. = 0.25 MIN
9.80 MIN (REF.) WHEN MEASURED FROM POINT DC
'A' DIM.
POINT DC ON FIXED T.E. STRUCTURE (10 IN. FORWARD OF TRAILING EDGE)
'B' DIM.
A
'B' DIM.
'A' DIM.
9.80 MIN (REF.) WHEN MEASURED FROM POINT DC
'DOWN' OUTBOARD AILERON AT FULL CONTROL WHEEL TRAVEL POSITION
1 X 13 ALUMINUM MEASURING STRIP REF. DOWN AILERON SHOWN, UP AILERON SIMILAR
0.25 MIN. OVERTRAVEL = 'B' DIM. (MINUS) 'A' DIM. 1

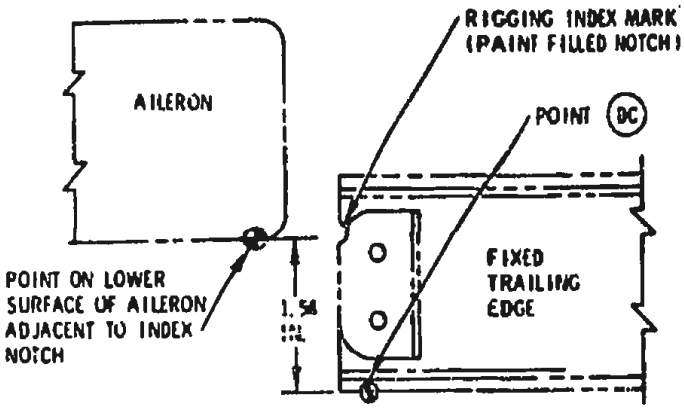
ACTUATOR BOTTOMING CHECK SCHEMATIC

NOTE

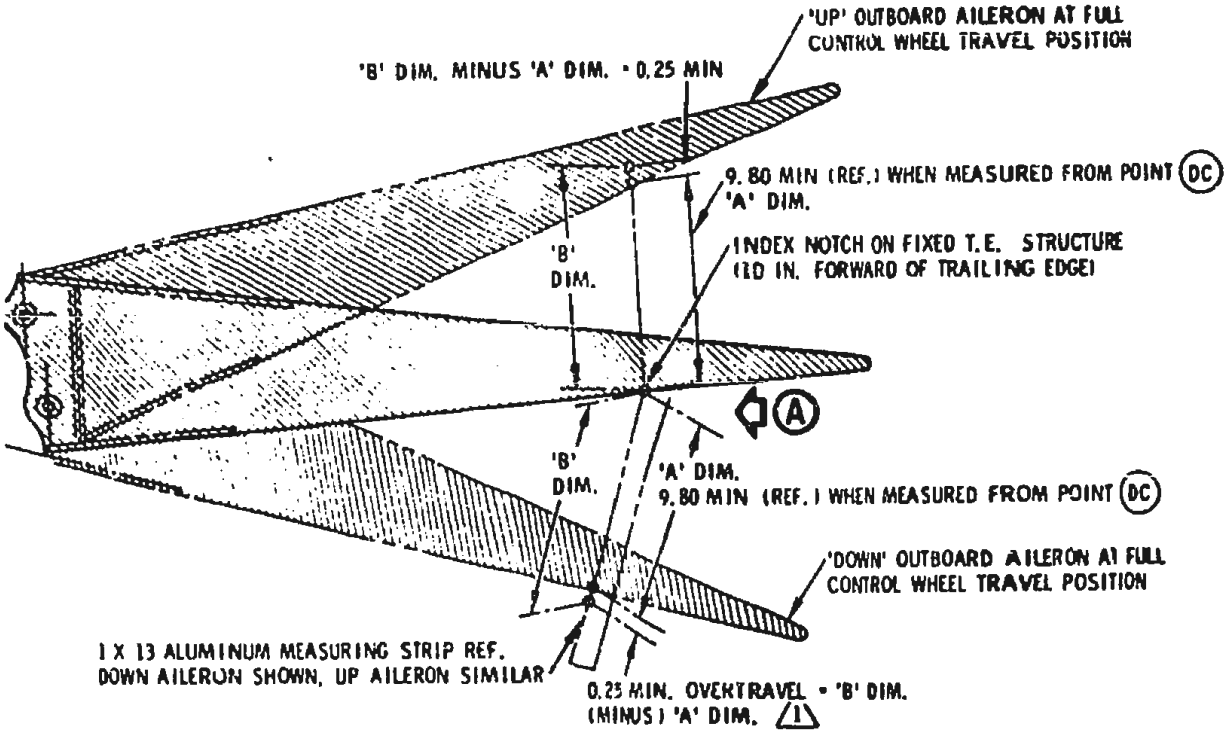
1 ALTERNATE: BOTH ACTUATORS ON ONE SURFACE MUST BOTTOM WITHIN 0.125 OF EACH OTHER

M1-0101-27-604

R Outboard Aileron Actuator Bottoming Check
R Figure 601



(A)
VIEW LOOKING FORWARD


'UP' OUTBOARD AILERON AT FULL CONTROL WHEEL TRAVEL POSITION
'B' DIM. MINUS 'A' DIM. = 0.25 MIN
9.80 MIN (REF.) WHEN MEASURED FROM POINT (DC)
'A' DIM.
INDEX NOTCH ON FIXED T.E. STRUCTURE (ID IN. FORWARD OF TRAILING EDGE)
'B' DIM.
(A)
'B' DIM.
'A' DIM.
9.80 MIN (REF.) WHEN MEASURED FROM POINT (DC)
'DOWN' OUTBOARD AILERON AT FULL CONTROL WHEEL TRAVEL POSITION
1 X 13 ALUMINUM MEASURING STRIP REF. DOWN AILERON SHOWN, UP AILERON SIMILAR
0.25 MIN. OVERTRAVEL = 'B' DIM. (MINUS) 'A' DIM. (1)

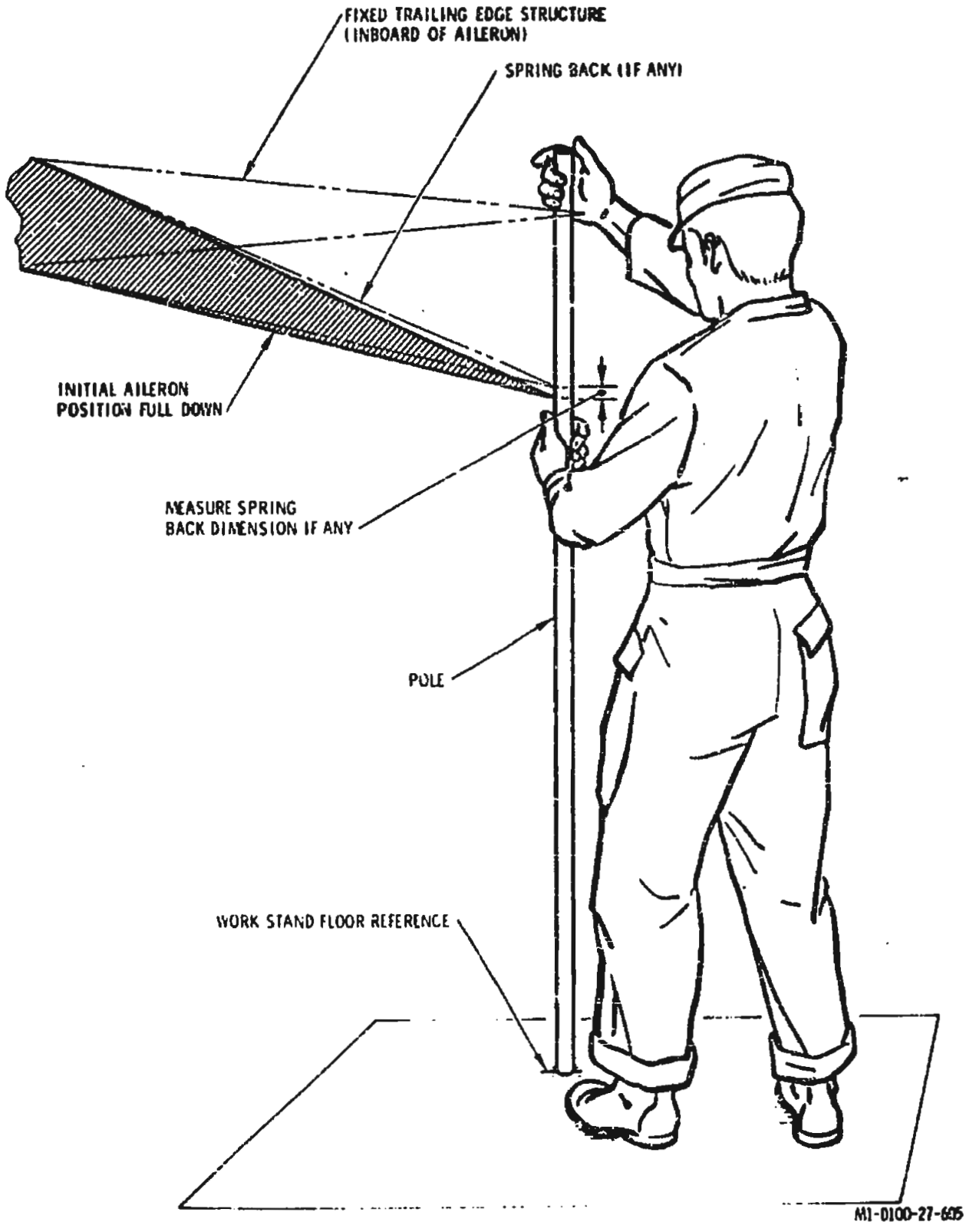
ACTUATOR BOTTOMING CHECK SCHEMATIC

NOTE

(1) ALTERNATE: BOTH ACTUATORS ON ONE SURFACE MUST BOTTOM WITHIN 0.125 OF EACH OTHER

M1-0100-27-674

Outboard Aileron Actuator Bottoming Check
Figure 601


FIXED TRAILING EDGE STRUCTURE (INBOARD OF AILERON)
SPRING BACK (IF ANY)
INITIAL AILERON POSITION FULL DOWN
MEASURE SPRING BACK DIMENSION IF ANY
POLE
WORK STAND FLOOR REFERENCE
M1-0100-27-605

Outboard Aileron Actuator Bottoming Check
Figure 602

R

R EFFECTIVITY: ALL
R
001B

OUTBOARD AILERON CONTROL SURFACE DAMPER - SERVICING

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-423, Cond A, 0.032-inch diameter, or equivalent

Cleaning Solvent, Fed Spec P-P-560, Type 1 (Permatex 403-D, Glaze Cote by Michalan)

Hydraulic pressure source of 70 to 100 psi, supplied with either MIL-H-5606 or MIL-H-6083 hydraulic fluid, filtered to minimum allowable filtration of ten microns (Malabar Dispenser PN 54048 or 54124) (G/ITEL 27-11-78)

Container, one-gallon

Damper filler line with adapter fitting (5/16-24 UNF thread)

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power System - Maintenance Practices

3. Servicing

R Servicing of the outboard aileron damper consists of adding fluid to damper. On -101 through -105 and -111 dampers, do not add fluid to damper if the piston indicator is below refill mark; replace damper as there is a strong possibility that air is entrapped in damper. If damper piston indicator is not visible in the sight window and reservoir piston spring coils are visible, reservoir is empty and damper should be replaced.

A. Outboard Aileron Damper

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open associated access panel (Ref. 6-40-00): inboard damper, 571 DB (left wing), 671 DB (right wing); outboard damper, 571 EB (left wing), 671EB (right wing).

(2) Check damper piston rod seal area for leakage (area wet with fluid). Replace damper if hydraulic leakage is indicated.

(3) Check damper sight window for oil level. See Fig. 301 oil level chart for action to be taken.

(4) If fluid must be added to damper, proceed as follows:

(a) Remove filler plug.

NOTE: The filler plug and bleed plugs are similar. Do not remove bleed plug as air might be introduced into damper. The filler port contains a check valve similar to a tire air valve. The damper cylinder has filler and bleed ports on one end and cylinder attach bearing and lube fitting on the other end. The filler port is located as follows:

- On -101 through -105 and -111 dampers; 180 degrees from the cylinder lube fitting.

- On -107 and -109 dampers; same side as cylinder lube fitting.

(b) Connect filler line to damper. (Verify that filler line is full of fluid before connecting to damper).

CAUTION: NEVER FILL PAST FULL MARK. OVERFILLED RESERVOIR CAN PRODUCE EXCESSIVE PRESSURES DURING OPERATION AND DAMAGE DAMPER.

NOTE: The FILL and BLEED ports are identified on damper.

(c) Using hydraulic pressure source, apply pressurized fluid (70 to 100 psi) to damper and fill to following level:

- On -101 through -105 and -111 dampers, fill until indicator reaches FULL level in sight window (Acceptable limits of FULL lever are 0.00 to -0.10 inch).

R - On -107 and -109 damper, fill until intersection of the blue- and red-stripped bands is opposite the appropriate temperature arrow.

NOTE: Damper indicator window is plexiglass. Use only approved cleaners or solvents to clean window (Fed Spec. P-P-560, Type 1).

(d) Remove filler line.

(e) Install filler plug and safety.

(f) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(g) Turn on hydraulic system B (Ref. 29-11-00).

CAUTION: CYCLING AILERON AT A HIGH RATE CAN DAMAGE THE DAMPER SEALS. CYCLE AILERONS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(h) Slowly cycle the ailerons from full up to full down several times. Verify that damper operation is smooth without any oscillation.

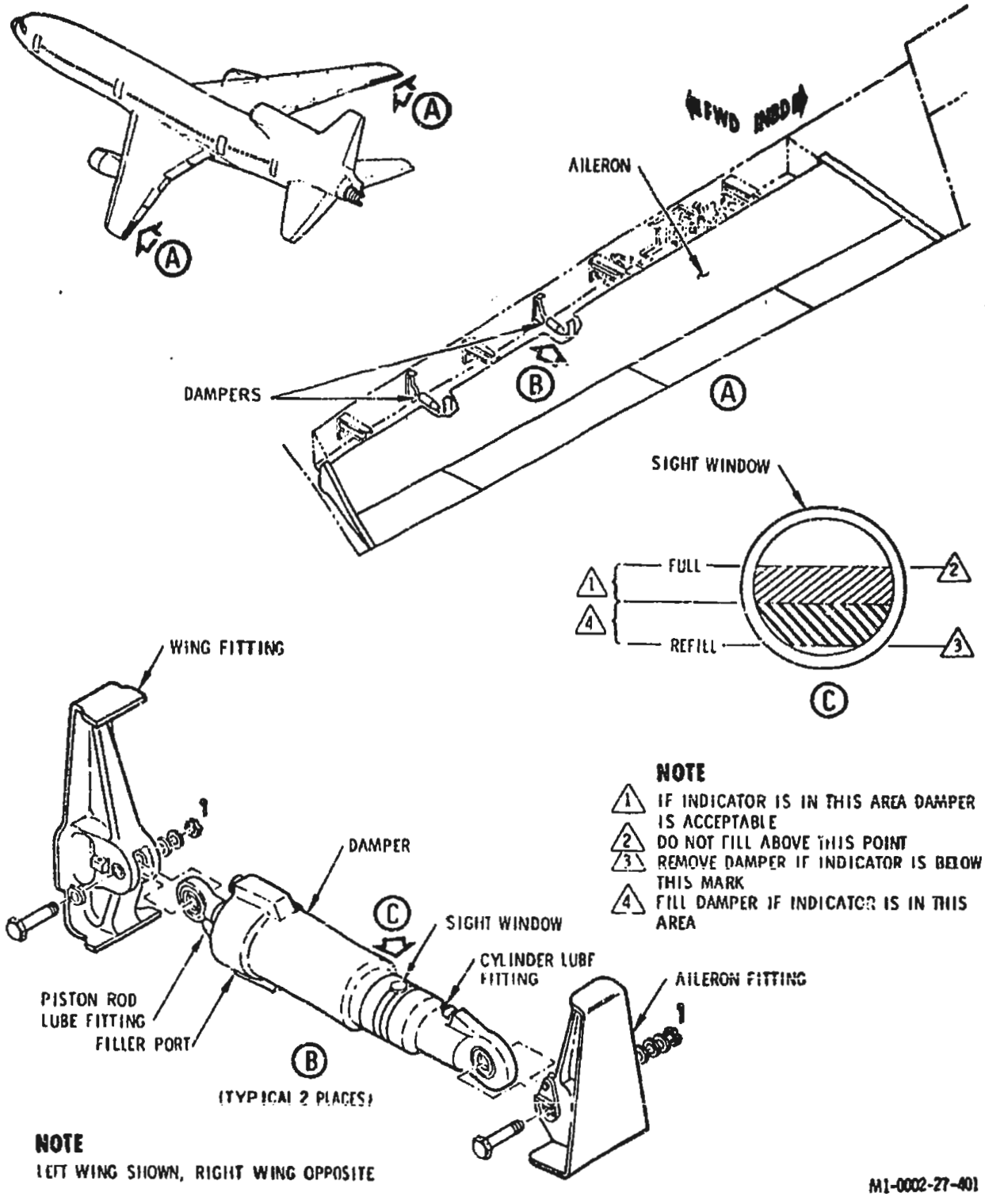
(i) Check damper sight window. Verify indicator still shows FULL.

NOTE: At high ambient temperatures, or after operating damper, indicator can show slightly above FULL and is acceptable.

(j) If damper operation is suspect for any reason, remove damper and return to shop for functional test.

(k) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(5) Close access panel.



NOTE

1. IF INDICATOR IS IN THIS AREA DAMPER IS ACCEPTABLE
2. DO NOT FILL ABOVE THIS POINT
3. REMOVE DAMPER IF INDICATOR IS BELOW THIS MARK
4. FILL DAMPER IF INDICATOR IS IN THIS AREA

NOTE

LEFT WING SHOWN, RIGHT WING OPPOSITE

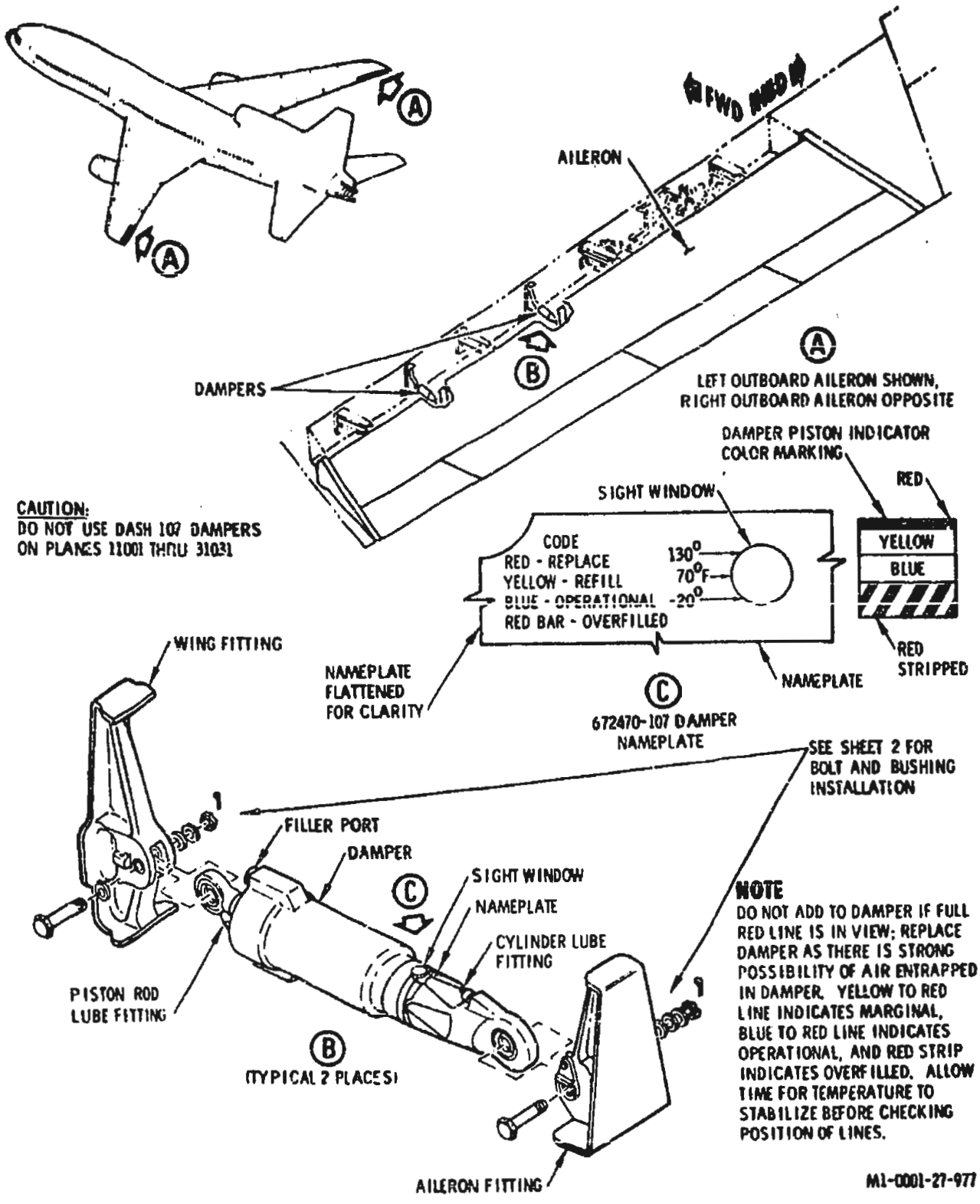
M1-0002-27-401

CR
CR

Outboard Aileron Damper - Servicing
Figure 301

EFFECTIVITY: 001-018 WITH SB27-088, WITHOUT SB27-126 AND 019-031 WITHOUT SB27-126

001B



CR
CR

Outboard Aileron Damper - Servicing
Figure 301

EFFECTIVITY: 001-031 WITH SB27-126 AND 032-999

001B

OUTBOARD AILERON CONTROL SURFACE DAMPER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Cotter pin, MS24665-302, or equivalent

Lock-wire, Fed Spec QQ-W-423, Form I, Cond A, 0.032 diameter, or equivalent

Lubricant, MIL-G-23827, Grease, or equivalent

2. Referenced Procedures

6-40-00	External Access Doors and Panels
12-23-00	Flight Controls Lubrication
24-41-00	External Power/Ground Service Systems - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

A. Removal

(1) Remove following access panels as applicable: left wing inboard damper 571DB, outboard damper 571EB; right wing inboard damper 671DB, outboard damper 671EB (Ref. 6-40-00). Remove access panel in aileron leading edge shroud below subject damper.

(2) Remove damper attaching bolts; remove damper (Ref. Fig. 401).

C NOTE: Damper removal will be facilitated by manually
C positioning aileron towards up and blocking
C aileron in up position.

B. Installation

CR NOTE: Planes 31032 and on were delivered with dash 107
CR dampers (large barrel). If dash 105 damper must be

C used to avoid flight delay, set up to replace with
C dash 107 within 500 flight hours. Dash 105 dampers
C are subject to A.D. 75-9-16 (see M11-AD-01). Dash
C 105 dampers are used on planes 11001 thru 31031.

(1) Verify all hydraulic power is turned off.

CAUTION: IT IS ESSENTIAL THAT CORRECT PART NUMBER DAMPER IS USED. CONSULT ILLUSTRATED PARTS CATALOG.

R (2) Verify replacement damper is properly filled. On -101
R through -105 and -111 dampers, the indicator in sight window should be close to, but should not be past FULL
R mark. On the -107 and -109 damper, the intersection of the blue- and red-striped bands should be opposite the appropriate temperature arrow.

CAUTION: THE DAMPER ATTACH FITTINGS ON THE WING AND AILERON INCORPORATE A SLIP-FIT BUSHING. VERIFY SLIP-FIT BUSHING IS INSTALLED IN BOTH FITTINGS.

C SEE FIG. 401 SHT. 2 FOR BUSHING INSTALLATION,
C LOCATION OF C/S WASHER, AND NUT TORQUE.

DAMPER INSTALLATION ON OUTBOARD AILERON IS UNCONVENTIONAL IN THAT THE DAMPER PISTON ROD IS ATTACHED TO WING REAR SPAR FITTING AND CYLINDER IS ATTACHED TO AILERON. DAMPER PISTON ROD-END MUST BE INSTALLED WITH LUBE FITTING DOWN AND CYLINDER END LUBE FITTING UP. VERIFY DAMPER IS PROPERLY INSTALLED OR STRUCTURE MAY BE DAMAGED.

(3) Coat damper piston rod bolt with grease, and connect damper piston rod to wing rear spar fitting by installing bolt, washers, and nut. Torque nut, install cotter pin, and lock-wire bolt (Ref. Fig. 401).

(4) Coat damper cylinder end fitting bolt with grease, and connect damper cylinder end fitting to aileron fitting by installing bolt, washers, and nut. Torque nut, install cotter pin, and lock-wire bolt.

(5) Lubricate damper lube fittings (Ref. 12-23-00).

(6) Install access panel on aileron shroud.

(7) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on electrical power (Ref. 24-41-00).

(9) Turn on hydraulic systems A and B for left wing, and systems B and D for right wing (Ref. 29-11-00).

CAUTION: CYCLING OUTBOARD AILERON AT A HIGH RATE CAN DAMAGE THE AILERON DAMPER SEALS. CYCLE CONTROL WHEELS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(10) Operate flight station control wheel through three full roll cycles.

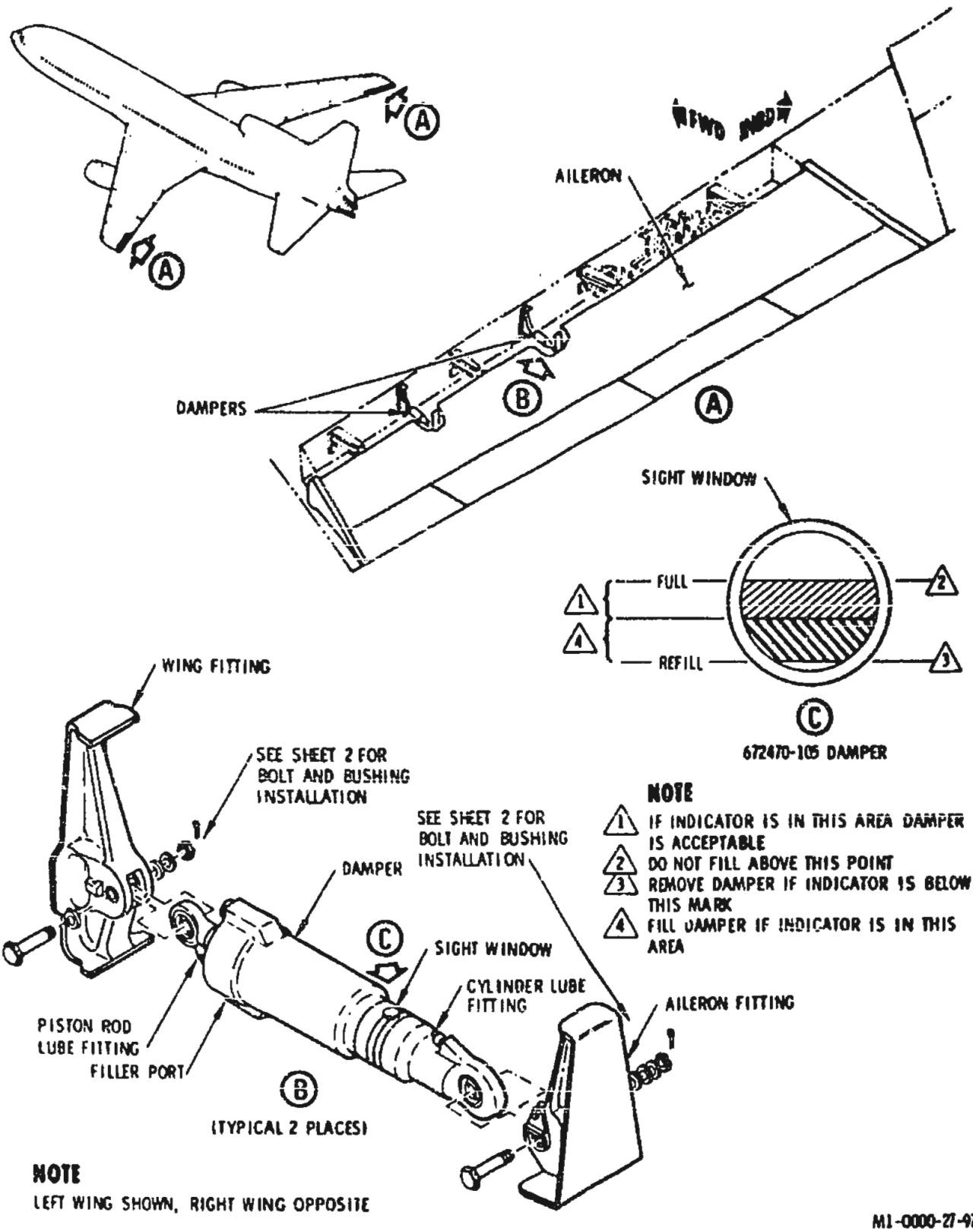
(11) Verify damper operates smoothly with no chatter, and damper clears aileron structure.

(12) Check damper piston rod for signs of external leakage.

(13) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(14) Turn off electrical power if no longer required (Ref. 24-41-00).

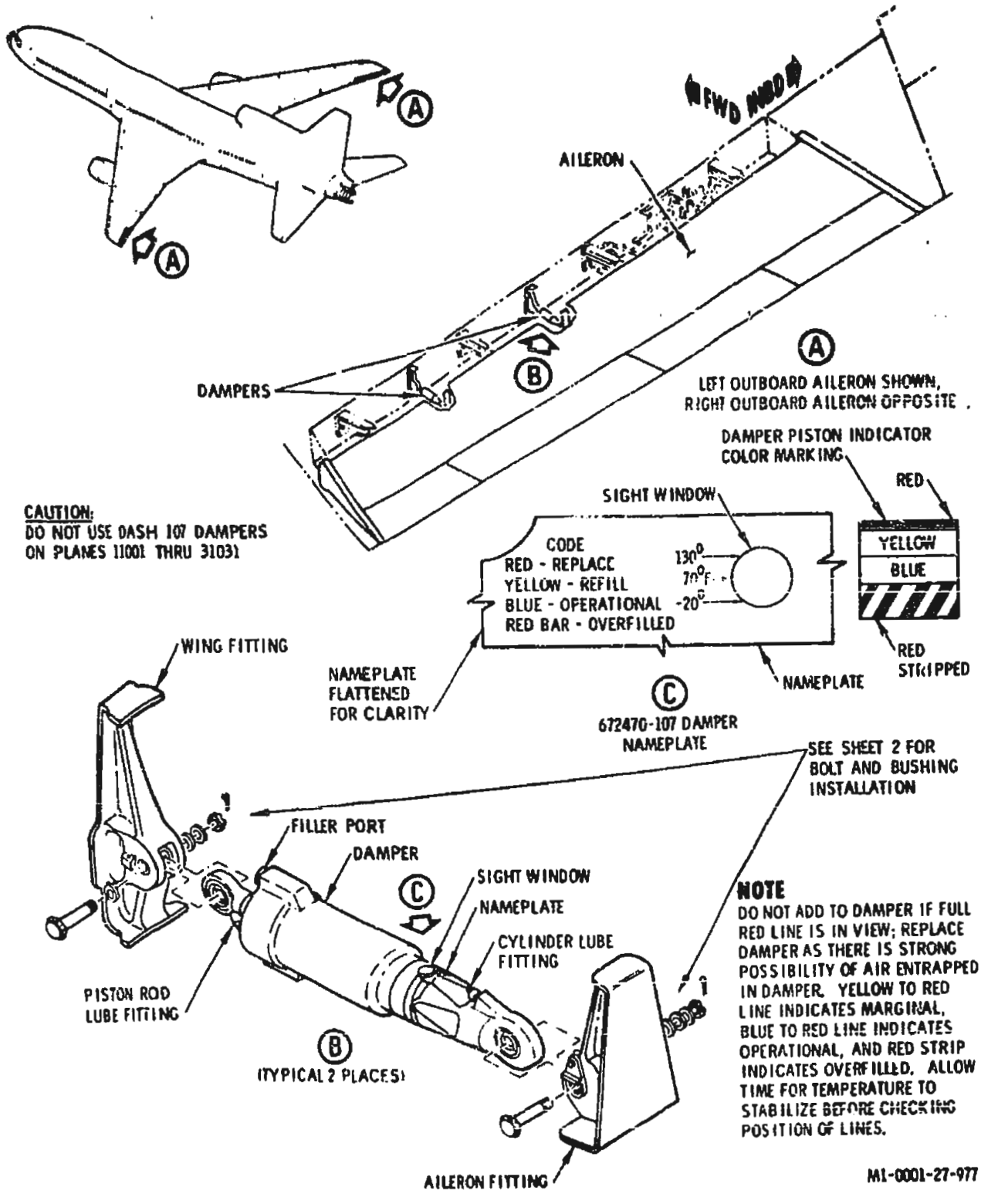
(15) Close access panels opened in Step 4A(1).



CR Outboard Aileron Damper - Removal and Installation
CR Figure 401 (Sheet 1)

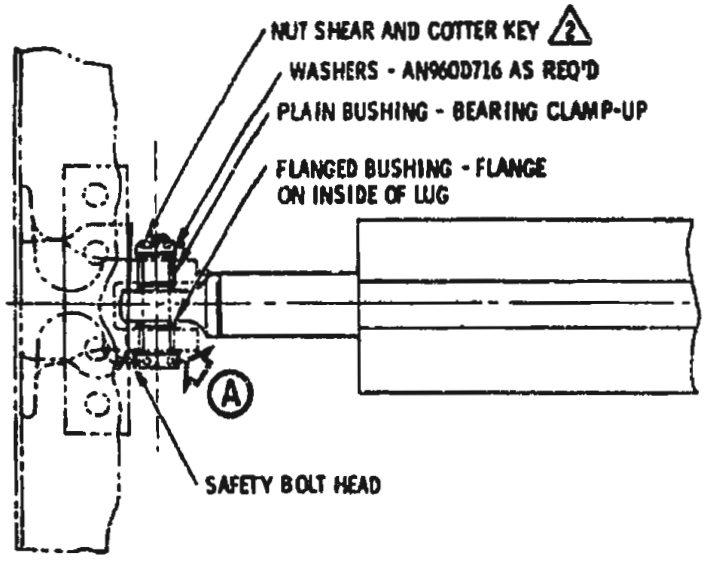
EFFECTIVITY: 001-018 WITH SB27-088, WITHOUT SB27-126 AND 022-031 WITHOUT SB27-126

001B

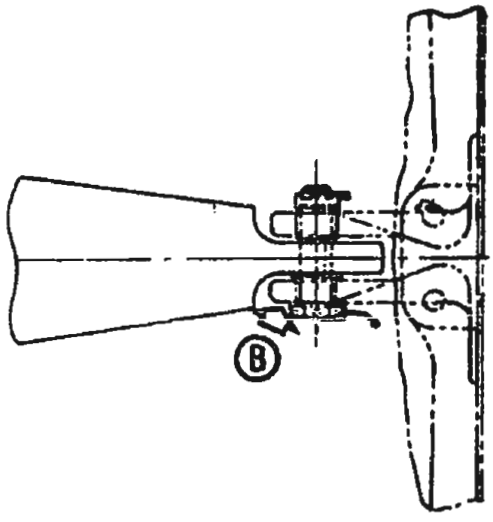


CR Outboard Aileron Damper - Removal and Installation
CR Figure 401 (Sheet 1)

EFFECTIVITY: 001-031 WITH SB27-126 AND 032-999


NUT SHEAR AND COTTER KEY 2
WASHERS - AN960D716 AS REQ'D
PLAIN BUSHING - BEARING CLAMP-UP
FLANGED BUSHING - FLANGE ON INSIDE OF LUG
A
SAFETY BOLT HEAD

O.B. WING STA 440.50 AND 476.81



O.B. AIL STA 115.753 AND 152.090

(A)
WASHER - C/S TO BOLT HEAD - ONE FLAT SIDE

(B)
ANTI-ROTATION CLIP

NOTE:

1. BOLT AND BUSHING INSTALLATION SAME FOR EACH END. C/S WASHER USED AT WING END. C/S ANTI-ROTATION CLIP USED AT AILERON END
2. TORQUE NUT 110/115 IN. LBS MAX TORQUE 165 IN. LBS

M1-0000-27-978

CR Outboard Aileron Damper - Removal and Installation
CR Figure 401 (Sheet 2)

EFFECTIVITY: ALL

001B

R # OUTBOARD AILERON DAMPER - ADJUSTMENT AND TEST

R 1. Adjustment/Test

R A. Functional Test

R (1) The outboard aileron damper must be removed and
R returned to the shop for functional testing.

INBOARD AILERON - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig Pin (2 each) - 5/16-inch diameter by 2 inches long (R2)

General Purpose Sling, PN B715, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Grease, Aircraft and Instrument, MIL-G-23827A (AEROSHELL 7), or equivalent

Corrosion Preventive Compound, MIL-C-16173, Grade 4, or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	12-23-00	Flight Controls Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE CENTER PANEL, ZONE 147.

A. Removal

(1) Remove four access panels and pylon fairing on bottom of wing, forward of inboard aileron: left wing: 551AB, 551BB, 551BB1, 551CB, and 453H; for right wing: 651AB, 651BB, 651BB1, 651CB, and 463H (Ref. 6-40-00).

(2) Remove the screws from the sling attach holes on the aileron and install the sling mounting plates (Ref. Fig. 401).

NOTE: The three aileron sling attach points incorporate 1/4-inch flush screws installed in nut plates. There are two attach points on the front beam, one on the outboard end of each hinge fitting. The third attach point is on the rear beam (four inches forward of trailing edge) and approximately 46 inches from the inboard edge of the aileron. The inboard aileron weighs 137 pounds.

(3) Using hoist to support sling, attach universal sling to the three aileron hoist mounting plates.

(4) Manually position aileron until trailing edge of aileron is 16 to 18 inches higher than leading edge. Take up on hoist tackle blocks until sling supports aileron.

(5) Disconnect the three aileron actuators from the aileron by removing the actuator-to-aileron attach bolts.

(6) Tie each actuator to supporting structure with rope to prevent actuator weight from bending hydraulic tubing.

(7) Disconnect the two servo feedback pushrods and the two aileron control bungees from the aileron by removing the pushrod and bungee connecting bolts. Be sure not to change the feedback pushrods or bungee length adjustments.

(8) At the outboard aileron hinge, disconnect the position transmitter link from the aileron by removing the link bolt.

(9) At the inboard aileron hinge, disconnect the two autopilot feedback transmitter pushrods from the aileron by removing the two bolts.

(10) Disconnect the bonding jumpers at the aileron hinge attachment by removing the bonding jumper bolt.

(11) Remove the two aileron hinge bolts and sleeves. Save the laminated shim washer for reuse.

(12) Move aileron aft to clear structure and lower aileron to cart.

(13) Remove sling mounting plates from aileron.

B. Installation

NOTE: Replacement aileron static unbalance must be within limits specified in Structural Repair Manual, Section 51-90-00. Weight and balance information is provided on a data placard located on the front spar inboard of the outboard hinge at aileron station 95.

(1) Install sling mounting plates on aileron.

(2) Using hoist to support sling, attach universal sling to mounting plates. Operate tackle blocks to position aileron so that trailing edge is 16 to 18 inches higher than leading edge. Also position aileron so that outboard end is higher than inboard end, to match wing dihedral.

(3) Raise the aileron into position.

(4) Install hinge connecting hardware as follows:

(a) On the inboard hinge, install the sleeve. Coat the bolt with corrosion preventive compound and install the bolt and the countersunk washer with the countersink facing the bolt head. Install the plain washer and nut but do not tighten nut.

(b) On the outboard hinge, install the laminated shim washer between the wing hinge fitting and the aileron hinge fitting shoulder bushing. Coat the sleeve and bolt with corrosion preventive compound. Install the sleeve, bolt and the countersunk washer with the countersink facing the bolt head. Install the plain washer and nut and tighten nut to clamp all components together.

R (c) Verify the inboard hinge wing hinge fitting is
R centered between the aileron hinge fittings. If
R not, add or peel the laminated shim washer
R installed on the outboard hinge to center the
R inboard hinge.

R NOTE: Shim adjustment on outboard hinge controls
R alignment of inboard hinge.

(d) On the outboard hinge, torque nut 40 ± 10 lb inch plus torque required to overcome self-locking properties of the nut.

(e) Torque the nut on the inboard hinge to standard torque values.

(5) Install bonding jumpers on each hinge by installing the hinge bolt retainer, washers, bolt, and spring washer.

(6) Butter-lube the actuator attach bolts with grease, MIL-G-23827A. Connect the three actuators to the aileron by installing the attaching bolt, washer, and nut. Install cotter pin and lock-wire bolt.

(7) Connect the two servo feedback pushrods and the two bungees to the aileron by installing the attaching bolts, washers, and nuts. Install cotter pins and lock-wire bolts.

(8) Connect the surface position transmitter link to the aileron by installing the attaching bolt, washer, and nut. Install cotter pin.

(9) Connect the two autopilot feedback transmitter pushrods to the aileron by installing the attaching bolts, washers, and nuts. Install cotter pins and lock-wire bolts.

(10) Disconnect sling from aileron mounting plates. Remove sling and hoist.

(11) Remove hoist mounting plates and install screws in mounting plate holes in aileron.

(12) Lubricate aileron hinge and actuator bearings (Ref. 12-23-00).

(13) Remove tags installed at beginning of Paragraph 3.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(14) Turn on hydraulic systems A, B, and C for left aileron, or systems B, C, and D for right aileron (Ref. 29-11-00).

(15) Turn on electrical power (Ref. 24-41-00).

CAUTION: OPERATING OUTBOARD AILERONS AT A HIGH RATE CAN DAMAGE THE SURFACE DAMPER SEALS. OPERATE CONTROL WHEEL SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(16) Slowly operate pilots control wheel through five complete roll cycles. Check that aileron actuation components operate smoothly (no binding) and clear all adjacent structure.

(17) With aileron faired, check that minimum clearance between aileron and inboard and outboard flap torque box structures is 0.20 inch.

(18) Check aileron neutral rig as follows:

(a) Position ROLL trim wheel on center console to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of the alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on the decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

The inboard aileron neutral index mark is a red paint-filled dimple on the No. 3 flap torque box. Align aileron lower surface with index mark. (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired).

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(b) Install a rig pin (R2) in both the aileron servo upper and lower input arms and servo. If aileron is in neutral (±0.12), aileron neutral rig is acceptable. If not, accomplish following Step (c).

WARNING: DO NOT DISCONNECT BOTH FEEDBACK PUSHRODS WITH HYDRAULIC POWER ON. SERVO WILL BE UNCONTROLLABLE.

CAUTION: DO NOT SHUT OFF HYDRAULIC POWER WITH RIG PINS IN THE SERVO. THE SERVO CAN BE PERMANENTLY DAMAGED.

NOTE: On the right inboard aileron servo, the rig pins will not fit freely through the servo input arms and servo due to the deslop bungee. When only upper rig pin is installed, aileron will droop slightly. When only lower rig pin is installed, aileron will rise slightly. Droop and rise should be nearly equal. When both rig pins are installed in the servo, the aileron should assume mid-position between droop and rise and be in neutral (±0.12 inch).

(c) Disconnect lower feedback pushrod from feedback arm. If aileron moves to neutral position (±0.060 inch), adjust lower feedback pushrod to hold aileron same neutral position and install bolt. If aileron does not move to neutral position with lower feedback pushrod disconnected, accomplish Steps (d) through (g).

(d) Note direction and amount aileron is out of neutral. Adjust lower feedback pushrod half the required correction (but not more than two turns). Reconnect lower feedback pushrod.

NOTE: One turn of feedback pushrod changes aileron position approximately 0.35 inch at neutral index. Lengthening pushrod raises aileron, shortening pushrod lowers aileron.

(e) Disconnect upper feedback pushrod from feedback bellcrank.

(f) Note direction and amount aileron is out of neutral. Adjust upper feedback pushrod half the required correction (but no more than two turns). Reconnect upper feedback pushrod.

(g) Repeat Step (c).

NOTE: If aileron was more than one inch out of neutral, it might require several adjustments of the feedback pushrods to safely "walk" the aileron to the neutral

position, by adjusting one feedback pushrod at a time.

(h) After adjusting feedback pushrods, tighten and lock-wire rod-end adjusting nut.

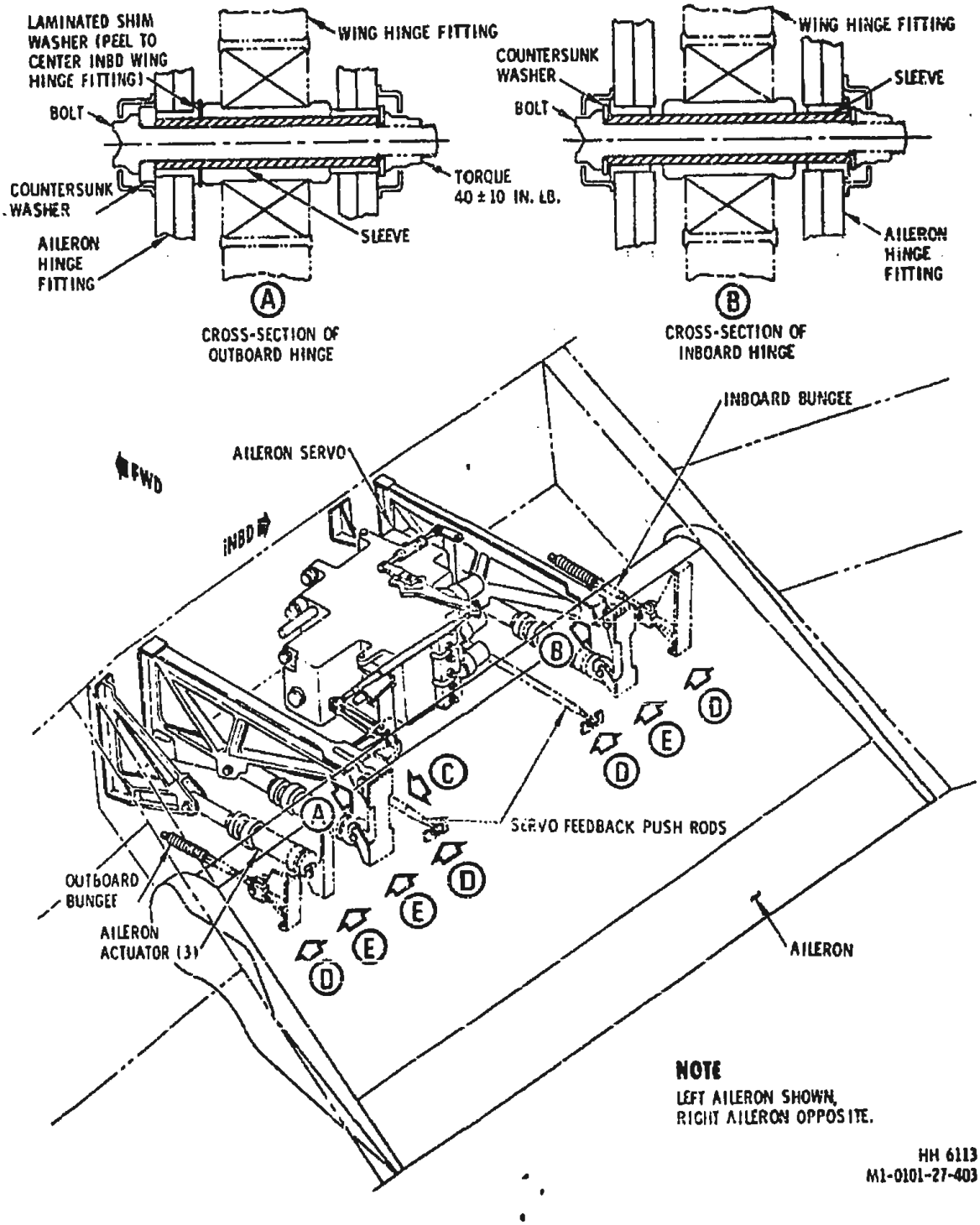
(i) Remove rig pins from servo.

(j) If the feedback pushrods were adjusted, cycle control wheel through several full left and right roll cycles to verify normal operation of aileron.

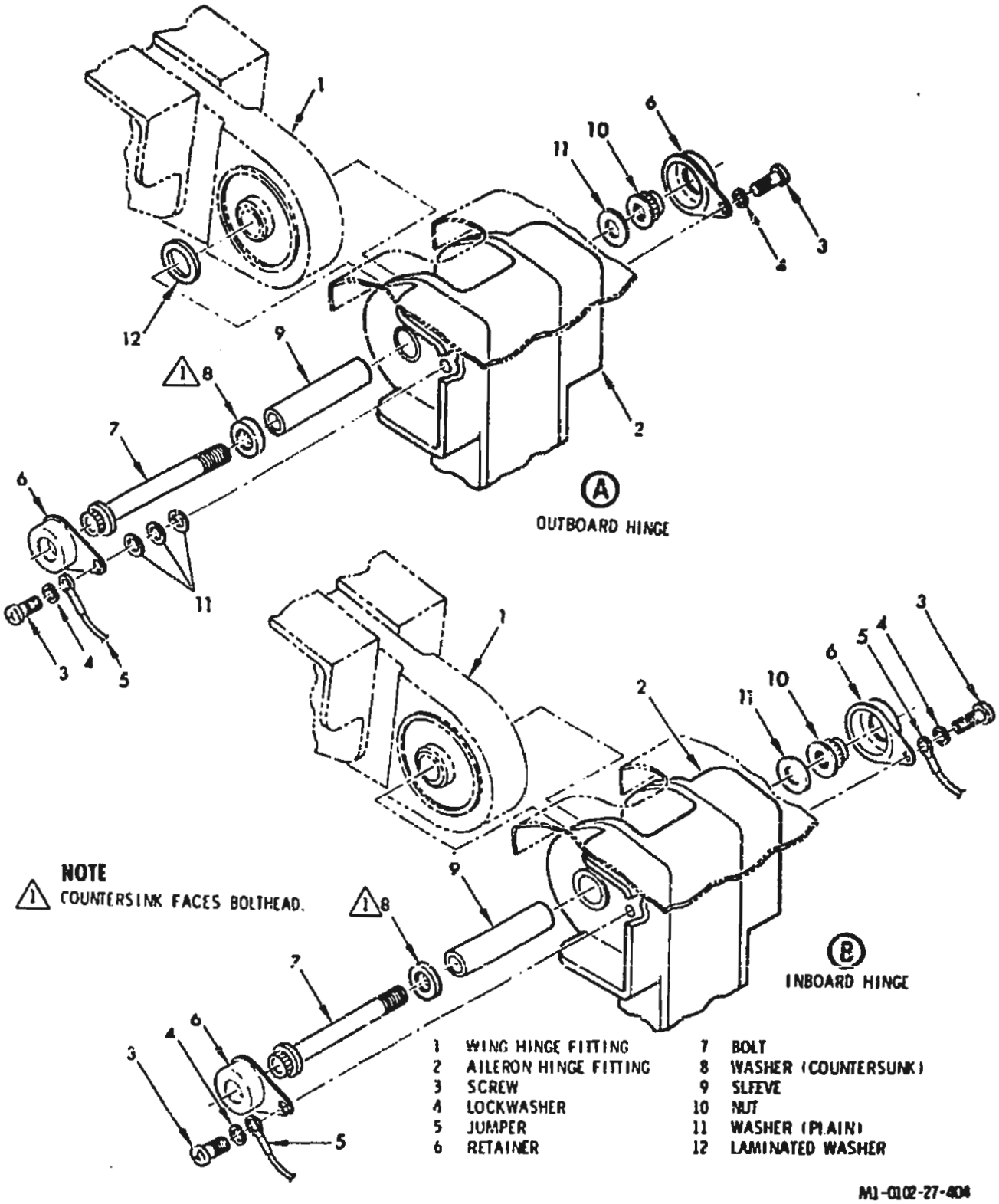
(19) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(20) Turn off electrical power if no longer required (Ref. 24-41-00).

(21) Close access doors opened in Step 3 A(1).



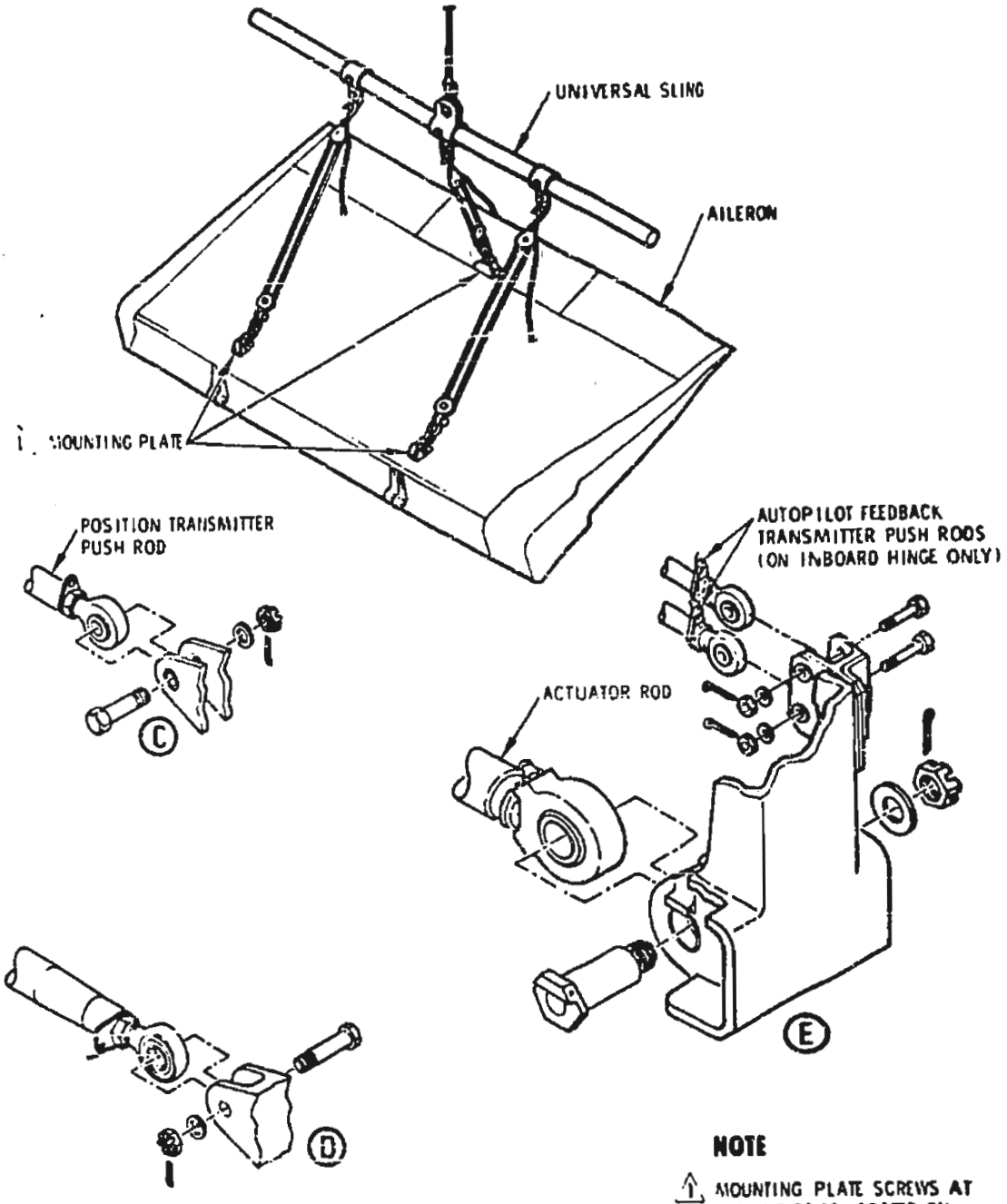
Inboard Aileron - Removal and Installation
Figure 401 (Sheet 1)



1	WING HINGE FITTING	7	BOLT
2	AILERON HINGE FITTING	8	WASHER (COUNTERSUNK)
3	SCREW	9	SLEEVE
4	LOCKWASHER	10	NUT
5	JUMPER	11	WASHER (PLAIN)
6	RETAINER	12	LAMINATED WASHER

M1-0102-27-404

Inboard Aileron - Removal and Installation
Figure 401 (Sheet 2)



TYPICAL ATTACHMENT FOR SERVO FEEDBACK PUSH RODS AND INBOARD AND OUTBOARD BUNGEES

NOTE

1. MOUNTING PLATE SCREWS AT LEADING EDGE LOCATED ON OUTBOARD SIDE OF HINGES.

HH 6169
M1-0101-27-406

Inboard Aileron - Removal and Installation
Figure 401 (Sheet 3)

R # INBOARD AILERON - INSPECTION AND CHECK

R 1. General

R This procedure checks the inboard aileron freeplay. The total
R freeplay includes freeplay movement of the aileron hinge
R bearing, and both actuator attach point bearings. If total
R freeplay exceeds allowable limits, the rod end or hinge bearings
R must be checked for excessive freeplay.

R 2. Referenced Procedures

R 24-41-00 External Power/Ground Service Systems - Maintenance
R Practices

R 27-11-28 Outboard Aileron - Inspection and Check

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 3. Inspection/Check

R A. Aileron Freeplay

R (1) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM.

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (2) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

R (3) Determine valve of roll trim bias from decal on the
R inside of the flight station center console cover.
R Position roll trim to rig pin neutral and tag control
R wheel.

(4) Tape a six inch scale vertically to the adjacent flap so that a reference can be made along the bottom trailing edge surface of the aileron to the scale.

(5) Pull down on the aileron surface to bottom out the freeplay so a true starting reference point can be determined.

(6) Hold a scale against the bottom trailing edge surface and mark where it intersects the vertical scale previously taped to the torque box.

R R (7) Apply an upward force on aileron trailing edge of 50 to 60 pounds.

(8) Hold the scale as in Step 6 and mark a new reference point on the taped vertical scale to indicate total freeplay travel of aileron.

(9) Measure the distance the trailing edge moved between the two reference points marked on the vertical scale. The resulting distance should be less than 0.497 inch (0.57 degrees) on either inboard ailerons.

NOTE: If any aileron exceeds the maximum freeplay travel inspect aileron actuator attach points and aileron hinge points for excessive wear.

(10) Turn off all hydraulic power systems A, B and C (Ref. 29-11-00).

(11) Turn off electrical power (Ref. 24-41-00).

OUTBOARD AILERON - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig Pin - 5/16-inch diameter by 2-inches long (R2)

General Purpose Sling, PN B715, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Grease, Aircraft and Instrument, MIL-G-32827A (AEROSHELL 7), or equivalent

2. Referenced Procedures

	6-40-00	External Access Doors and Panels
	12-23-00	Flight Controls Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices
R R	51-90-00	Structural Repair Manual - Control Surface Mass Balance/Repair

3. Removal/Installation

R R R WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) Open four hinged access doors on bottom of wing, forward of outboard aileron: for left wing: 571AB2, 571CB, 571DB and 571EB; for right wing: 671AB2, 671CB, 671DB, and 671EB (Ref. 6-40-00).

R R (2) Remove three screws from sling attaching holes on aileron and install hoist mounting plates (Ref. Fig. 401).

NOTE: The three sling attach points incorporate 1/4-inch flush screws installed in nut plates. There are two attach points on front beam, one just inboard of No. 1 hinge and one just outboard of No. 4 hinge. The third attach point is on rear beam (four inches forward of trailing edge) and is located approximately mid-span. The outboard aileron weighs 156 pounds.

(3) Using hoist to support sling, attach universal sling to the three aileron mounting plates.

(4) Manually position aileron to approximately faired position. Take up on hoist until sling supports aileron.

(5) Disconnect the two aileron actuators from aileron by removing actuator bolts.

(6) Tie each actuator to supporting structure with rope to prevent bending acutator rigid hydraulic tubing.

(7) Disconnect the two servo feedback push rods from aileron by removing push rod bolts. Be sure not to change feedback pushrod or bungee length adjustment.

(8) Disconnect position transmitter link from aileron by removing link bolt.

NOTE: The position transmitter is mounted on the No. 2 hinge.

(9) Disconnect bonding jumpers at aileron hinges by removing bonding jumper screws and hinge bolt retainers.

(10) Disconnect hydraulic dampers from aileron by removing bolt connecting each damper to aileron.

(11) Remove aileron hinge sleeve and bolt from hinges No. 1 and 4, and bolt from hinges No. 2 and 3.

(12) Move aileron aft to clear structure and lower aileron on cart.

(13) Remove sling mounting plates from aileron.

B. Installation (Ref. Fig. 401)

NOTE: Replacement aileron static unbalance must be within limits specified in Structural Repair Manual, Section 51-90-00. Weight and balance information is provided

on a data placard located on front spar inboard of second hinge (counting from inboard end) at outboard aileron station 83.

(1) Install sling mounting plates on aileron.

(2) Using hoist to support sling, attach universal sling to mounting plates.

(3) Raise aileron into position. Use tackle blocks to raise outboard end of aileron to match wing dihedral.

(4) On hinge No. 4 install hinge sleeve, bolt, washers, and nut.

(5) On hinge No. 1, install hinge sleeve, bolt, washers, and nut. Verify chamfer of washer under bolt head faces bolt head, and chamfer of washer under nut faces sleeve. Torque nut 90 (±10) lb in. plus run-down torque.

(6) On hinge No. 2, install bolt and nut. Tighten nut until 0.010 to 0.030 inch clearance is obtained between nut and bushing (Ref. Fig. 401, Sheet 1).

(7) On hinge No. 3, install bolt and nut. Tighten nut until 0.010 to 0.030 inch clearance is obtained between nut and bushing.

(8) Install bonding jumpers by installing hinge bolt retainers, washers, and bonding jumper screws.

(9) Butter-lube actuator attach bolts with grease, MIL-G-23827A. Connect the two actuators to aileron by installing attaching bolt, washer, and nut. Install cotter pin and lock-wire bolt.

R (10) Install dampers as follows:

R (a) Verify outboard damper cylinder lube fitting is
R positioned up to allow access door to be closed.

R NOTE: Inboard damper cylinder lube fittings may
R be installed either top or bottom.

R (b) Connect damper to aileron with bolt washers and
R nuts.

R (c) Install cotterpin, and lockwire bolt.

NOTE: The damper installation is unconventional in that the damper cylinder is connected to aileron

and damper piston rod is attached to wing fitting.

(11) Connect the two servo feedback pushrods to aileron by installing attaching bolt, washer, and nut. Install cotter pin and lock-wire bolt. Verify servo feedback pushrod lengths have not been changed.

(12) Connect position transmitter link to aileron by installing attaching bolt, washer, and nut. Install cotter pin.

(13) Disconnect sling from aileron mounting plates. Remove sling and hoist.

(14) Remove hoist mounting plates from aileron. Install screws in mounting plate attach holes.

(15) Lubricate aileron hinge bearings, damper bearings, and actuator bearings (Ref. 12-23-00).

(16) Remove tags installed at beginning of Paragraph 3.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(17) Turn on electrical power (Ref. 24-41-00).

(18) Turn on hydraulic systems A and B for left aileron, or systems B and D for right aileron (Ref. 29-11-00).

CAUTION: OPERATING OUTBOARD AILERONS AT A HIGH RATE CAN DAMAGE THE SURFACE DAMPER SEALS. OPERATE CONTROL WHEEL SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(19) Operate pilots control wheel through five complete roll cycles. Check that all aileron actuation components operate smoothly (no binding) and clear all adjacent structure.

(20) Position aileron to neutral. Check minimum clearance between aileron and wing structure is 0.20 inch at both inboard and outboard ends.

(21) Check aileron neutral rig as follows:

(a) Position outboard aileron to neutral.

NOTE: On aircraft 001-018, 021, 022, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge

On aircraft 019, 020, 023-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(b) Install rig pin (R2) in servo input arm and servo. The aileron must be in neutral (±0.12 inch). If not, accomplish following Steps (c) through (e).

WARNING: DO NOT DISCONNECT BOTH FEEDBACK PUSHRODS WITH HYDRAULIC POWER ON. SERVO WILL BE UNCONTROLLABLE.

CAUTION: DO NOT SHUT OFF HYDRAULIC POWER WITH RIG PIN IN SERVO. THE SERVO CAN BE PERMANENTLY DAMAGED.

(c) Disconnect secondary (outboard) feedback pushrod from bellcrank. With only primary (inboard) feedback pushrod connected, the aileron should be in neutral (±0.12 inch). If it is, determine mid-point of free play in secondary control system; adjust secondary feedback pushrod to mid-point of free play and connect to bellcrank. Aileron must remain in same neutral position.

(d) If aileron is not in neutral with only primary feedback pushrod connected, reconnect secondary feedback pushrod to bellcrank and adjust primary feedback pushrod (lengthening pushrod raises aileron); reconnect to bellcrank, then repeat Step (c).

(e) After adjusting feedback pushrods, tighten and lock-wire rod-end adjusting nut.

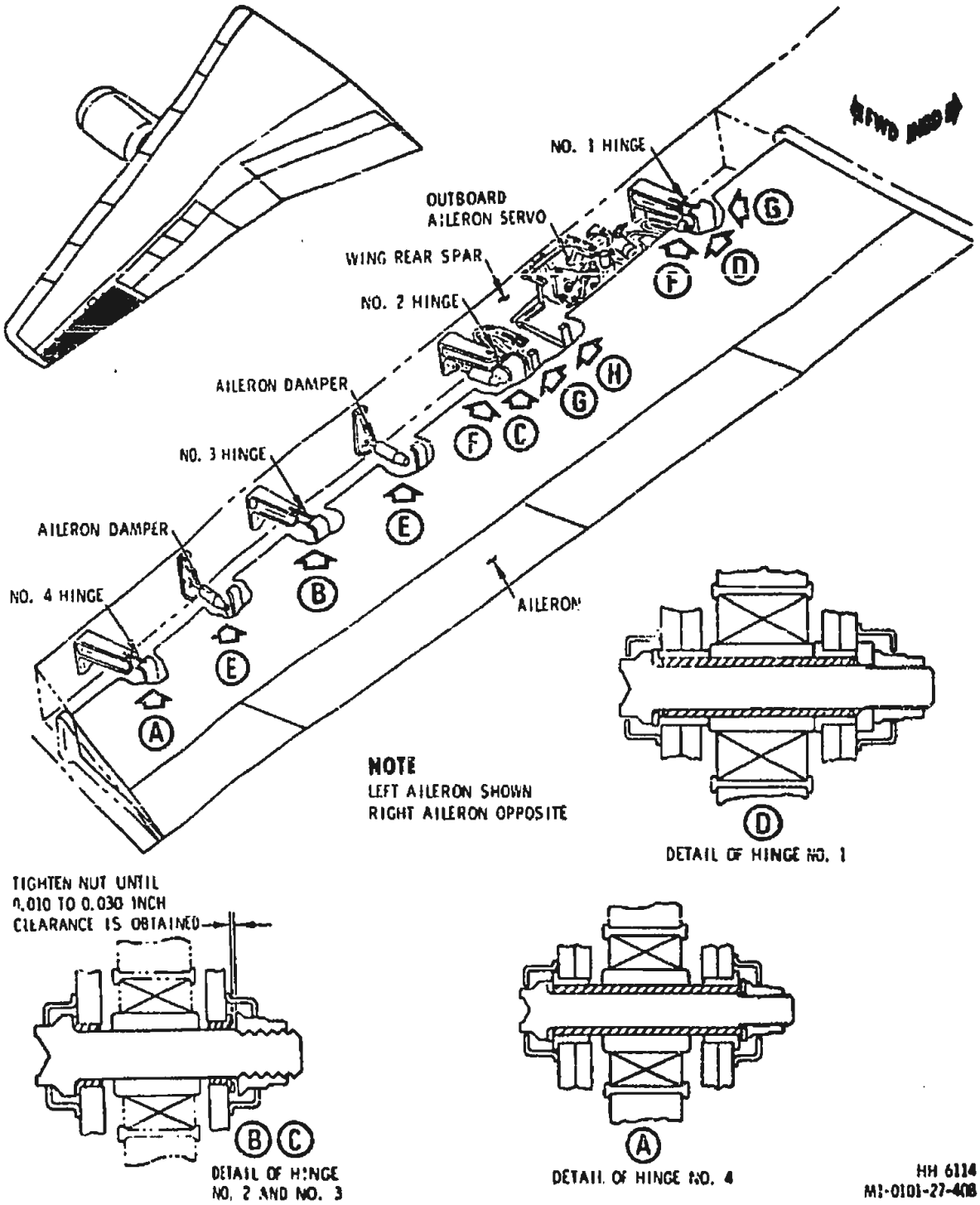
(f) Remove rig pin from servo.

(g) If feedback pushrods were adjusted, cycle control wheel through several full left and right roll cycles to verify normal operation of aileron.

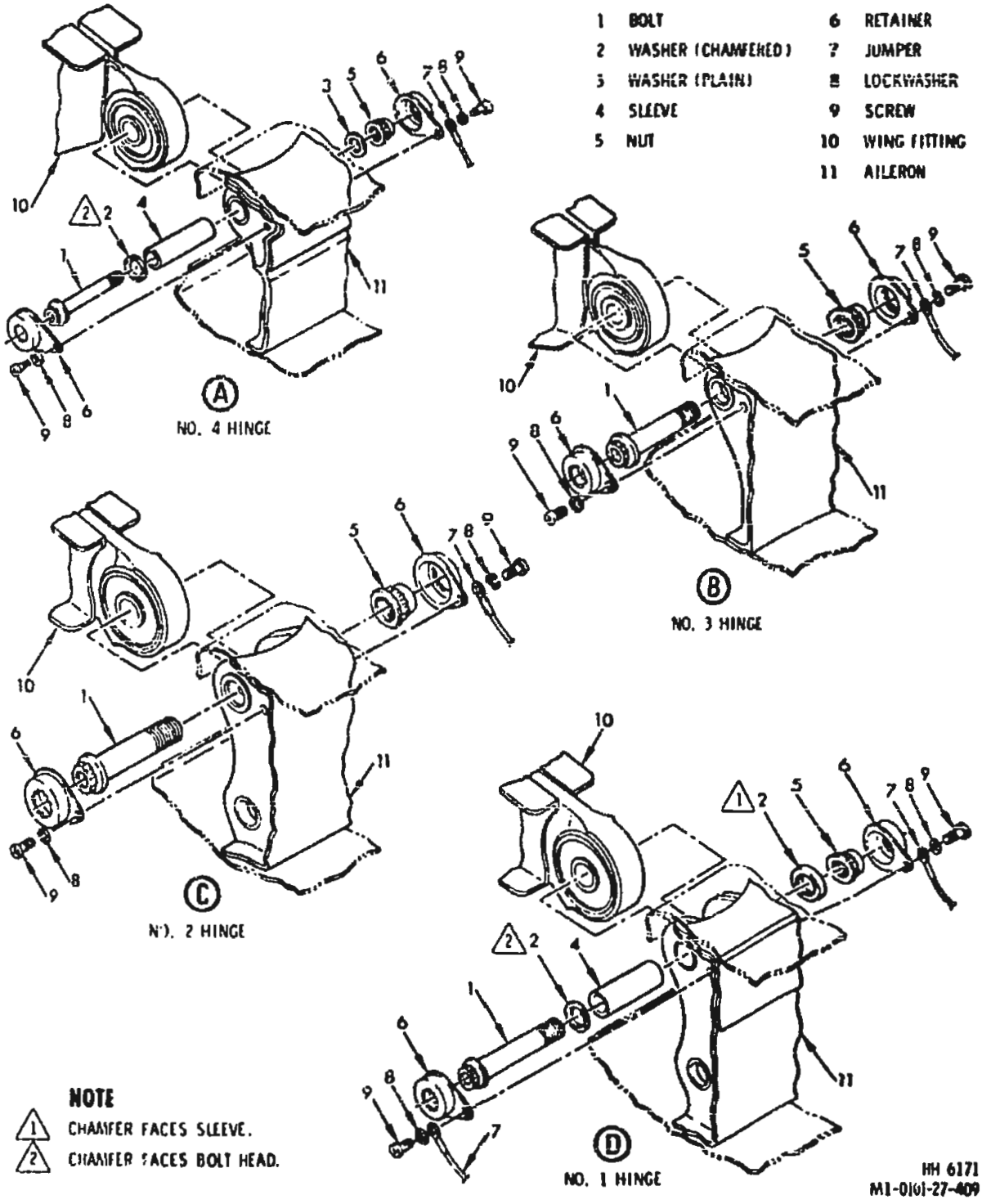
(22) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(23) Turn off electrical power if no longer required (Ref. 24-41-00).

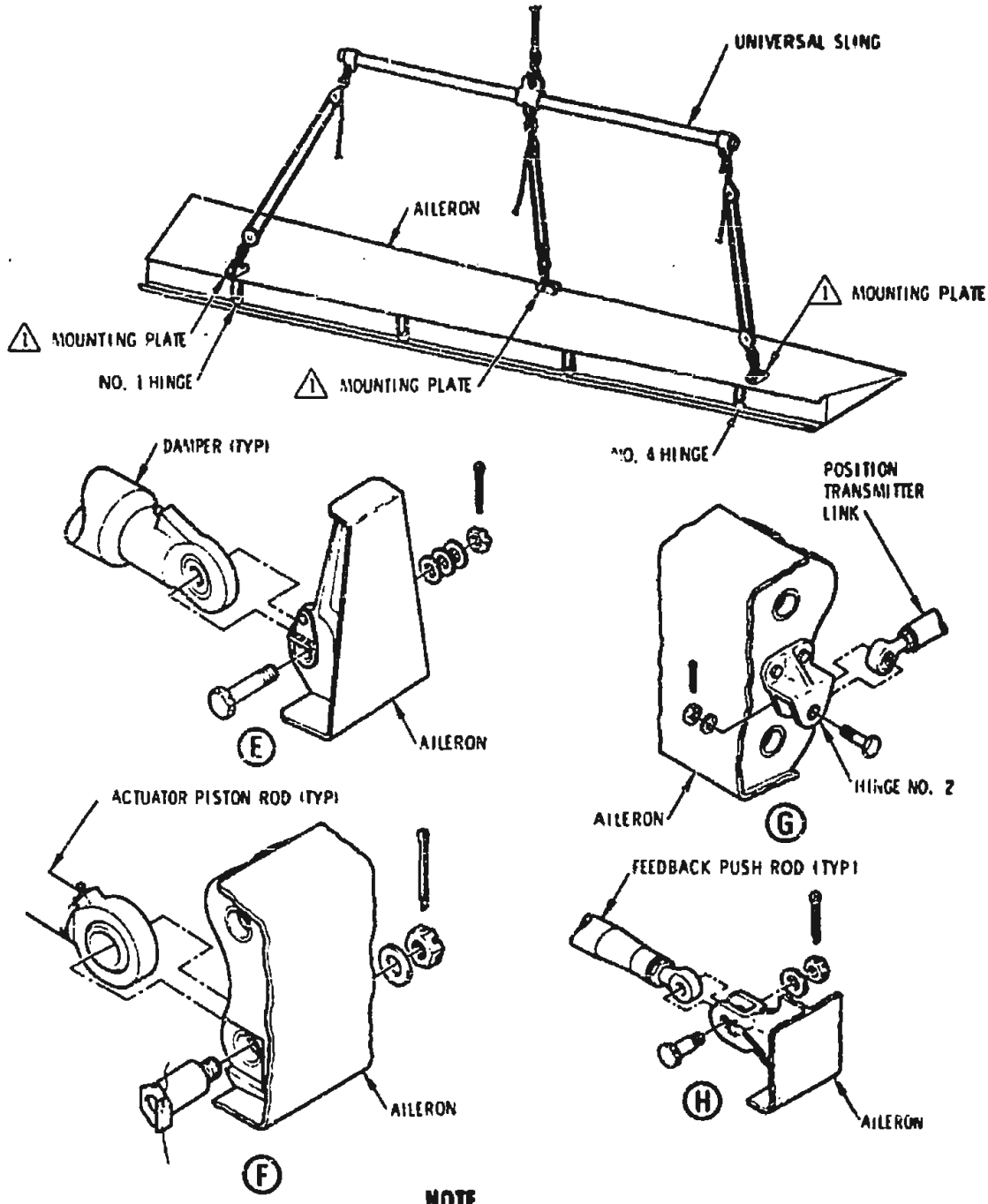
(24) Close access doors opened in Step 3A(1).



Outboard Aileron - Removal and Installation
Figure 401 (Sheet 1)



Outboard Aileron - Removal and Installation
Figure 401 (Sheet 2)



NOTE

1 MOUNTING PLATE SCREWS ON LEADING EDGE LOCATED JUST INBOARD OF NO. 1 HINGE AND JUST OUTBOARD OF NO. 4 HINGE.

HH 6115
M1-0101-27-410

Outboard Aileron - Removal and Installation
Figure 401 (Sheet 3)

OUTBOARD AILERON - INSPECTION AND CHECK

1. General

This procedure checks the outboard aileron freeplay. The total freeplay includes freeplay movement of the aileron hinge bearing, and both actuator attach point bearings. If total freeplay exceeds allowable limits, the rod end or hinge bearings must be checked for excessive freeplay.

2. Referenced Procedures

24-41-00	External Power/Ground Service Systems - Maintenance Practices
27-11-27	Inboard Aileron - Inspection and Check
29-11-00	Hydraulic Power System - Maintenance Practices

3. Inspection/Check

A. Aileron Freeplay

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR-DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (2) Turn on hydraulic systems A, B, and D (Ref. 29-11-00).

CR NOTE: Accomplish following check on all hydraulic
CR systems (A, B, and D), but operate only one
CR system at a time.

(3) Determine value of roll trim bias from decal on inside of flight station center console cover. Position roll trim to rig pin neutral and tag control wheel.

(4) Tape a six inch scale vertically to the fixed structure adjacent to the inboard end of aileron at a point 10 inches forward of the trailing edge of the aileron. This will provide for a reference along the bottom trailing edge surface of the aileron to the scale.

(5) Pull down on the aileron surface to bottom out the freeplay so a true starting reference point can be determined.

(6) Hold a scale against the bottom trailing edge surface and mark where it intersects the vertical scale previously taped to the fixed structure.

(7) Apply an upward force on aileron trailing edge of 50 to 60 pounds.

(8) Hold the scale as in Step 6 and mark a new reference point on the taped vertical scale to indicate total freeplay travel of aileron.

(9) Measure the distance the trailing edge moved between the two reference points marked on the vertical scale. The resulting distance should be less than 0.067 inch (0.13 degrees) on either outboard ailerons.

NOTE: If any aileron exceeds the maximum freeplay travel inspect aileron actuator attach points and aileron hinge points for excessive wear.

R (10) Turn off all hydraulic power systems A, B and D (Ref. 29-11-00).

(11) Turn off electrical power (Ref. 24-41-00).

R # OUTBOARD AILERON - APPROVED REPAIRS

R 1. General

R This procedure should only be accomplished if the outboard aileron actuator bottoms during the bottoming check conducted in 27-11-24, Inspection and Check.

R Accomplish Paragraph 3A or 3B to rework the outboard aileron. Section 3A reworks the outboard aileron actuator fitting; Section 3B replaces the outboard aileron actuator fitting.

R 2. Referenced Procedures

R	20-51-04	Environmental Sealing of Model L-1011 Airplane - PB75-425D
R	20-51-08	Touchup Requirements For Finishes On L-1011 Aircraft - PB78-463C
R	27-11-28	Outboard Aileron - Removal and Installation
R	51-40-01	Structure Repair Manual - Fastener Removal and Installation

R 3. Approved Repairs

R A. Rework of Aileron Using Kit 1608085-101 (Ref. SB57-095)

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (Ref. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R (1) Remove 1529099-103/-104 Left or Right Outboard Aileron Assembly from aircraft, reference Figure 801 and Maintenance Manual 27-11-28.

R (2) Remove and retain 1530017-141/-142 Skin by removing fasteners, reference Figure 801, Sheets 1 and 7.

R (3) Remove and retain 1530017-135/-136 Skin by removing fasteners, reference Figure 801, Sheets 1 and 7.

R (4) Remove and retain 1529382-101/-102 Skin from the aileron assembly by removing fasteners, reference Figure 801, Sheets 1 and 8.

R (5) Remove and retain 1529383-101/-102 Skin from the
R aileron assembly by removing fasteners, reference
R Figure 801, Sheets 1 and 8.

R (6) The following procedure is applicable to
R 1529985-115/-116 Fitting Assembly only, reference
R Figure 801, Sheets 1, 2, 3 and 8:

R (a) Remove 1529985-115/-116 Fitting Assembly by
R removing fasteners, reference Structural Repair
R Manual 51-40-01.

R (b) Remove and discard 1529341-101/-102 Clip by
R removing fasteners. Retain LH7559-3 Nuts and
R AN960-101 Washers.

R (c) Remove and discard 1529376-115, -117 and -147
R Shims.

R NOTE: If these shims are not damaged, they may be
R reused. If damaged, new shims should be
R made, same thickness as old ones, so that
R fitting location will be maintained.

R (d) Remove LS10020-12PP20 and LS10020F-12PP18 Bushings
R from the fitting.

R (e) Remove and discard two 1529985-107 Bushings from
R the fitting.

R (f) Remove and discard two 9507-10 Inserts.

R (g) Machine fitting flange around the bushing hole
R area, reference Figure 801, Sheets 1 and 2.

R (h) Inspect machined parts, using fluorescent Type I,
R reference MIL-I-6866.

R (i) Shot peen on the machined surface, reference
R Figure 801, Sheets 1 and 2.

R (j) Reanodize or touch up fitting, reference
R Maintenance Manual 20-51-08.

R NOTE: If reanodize, remove paint and clean the
R fitting with solvent. Prime and coat the
R fitting.

R (k) Drill two 0.3738 - 0.3750 inch diameter holes
R through the fitting, reference Figure 801, Sheet
R 2.

R (l) Drill 0.296 - 0.303 inch diameter hole insert,
R reference Figure 801, Sheet 2.

R (m) Drill 0.3750 - 0.3758 inch diameter and
R countersink 100° and 0.020 - 0.030 deep in upper
R and lower flanges of the fitting, reference Figure
R 801, Sheets 2 and 3.

R (n) Install eight 1608219-107 plugs in the fitting
R with MIL-S-22473, Grade A-A Sealant, reference
R Figure 801, Sheets 2, 3 and 5.

R NOTE: Allow 24 hours cure time.

R (o) Install two 1608219-101 Plugs in the fitting with
R MIL-S-22473, Grade A-A Sealant, reference Figure
R 801, Sheet 2.

R NOTE: Allow 24 hours cure time.

R (p) Install two 1608219-103 Plugs in the fitting with
R MIL-S-22473, Grade A-A Sealant, reference Figure
R 801, Sheet 2.

R NOTE: Allow 24 hours cure time.

R (q) Install 9507-10 Insert with LM40-2180, Type II
R Sealant in the fitting, reference Figure 801,
R Sheet 2.

R (r) Drill two 1.0640 - 1.0649 inch diameter holes in
R line at new location for bushing installation,
R reference Figure 801, Sheets 1 and 2.

R (s) Install two LS3859FR14PP13 Bushings with
R LCM40-2180, Type II Sealant, reference Figure 801,
R Sheets 1 and 2.

R (t) Drill two 0.8745 - 0.8750 inch diameter holes in
R line through LS3859FR14PP13 Bushings, reference
R Figure 801, Sheets 1 and 2.

R (u) Install 1608010-101 Retainer and secure with
R AN960-10 Washer, NAS6203-3H Bolt and Lockwire,
R reference Figure 801, Sheet 3.

R (v) Drill two 1.0415 - 1.0426 inch diameter holes in
R line in the fitting at new location, reference
R Figure 801, Sheets 1 and 2.

R (w) Install 1608217-101 Bushing and 1608218-101
R Bushing in the fitting with MIL-C-16173, Grade 4

compound and LCM40-2180, Type II Sealant, as noted reference Figure 801, Sheet 1.

(x) Drill two 0.296 - 0.303 inch diameter holes at new location for insert, reference Figure 801, Sheet 2.

(y) Install two 9507-10 Inserts with LCM40-2180, Type II Sealant, reference Figure 801, Sheet 2.

(z) Reidentify fittings as follows:

New P/N Reidentified as	Nomenclature	Old P/N
1529985-119	Fitting Assembly	1529985-115
1529985-120	Fitting Assembly	1529985-116
1529985-121	Fitting	1529985-117
1529985-122	Fitting	1529985-118

(aa) Install 1529985-119/-120 Fitting Assembly on the Aileron Assembly with new or old 1529376-155, -117, -147 and -155 Shims and secure with fasteners, reference Maintenance Manual 20-51-04, Structural Repair Manual 51-40-01 and Figure 801, Sheets 1, 2 and 3.

NOTE: Drill holes through shims for fasteners attachment.

(7) The following pocedure is applicable to 1529343-109/-110 Fitting Assembly only, reference Figure 801, Sheets 4, 5, 6, 7 and 8:

(a) Remove 1529343-109/110 Fitting Assembly by removing fasteners, reference Structural Repair Manual 51-40-01.

(b) Remove and discard 1529342-101/-102 Clip, reference Figure 801, Sheet 4.

(c) Remove 1529376-125, -127 and -149 shims.

NOTE: If these shims are not damaged, they may be reused. If damaged, new shims should be made same thickness as old ones so that fitting location will be maintained.

R (d) Remove and discard two LS3859FR14PP13 Bushing from
R the fitting.

R (e) Remove and discard 1529343-111 and LS10020F12PP15
R Bushings from the fitting.

R (f) Remove and discard 9507-10 Inserts.

R (g) Remove and retain 1533072-101 Clevis.

R (h) Machine fitting flange around the bushing hole
R area, reference Figure 801, Sheets 4 and 5.

R (i) Inspect machined parts, using fluorescent Type I,
R reference MIL-I-6866.

R (j) Shot peen on the machined surface, reference
R Figure 801, Sheets 4 and 5.

R (k) Reanodize or touch up fitting, reference
R Maintenance Manual 20-51-08.

R NOTE: If reanodize, remove paint and clean the
R fitting with solvent. Prime and coat the
R fitting.

R (l) Drill two 0.3750 - 0.3758 inch diameter holes
R through the fitting, reference Figure 801, Sheet
R 5.

R (m) Drill 0.296 - 0.303 inch diameter hole for insert,
R reference Figure 801, Sheet 5.

R (n) Drill 0.3750 - 0.3758 inch diameter and
R countersink 100° and 0.020 - 0.030 deep in upper
R and lower flanges of the fitting, reference Figure
R 801, Sheets 4, 5 and 6.

R (o) Install eight 1608219-107 Plugs in the fitting
R with MIL-S-22473, Grade A-A Sealant, reference
R Figure 801, Sheets 4, 5, and 6.

R NOTE: Allow 24 hours cure time.

R (p) Install two 1608219-105 Plugs in the fitting with
R MIL-S-22473, Grade A-A Sealant, reference Figure
R 801, Sheet 5.

R NOTE: Allow 24 hours cure time.

(q) Install 9507-10 Insert in the fitting with LCM40-2180, Type II Sealant, reference Figure 801, Sheet 5.

(r) Drill two 1.0640 - 1.0649 inch diameter holes in line through the fitting at new location for bushing installation, reference Figure 801, Sheet 5.

(s) Install two 1608219-101 plugs in the fitting with MIL-S-22473, Grade A-A Sealant, reference Figure 801, Sheet 5.

NOTE: Allow 24 hours cure time.

(t) Install two LS3859FR14PP13 Bushings with LCM40-2180, Type II Sealant, reference Figure 801, Sheet 5.

(u) Drill 0.8745 - 0.8750 inch diameter two holes in line through LS3859FR14PP13 Bushings, reference Figure 801, Sheet 5.

(v) Install 1608010-101 Retainer and secure with AN960-10 washer, NAS6203-3H Bolt and Lockwire, reference Figure 801, Sheets 4 and 6.

(w) Drill two 1.0415 - 1.0426 inch diameter holes in the fitting, reference Figure 801, Sheet 5.

(x) Install two 1608217-103 Bushings in the fitting with LCM40-2180, Type II Sealant, reference 801, Sheet 5.

(y) Drill 0.9375 - 0.9384 inch diameter two holes in line through 1608217-103 Bushings, reference Figure 801, Sheet 5.

(z) Drill two 0.296 - 0.303 inch diameter holes at new location for insert, reference Figure 801, Sheet 5.

(aa) Install two 9507-10 Inserts in the fitting with LCM40-2180, Type II Sealant, reference, Figure 801, Sheet 5.

(bb) Reinstall 1533072-101 on the fitting and secure with fasteners, reference Maintenance Manual 20-51-04, Structural Repair Manual 51-40-01.

(cc) Reidentify fittings as follows:

New P/N Reidentified as	Nomenclature	Old P/N
1529343-115	Fitting Assembly	1529343-109
1529343-116	Fitting Assembly	1529343-110
1529343-117	Fitting	1629343-113
1529343-118	Fitting	1629343-114

(dd) Install 1529343-115/-116 Fitting Assembly on the Aileron Assembly with new or old 1529376-125, -127, -149 and -157 shims and secure with fasteners, reference Maintenance Manual 20-51-04, Structural Repair Manual 51-40-01 and Figure 801, Sheet 4.

R (8) Reinstall 1529383-101/-102 Skin on the Aileron Assembly and secure with fasteners, reference Figure 801, Sheet 8.

R (9) Reinstall 1529382-101/-102 Skin on the Aileron Assembly and secure with fasteners, reference Figure 801, Sheet 8.

R (10) Reinstall 1530017-135/-136 Skin on the Aileron Assembly and secure with fasteners, reference Figure 801, Sheet 7.

R (11) Reinstall 1530017-141/-142 Skin and secure with fasteners, reference Figure 801, Sheet 7.

R (12) Reidentify parts as follows:

New P/N Reidentify as	Nomenclature	Old P/N
1529099-105	Aileron Assembly	1529099-103
1529099-106	Aileron Assembly	1529099-104
1529376-153	Beam Assembly	1529376-103
1529376-154	Beam Assembly	1529376-104

R (13) Reinstall Outboard Aileron Assembly (Ref. 27-11-28).

B. Rework of Aileron Using Kit 1608086-105 (Ref. SB57-095)

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT
R OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147.

R (1) Remove 1529099-103/-104 Left and Right Outboard Aileron
R Assembly from aircraft, reference Figure 801 and
R Maintenance Manual 27-11-28.

R (2) Remove and retain 1530017-141/142 Skin by removing
R fasteners, reference Figure 801, Sheet 7.

R (3) Remove and retain 1530017-135/-136 Skin by removing
R fasteners, reference Figure 801, Sheet 7.

R (4) Remove and retain 1529382-101/-102 Skin from the
R aileron assembly by removing fasteners, reference
R Figure 801, Sheet 8.

R (5) Remove and retain 1529383-101/-102 Skin from the
R aileron assembly by removing fasteners, reference
R Figure 801, Sheet 8.

R (6) Make necessary tools to install fitting assembly,
R reference 802.

R (7) The following procedure applicable to 1529985-115/-116
R and -119/-120 Fitting Assemblies only:

R (a) Insert a guide pin through hinge location (upper
R hole) in 1529985-115/-116 Fitting Assembly and tie
R down with the brackets to structure so that new
R fitting hinge location is installed in the
R identical location to existing fitting, reference
R Figure 802.

R (b) Remove the guide pin from the fitting and
R brackets, reference Figure 802.

R (c) Remove 1529985-115/-116 Fitting Assembly by
R removing fasteners, reference Structural Repair
R Manual 51-40-01 and Figure 801, Sheets 1, 2 and 3.

R (d) Remove and retain LS10020-12PP20 Bushing from the
R fitting, reference Figure 801, Sheet 1.

R NOTE: Bushing may be reused.

R (e) Discard 1529985-115/-116 Fitting Assembly.

(f) Install LS10020-12PP20 Bushing in 1529985-119/-120 Fitting Assembly with MIL-C-16173, Grade A compound, reference Figure 801, Sheet 1.

(g) Install 1529985-119/-120 Fitting Assembly in place of the existing fitting installation.

(h) Insert the guide pin through brackets and fitting hinge pin hole, reference Figure 802.

(k) Measure a gap between the fitting, the beam web and the caps. If any gap between the fitting and the beam web or caps, install shims as required, reference Figure 802.

(j) Drill holes through shims for fasteners installation.

(k) Remove all tools, reference Figure 802.

(l) Secure Fitting Assembly with fasteners, reference Maintenance Manual 20-51-04, Structural Repair Manual 51-40-01, and Figure 801, Sheets 1, 2 and 3.

R (8) The following procedure applicable to 1529343-109/-110 and -115/-116 Fitting Assemblies:

(a) Insert a guide pin through hinge location in 1529343-109/-110 Fitting Assembly and tie down with the brackets to structure so that new fitting hinge location is installed in the identical location to existing fitting, reference Figure 802.

(b) Remove the guide pin from the fitting and brackets, reference Figure 802.

(c) Remove 1529343-109/-110 Fitting Assembly by removing fasteners, Structural Repair Manual 51-40-01 and Figure 801, Sheets 4, 5 and 6.

(d) Remove and retain 1533072-101 Clevis from the fitting, reference Figure 801, Sheet 6.

(e) Discard 1529343-109/-110 Fitting Assembly.

(f) Install 1533072-101 Clevis on the 1529343-115/-116 Fitting Assembly and secure with fasteners, reference Figure 801, Sheet 6, Structural Repair Manual 51-40-01 and Maintenance Manual 20-51-04.

(g) Install 1529343-115/-116 Fitting Assembly in place of the existing fitting installation.

(h) Insert the guide pin through brackets and the fitting hinge pin hole, reference Figure 802.

(i) Measure a gap between the fitting, the beam web and the caps. If any gap between the fitting, the beam web and caps, install shims as required, reference Figure 802.

(j) Drill holes through shims for fasteners installation.

(k) Remove all tools, reference Figure 802.

(l) Secure fitting assembly with fasteners, reference Maintenance Manual 20-51-04, Structural Repair Manual 51-40-01 and Figure 801, Sheets 4, 5 and 6.

R (9) Reinstall 1529383-101/-102 Skin on the Aileron Assembly and secure with fasteners, reference Figure 801, Sheet 8.

R (10) Reinstall 1529382-101/-102 Skin on the Aileron Assembly and secure with fasteners, reference Figure 801, Sheet 8.

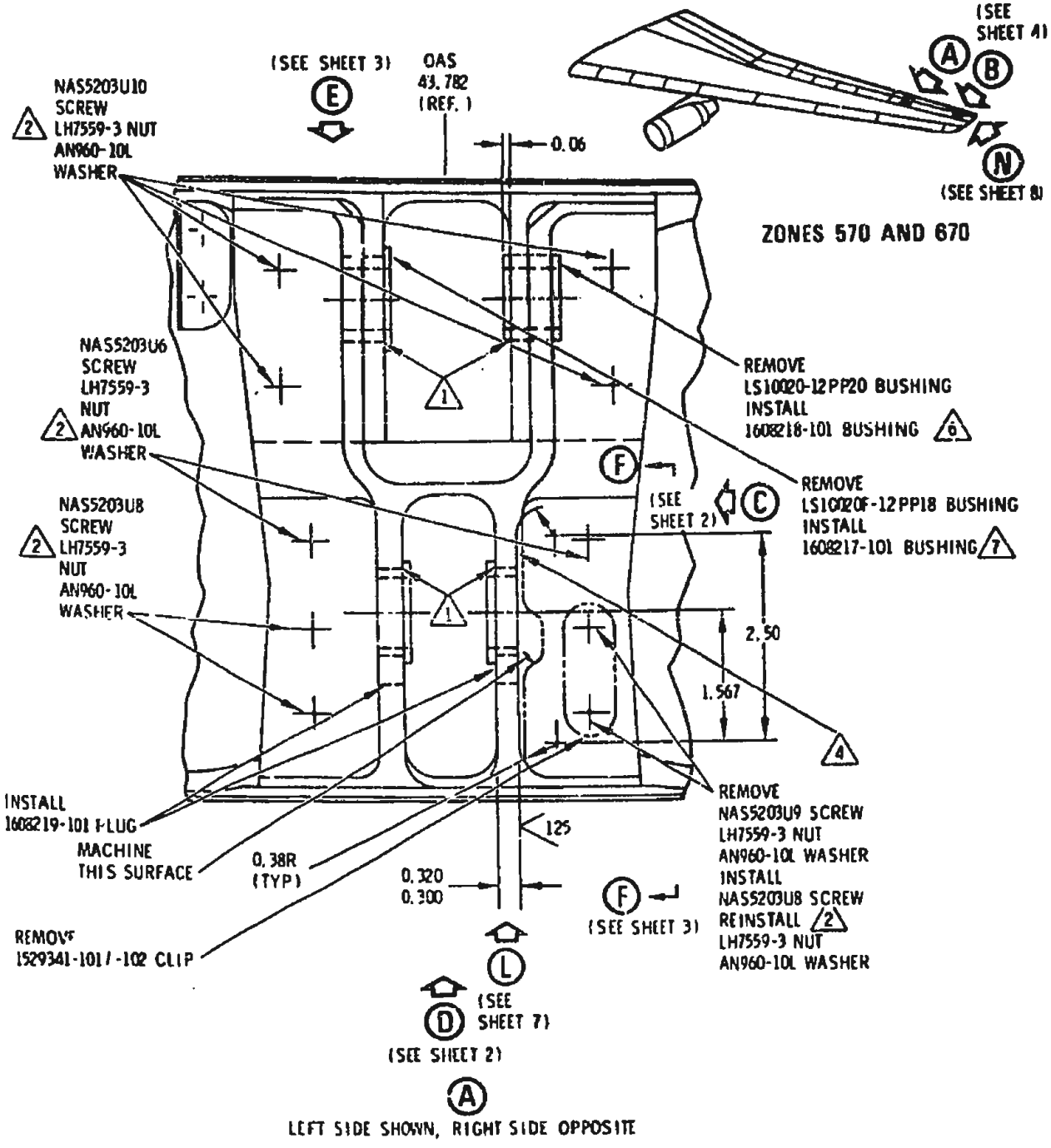
R (11) Reinstall 1530017-135/-136 Skin on the Aileron Assembly and secure with fasteners, reference Figure 801, Sheet 7.

R (12) Reinstall 1530017-141/-142 Skin and secure with fasteners, reference Figure 801, Sheet 7.

R (13) Reidentify parts as follows:

New P/N Reidentified as	Nomenclature	Old P/N
1529099-105	Aileron Assembly	1529099-103
1529099-106	Aileron Assembly	1529099-104
1529376-153	Beam Assembly	1529376-103
1529376-154	Beam Assembly	1529376-104

R (14) Reinstall Outboard Aileron Assembly (Ref. 27-11-28).



NOTE

SEE SHEET 8 FOR NOTES

M1-0100-27-606

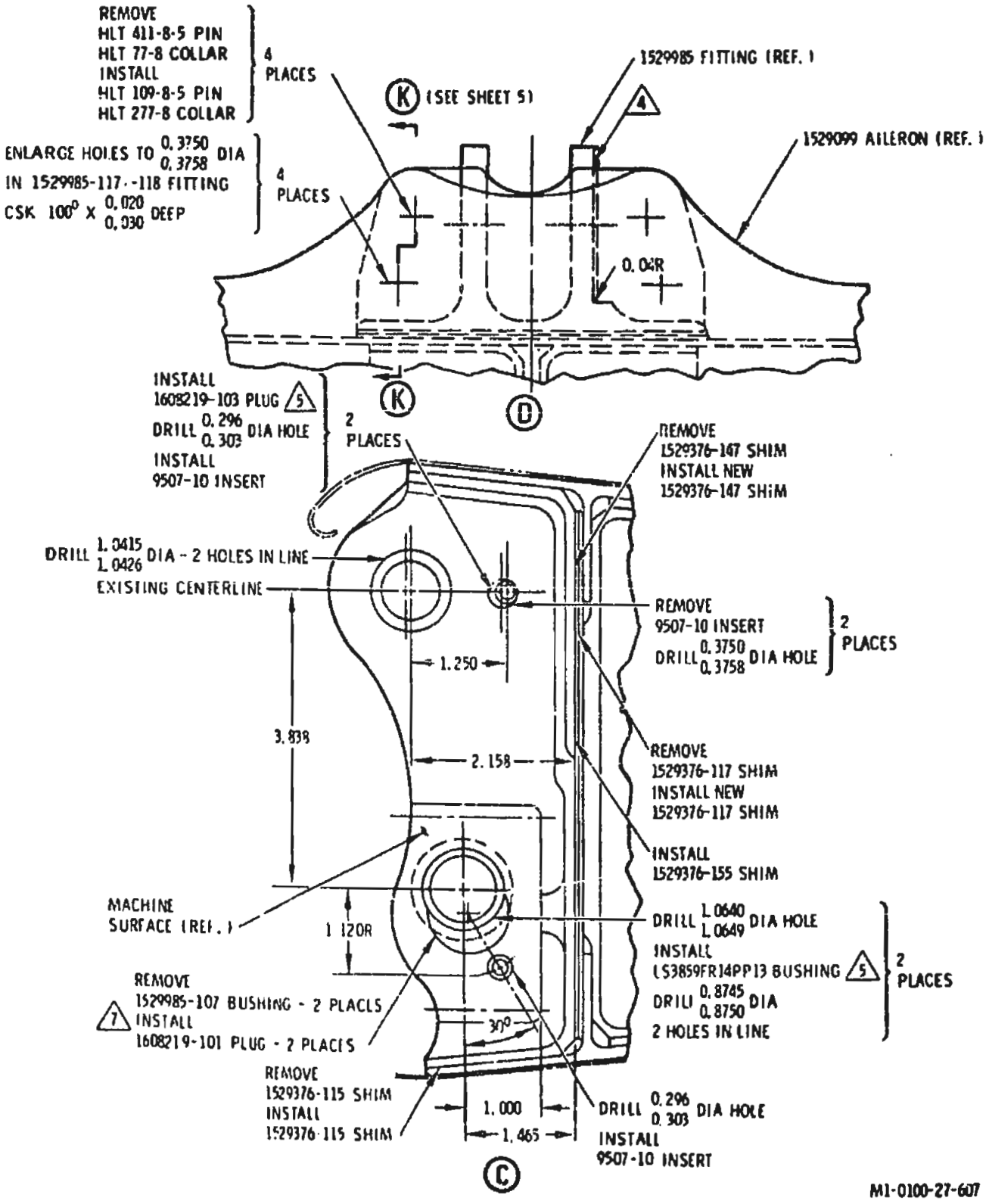
RR

Outboard Aileron Fitting Rework
Figure 801 (Sheet 1)

RR

EFFECTIVITY: ALL

001B

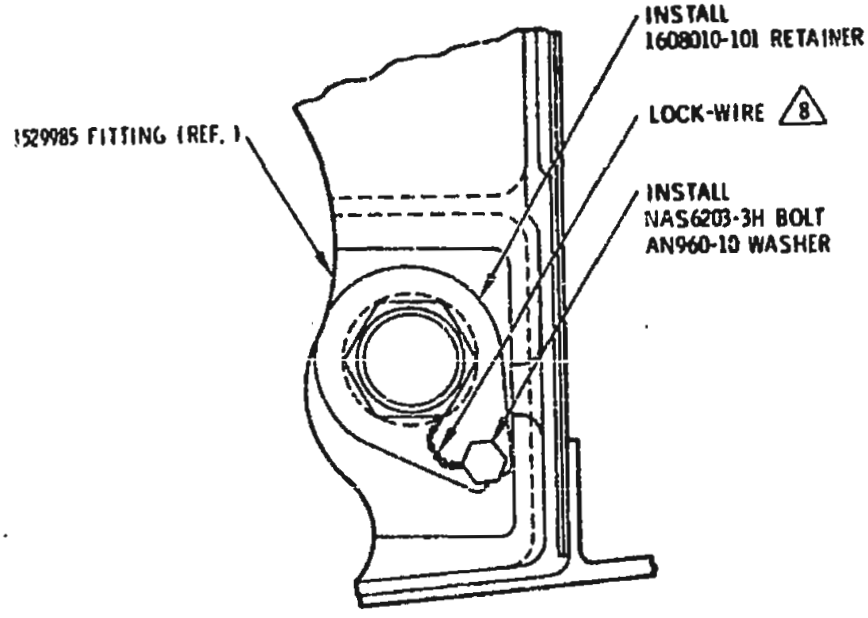


R
R

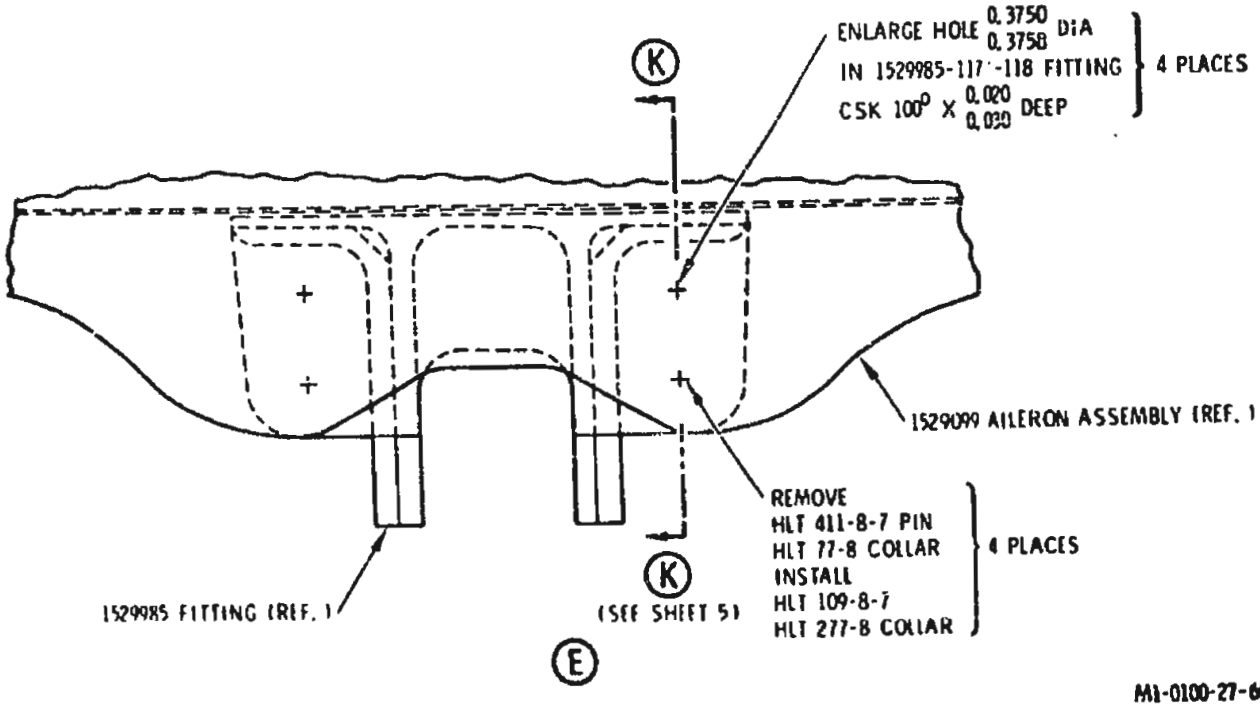
Outboard Aileron Fitting Rework
Figure 801 (Sheet 2)

R EFFECTIVITY: ALL

001B



(F)

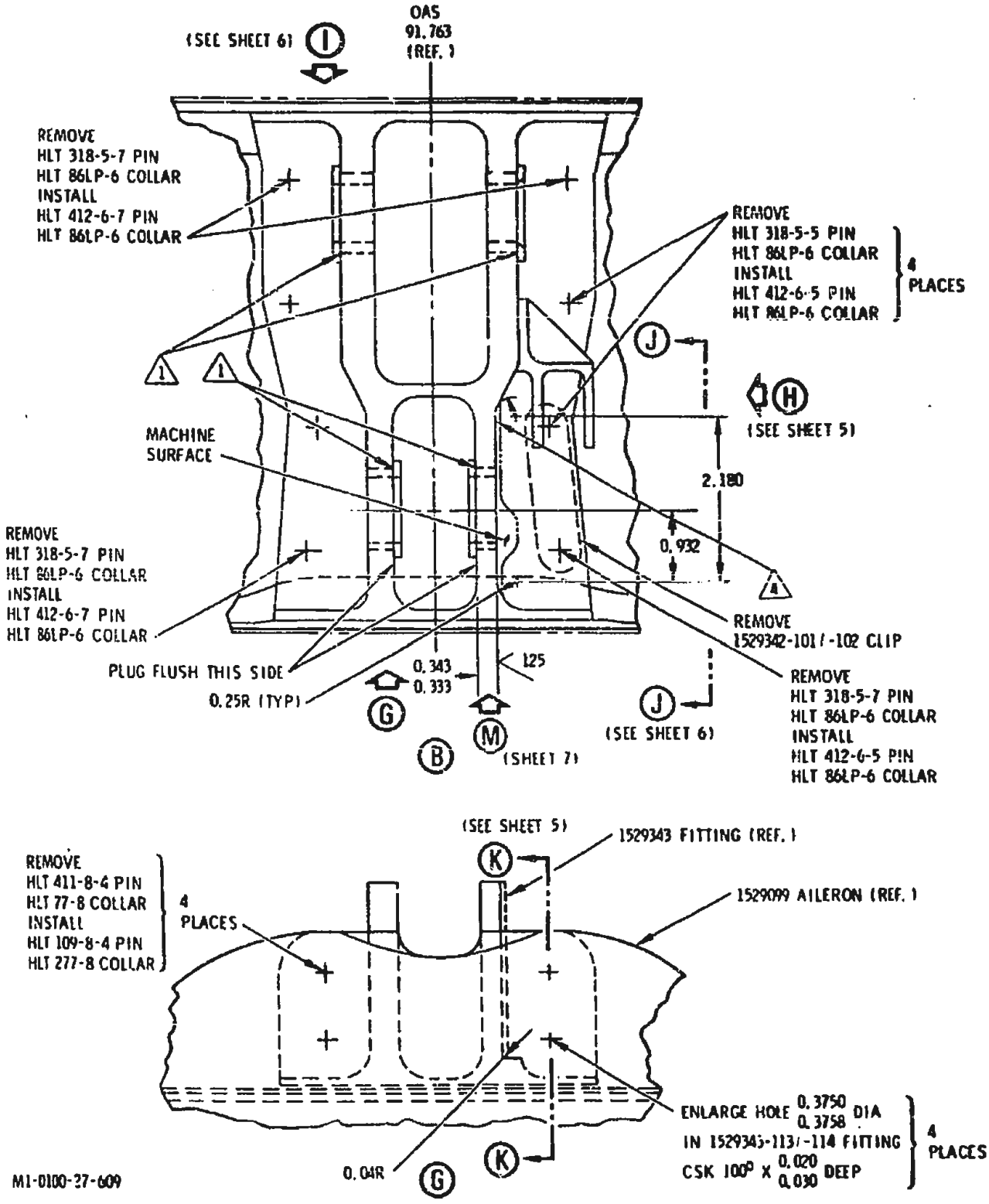


(E)

M1-0100-27-608

R Outboard Aileron Fitting Rework
R Figure 801 (Sheet 3)

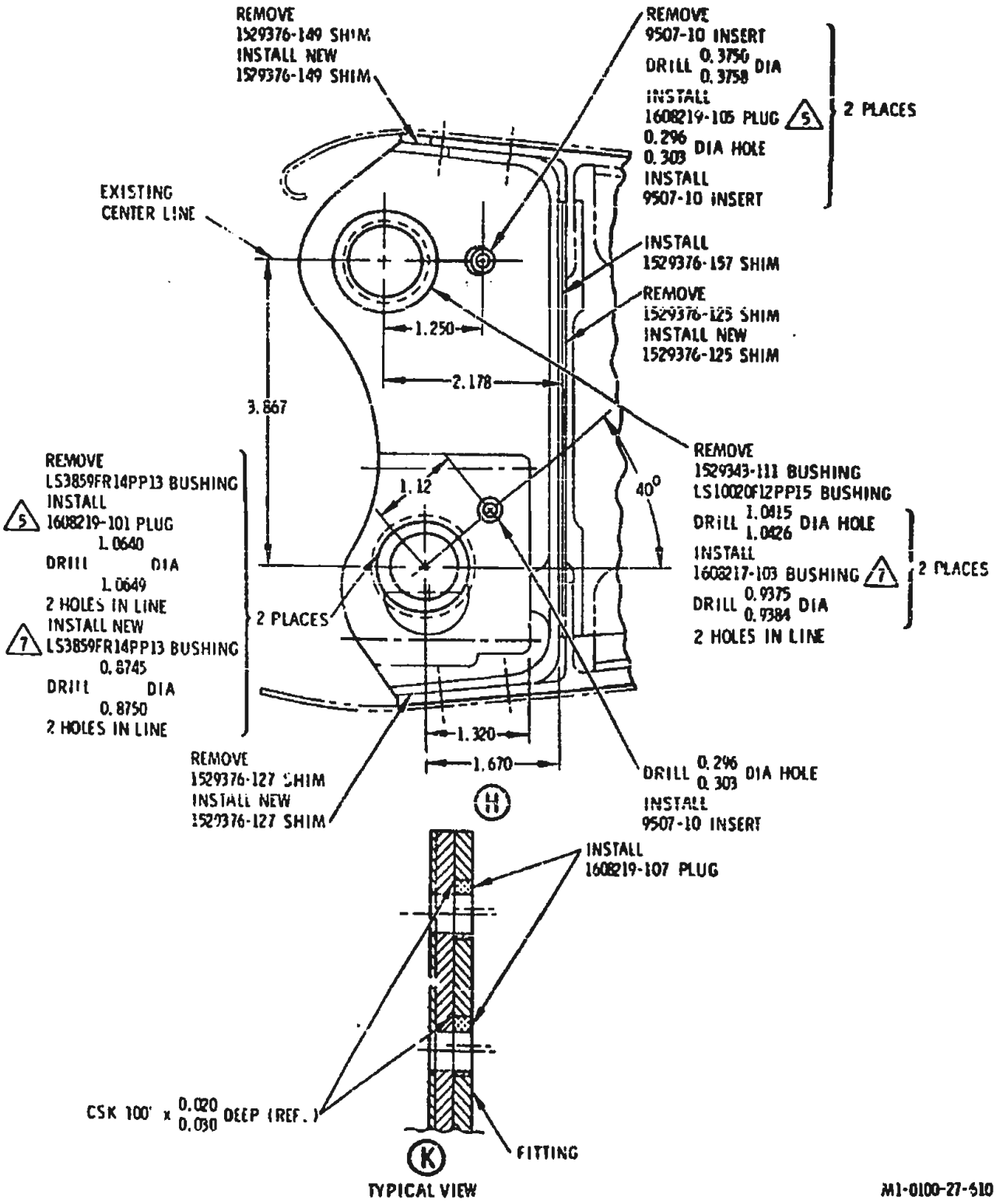
R EFFECTIVITY: ALL
R
101B



R R Outboard Aileron Fitting Rework
Figure 801 (Sheet 4)

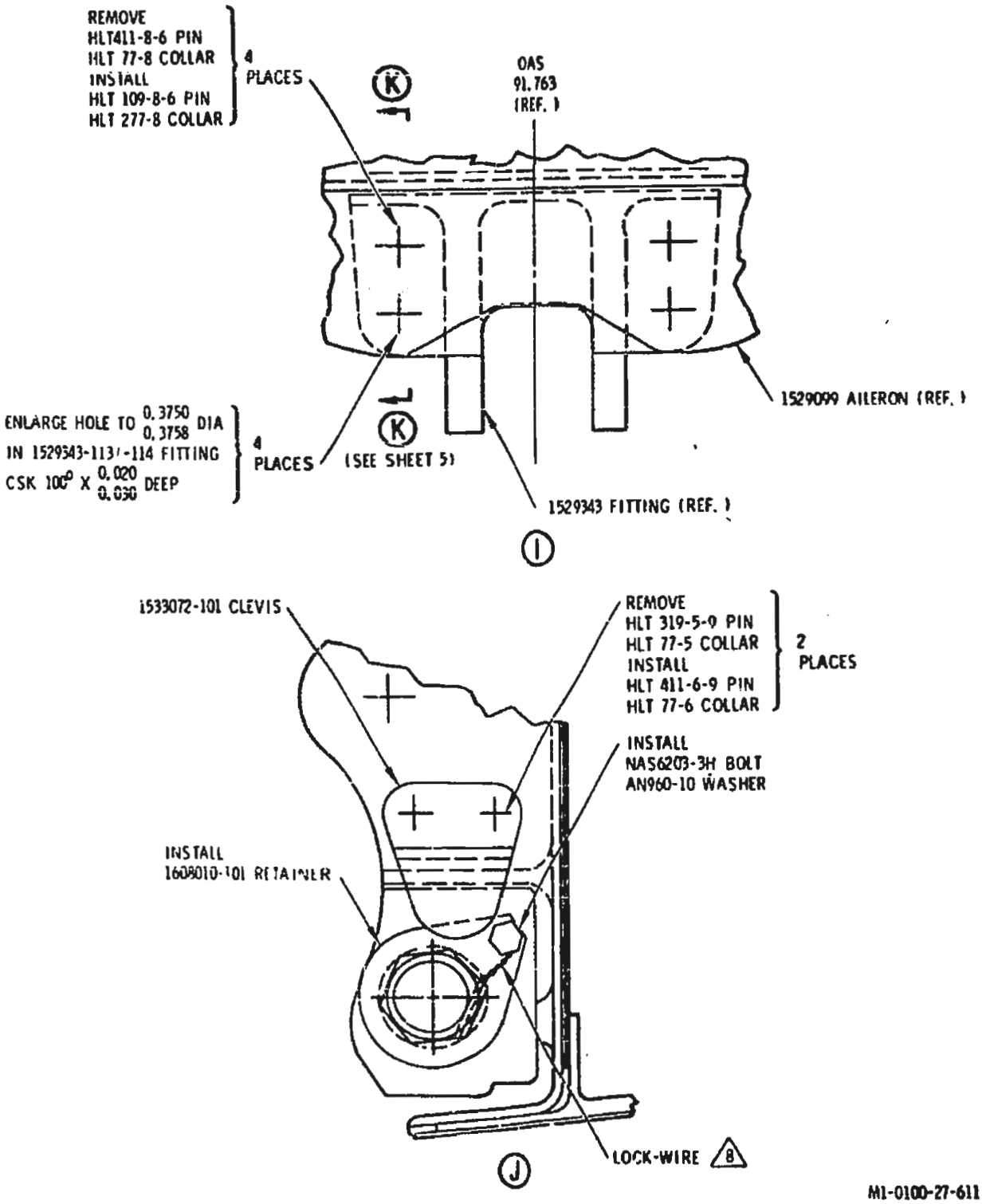
R EFFECTIVITY: ALL

0018



Outboard Aileron Fitting Rework
Figure 801 (Sheet 5)

EFFECTIVITY: ALL

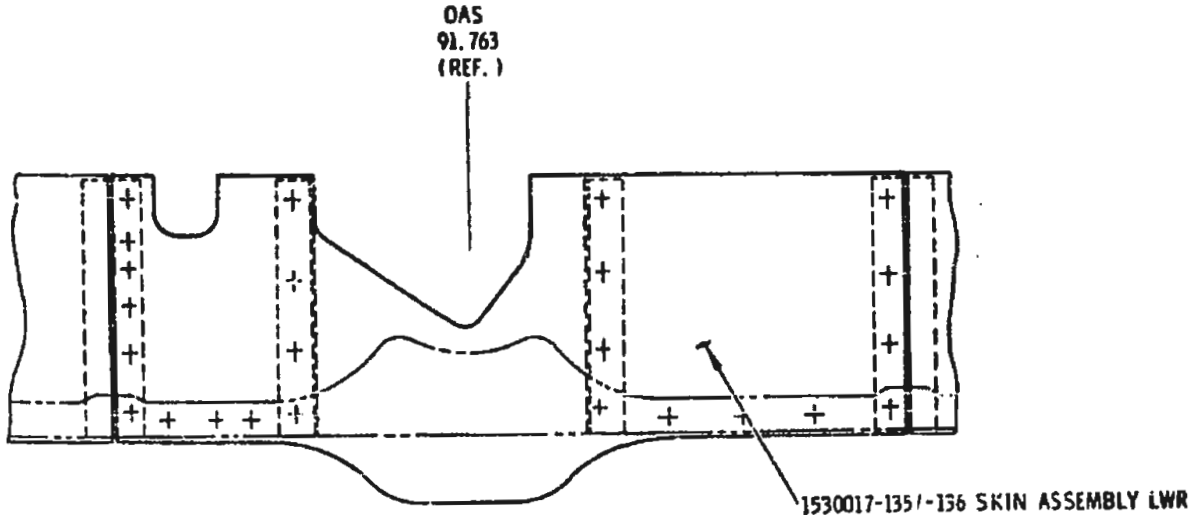


M1-0100-27-611

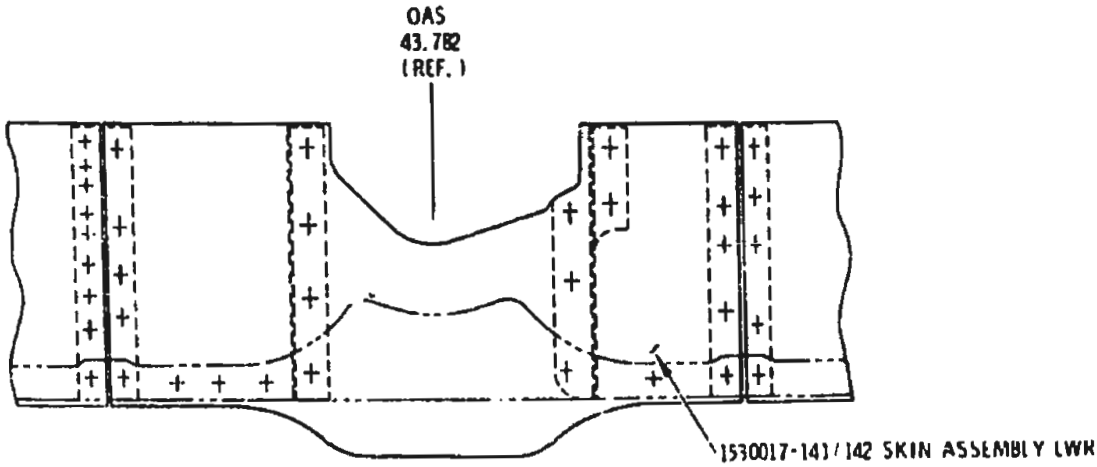
R R Outboard Aileron Fitting Rework
Figure 801 (Sheet 6)

R R EFFECTIVITY: ALL

001B



Ⓜ
VIEW LOOKING UP

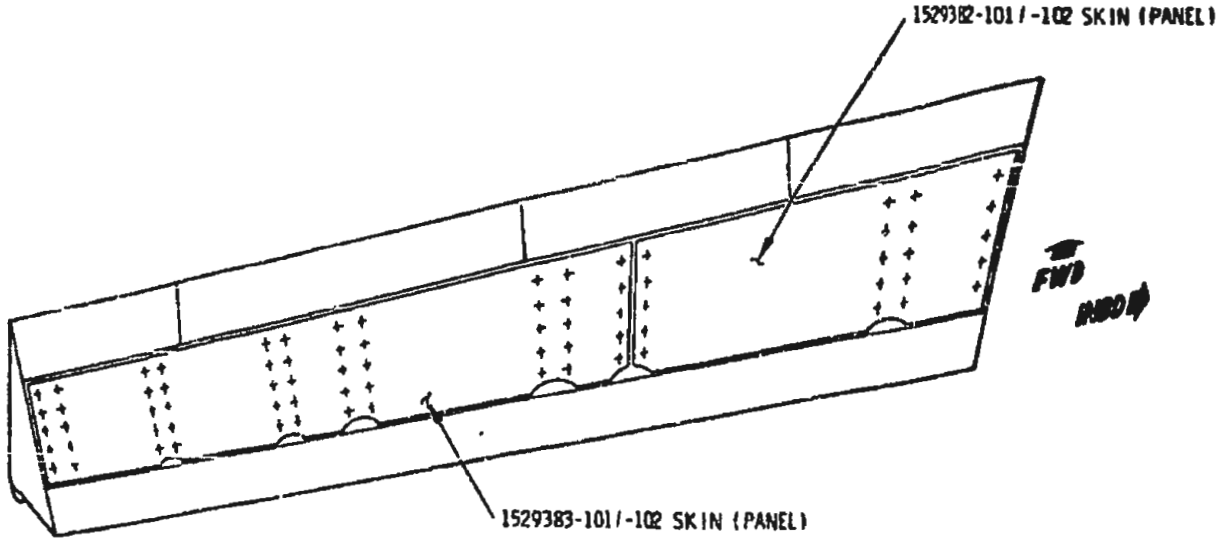


Ⓛ
VIEW LOOKING UP

M1-0100-27-612

R
R Outboard Aileron Fitting Rework
Figure 801 (Sheet 7)

R EFFECTIVITY: ALL
R
R
001B



(N)

OUTBOARD AILERON, VIEW LOOKING UP
LEFT SIDE SHOWN, RIGHT SIDE OPPOSITE

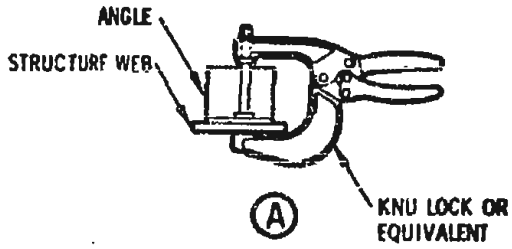
NOTE

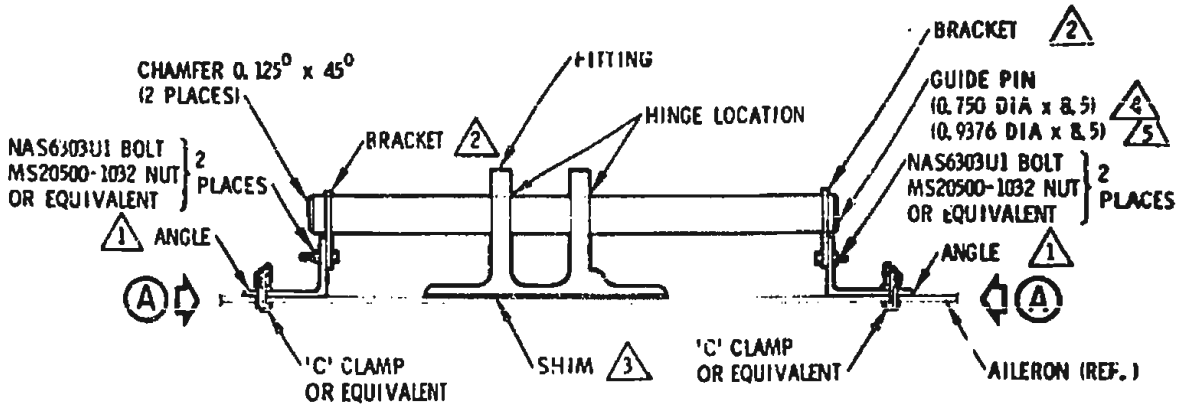
1. CHAMFER 0.02/0.03 X 45°
2. INSTALL HEAD OF SCREW NEAR SIDE AND WASHER FAR SIDE
3. WET INSTALL ALL FASTENERS IN ACCORDANCE WITH MAINTENANCE MANUAL 20-51-08
4. INSPECT PART IN ACCORDANCE WITH MIL-I-6866, USING FLOURESCENT TYPE I. SHOT PEEN MACHINED AREA (EXCEPT HOLE) IN ACCORDANCE WITH MIL-S-13165 (CALC LCP70-1038) SIZE 230 TO 330, INTENSITY 0.004A TO 0.006A
5. USE MIL-S-22473, GRADE A-A SEALANT
6. APPLY CORROSION PREVENTIVE COMPOUND MIL-C-16173, GRADE 4 IN HOLE AREAS
7. INSTALL BUSHING WITH LCM40-2180, TYPE II
8. SAFETY IN ACCORDANCE WITH MAINTENANCE MANUAL 20-00-06

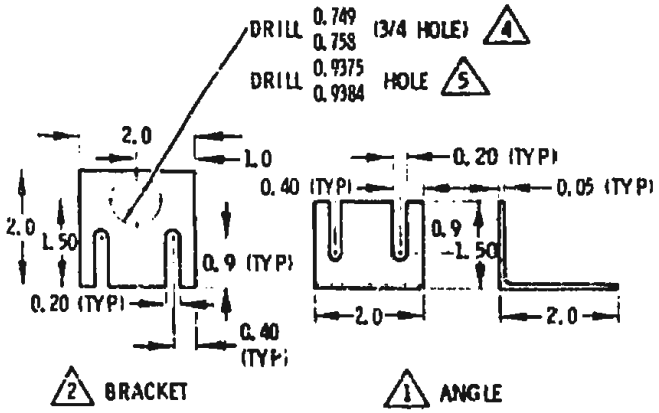
M1-0100-27-613

R
R Outboard Aileron Fitting Rework
Figure 801 (Sheet 8)

R EFFECTIVITY: ALL
R
001B




CHAMFER 0.125° x 45° (2 PLACES)
NAS6303U1 BOLT MS20500-1032 NUT OR EQUIVALENT 2 PLACES
1 ANGLE
BRACKET 2
FITTING
HINGE LOCATION
'C' CLAMP OR EQUIVALENT
SHIM 3
BRACKET 2
GUIDE PIN (0.750 DIA x 8.5) 4 (0.9376 DIA x 8.5) 5
NAS6303U1 BOLT MS20500-1032 NUT OR EQUIVALENT 2 PLACES
ANGLE 1
'C' CLAMP OR EQUIVALENT
AILERON (REF.)



NOTE

1. 0.05 x 1.50 x 2 x 2 ANGLE
2. 0.05 x 2 x 2 BRACKET
3. INSTALL SHIM(S) AS REQUIRED TO ALIGN WITH THE GUIDE PIN
4. MAKE TWO BRACKETS AND A GUIDE PIN FOR 1529343-115/-116 FITTING TO INSTALL
5. MAKE TWO BRACKETS AND A GUIDE PIN FOR 1529985-119/-120 FITTING TO INSTALL

M1-0100-27-614

R R Outboard Aileron Fitting Installation
Figure 802

R R 0018 EFFECTIVITY: ALL

AILERON/SPOILER CABLE SCISSOR LINKAGE ASSEMBLY REMOVAL AND INSTALLATION

1. Equipment and Materials

Aileron Support Tool, BF90, or equivalent

Rig Pins, 5/16-inch diameter by 6-inches long (R6) three each; 5/16-inch diameter by 3-inches long (R3) one each

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	24-41-00	External Ground/Power Systems - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Open access panel 561BB and 571AB-2 (left wing) or 661BB and 671AB-2 (right wing) to gain access to aileron/spoiler cable scissor linkage (Ref. 6-40-00).

(2) Remove bolt that connects aileron pushrod to scissor linkage upper bellcrank.

(3) Remove bolt that connects No. 3 spoiler pushrod to scissor linkage lower bellcrank.

(4) On spoiler scissor linkage (bottom bellcranks), loosen spoiler cable turnbuckle until spoiler cables are slack.

(5) Tag spoiler cables for identification. Remove bolts that connect spoiler cables to scissor linkage bellcranks.

(6) On aileron scissor linkage (top bellcranks), loosen one of the aileron turnbuckles until aileron cables are slack.

(7) Tag aileron cables for identification. Remove bolts that connect aileron cables to scissor linkage bellcranks.

(8) Remove bolts attaching scissor linkage assembly to mounting bracket. Remove scissor linkage assembly.

B. Installation

(1) On replacement scissors assembly, loosen both nuts on each pivot bolt assembly and retorque as follows:

(a) Torque nut on larger diameter outer bolt to 70 to 80 lb-in.

NOTE: Larger diameter bolt must be torqued first to prevent spoiler control system friction problems.

(b) Torque nut on inner bolt to 20 to 25 lb-in.

(c) Install lockwire between inner and outer pivot bolt nuts.

(2) Verify all hydraulic power is turned off and that hydraulic control panels are tagged.

(3) While guiding inboard aileron output pushrod and inboard aileron to outboard aileron cables, manually position both inboard and outboard aileron (on wing being worked) to neutral position (±0.060-inch) and install aileron support tool on both ailerons (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R Maintenance Practices.

On aircraft without SB27-162,
inboard aileron neutral is with aileron faired.

On aircraft with SB27-162,
inboard aileron neutral is with aileron 1.5 degrees up from faired.

On aircraft 001-018, 021, 022,
outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

On aircraft 019, 020, 023-999,
outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(4) Position scissor linkage assembly on mounting pads and install the eight mounting bolts and washers.

(5) Install rig pin R6 through scissor linkage frame and scissor linkage aileron arm (76).

(6) Connect inboard aileron output pushrod (19) to scissor linkage arm (76) with bolt, washers and nut. Bolt should be a free fit. If not, adjust pushrod (19). Install cotter pin.

(7) Connect aileron cables to respective scissor linkage bellcranks (top bellcranks) with bolts, washers and nuts. Install cotter pins.

(8) With rig pin in scissor linkage arm (76), adjust aileron cable turnbuckles to the following requirements (Ref. Fig. 401, Sheet 1):

(a) Rig pin R3 fits freely through outboard aileron scissor linkage arm (78).

(b) Cable bellcrank (20) is 90 (±2) degrees to wing rear spar.

(c) Cable tension conforms to aileron cable temperature compensation chart.

(9) Safety turnbuckles.

(10) Remove rig pins from both aileron scissor linkage bellcranks.

(11) Verify speedbrake control lever in flight station is full forward (0-degree position).

(12) Open access panel 541GB-1 (left wing) or 641GB-1 (right wing) to gain access to spoiler bellcranks just outboard of the No. 2 spoiler servo.

(13) Verify spoilers 2 and 3 on both wings are full down (pistons bottomed).

(14) Connect spoiler cables to respective scissor linkage bellcranks (bottom bellcranks) with bolts, washers and nuts. Install cotter pins.

(15) Adjust turnbuckle between cable bellcranks (just outboard of No. 2 spoiler servo) and scissor linkage to the following requirements (Ref. Fig. 401, Sheet 2):

(a) Rig pins R6 fits through bracket and cable bellcranks (81) and (84) and through (82) and (83).

NOTE: Upper bellcranks (82) and (84) are part of spoiler No. 4, 5 and 6 control. If necessary, position bellcranks (82) and (84) to install rig pins in bellcranks (81) and (83).

(b) Rig pin (R6) fits through the aileron/spoiler scissor linkage bracket and bellcrank (80).

(c) Cable tension conforms to spoiler cable temperature compensation chart.

(16) Safety turnbuckles.

NOTE: On aircraft 001-006, turnbarrel locking clip slots may not be located correctly to prevent Lockclad cable twist and cause cable terminal bearings to interfere with bellcrank clevises. Light contact is permissible if static clearance can be shown simultaneously on both ends of cable assembly by hand rotation of cable. If terminal bearing is interfering with bellcrank clevis, readjust cable to maintain rig but eliminate cable twist. If the turnbuckle locking clip slots do not line up without causing cable twist, ignore these locking slots and safety with lock-wire.

(17) Remove rig pins from spoiler cable bellcranks and spoiler scissor linkage. Verify all rig pins are removed from aileron and spoiler control systems.

(18) Remove aileron support tool from both ailerons.

(19) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(20) Turn on electrical power (Ref. 24-41-00).

(21) Turn on all four hydraulic systems (Ref. 29-11-00).

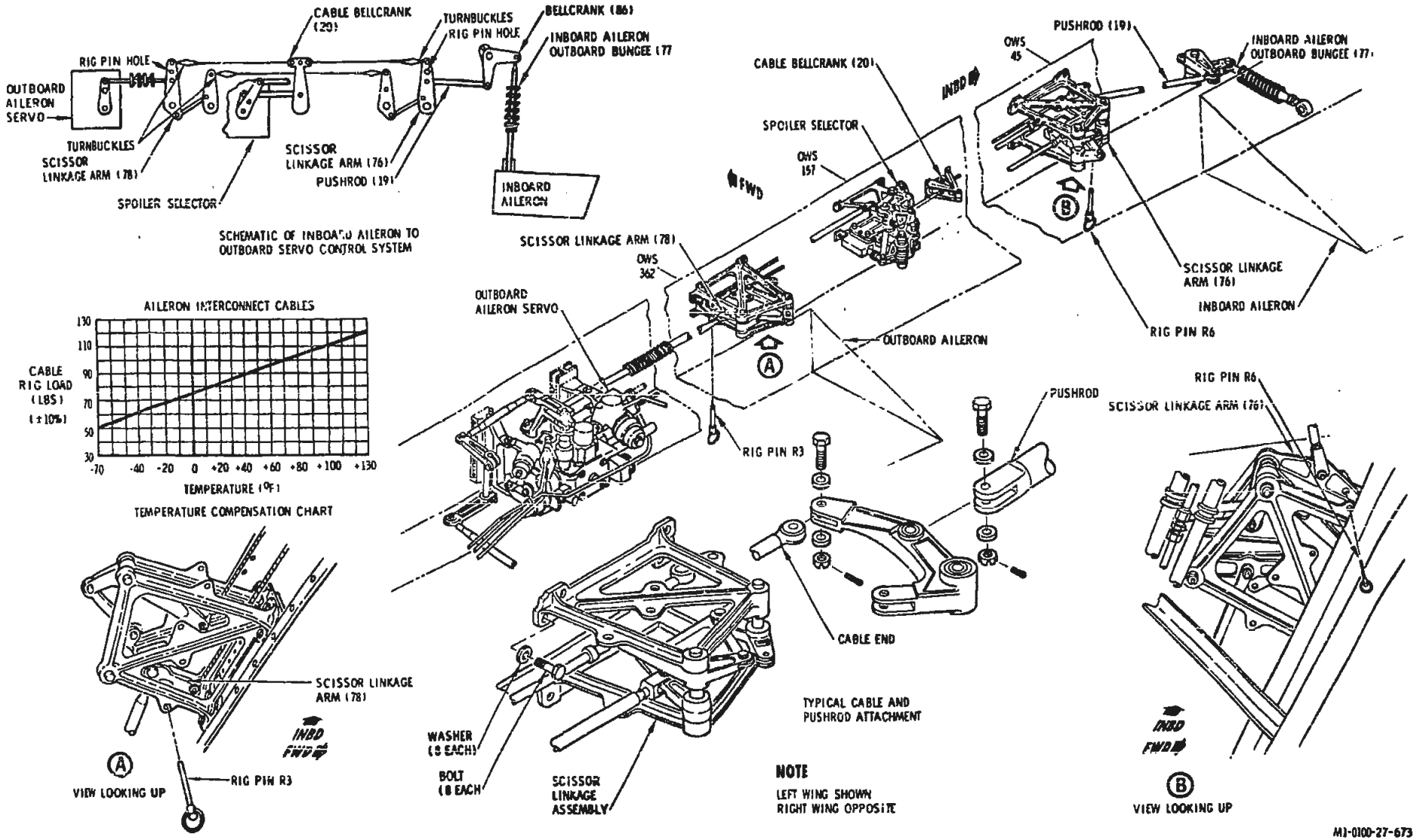
(22) Slowly operate aileron control wheel through full left and right roll inputs. Visually verify normal operation of the inboard-to-outboard aileron control system. Verify outboard aileron follows inboard aileron movement.

(23) Slowly operate speedbrake control lever through full speedbrake applications. Visually verify normal operation of No. 2 and 3 spoiler control system in wing. Verify spoilers No. 2 and 3 on replacement side follow spoilers No. 2 and 3 on opposite wing.

(24) Turn off hydraulic power if no longer required (Ref. 29-11-00).

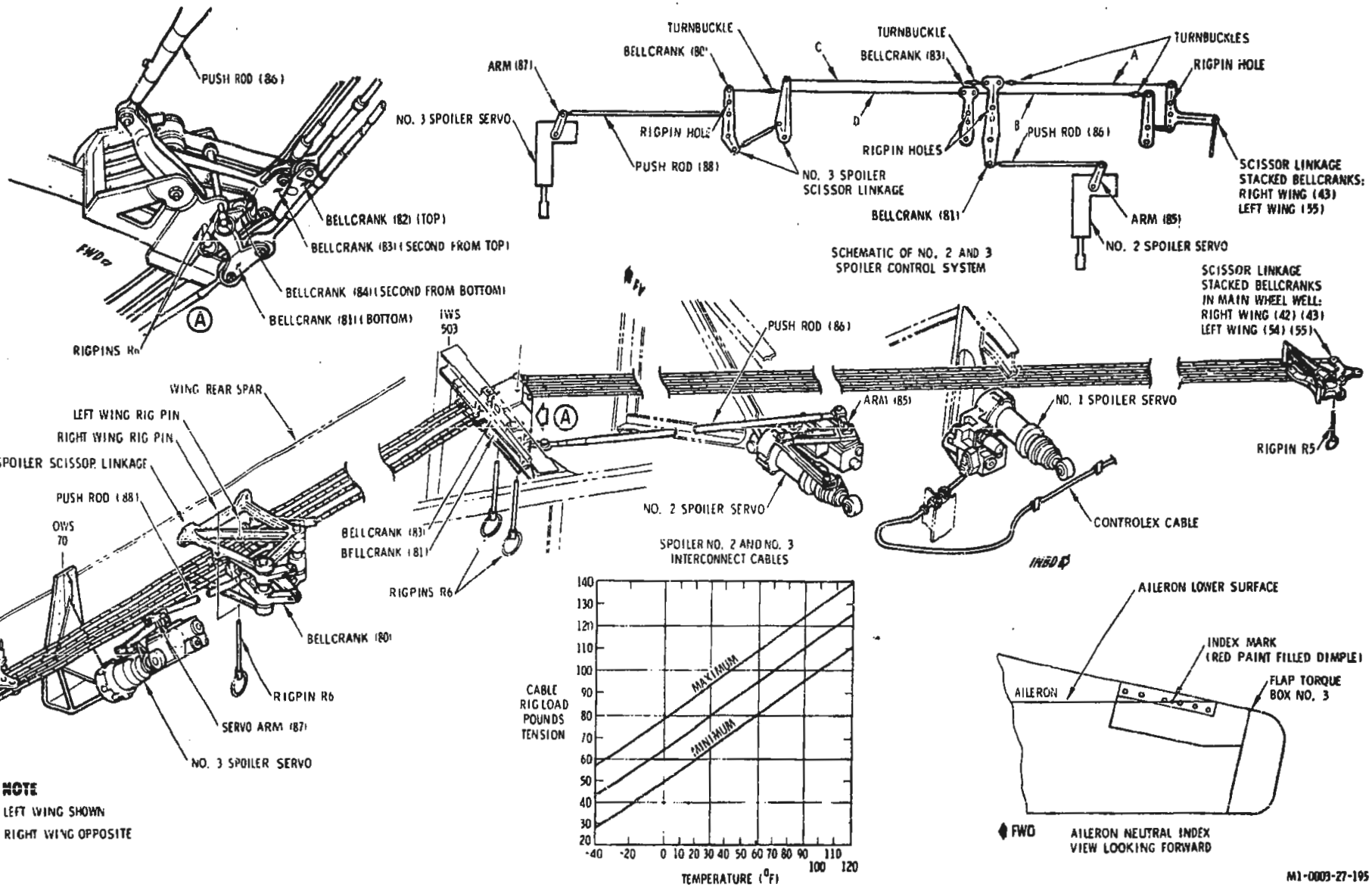
(25) Turn off electrical power if no longer required (Ref. 24-41-00).

(26) Install access panels.



R Aileron/Spoiler Cable Scissor Linkage Assembly
R Removal and Installation
R Figure 401 (Sheet 1)

R EFFECTIVITY: ALL
R
0018



NOTE
LEFT WING SHOWN
RIGHT WING OPPOSITE

M1-0003-27-195

R Aileron/Spoiler Cable Scissor Linkage Assembly
R Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: ALL

001B

INBOARD AILERON INBOARD BUNGEE CARTRIDGE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin, 5/16-inch diameter by 3 inches long (R3) and 6 inches long (R6) (part of rig pin kit PN P735)

Aileron Support Tool, BF90, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	27-11-00	Aileron Control System - Adjustment and Test
R	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Remove applicable access panel 551AB or 651AB (Ref. 6-40-00).

NOTE: Access panel is the most inboard panel just forward of inboard aileron.

(2) Unload aileron inboard bungee as follows:

(a) For left aileron bungee removal, manually move both left and right inboard ailerons to the neutral position (±0.060 inch) and install aileron support tool (Ref. 27-11-00).

(b) For right aileron bungee removal, manually move right inboard aileron to the neutral position (±0.060 inch) and install aileron support tool.

NOTE: Inboard aileron neutral index mark is a red paint-filled dimple on the No. 3 flap torque

box. Align lower inboard surface of aileron with index mark (Ref. Fig. 401). (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.)

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(3) Remove cotter pin, nut, washer, and bolt with washer from bungee cartridge end attached to the bellcrank (Ref. Fig. 401).

(4) Remove cotter pin, nut, washer, and bolt with washer from bungee cartridge end attached to the aileron fitting and remove bungee cartridge.

B. Installation

(1) Ensure ailerons are in neutral position [Step 3A(2)].

(2) On aircraft 001-006, insert rig pin (R6) in rig pin holes of bracket and stacked bellcranks. Verify forward arm of bellcrank (1) is parallel to wing rear spar. If not, adjust pushrod (2) (Ref. Fig. 401).

(2) On aircraft 008-999, insert rig pin (R3) through bracket and bellcrank (2), connected to forward end of bungee.

(3) With inboard aileron in neutral (±0.060 inch) and rig pin installed in accordance with Step (2), verify bungee fits between aileron fitting and bellcrank (2). If not, adjust length of bungee.

NOTE: If bungee rod end is adjusted, verify rod end locking key is properly engaged and locknut is tightened and lock-wired to locking key.

(4) Install bungee cartridge to aileron fitting and to bellcrank with bolt, washer, and nut. Tighten nut and secure each end with cotter pin. (Bungee is installed with adjustable rod end attached to aileron.)

(5) Remove rig pin installed in Step 3B(2). Verify there are no rig pins in any part of aileron control system.

(6) Remove placards from hydraulic control panels.

(7) Remove aileron support tool.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

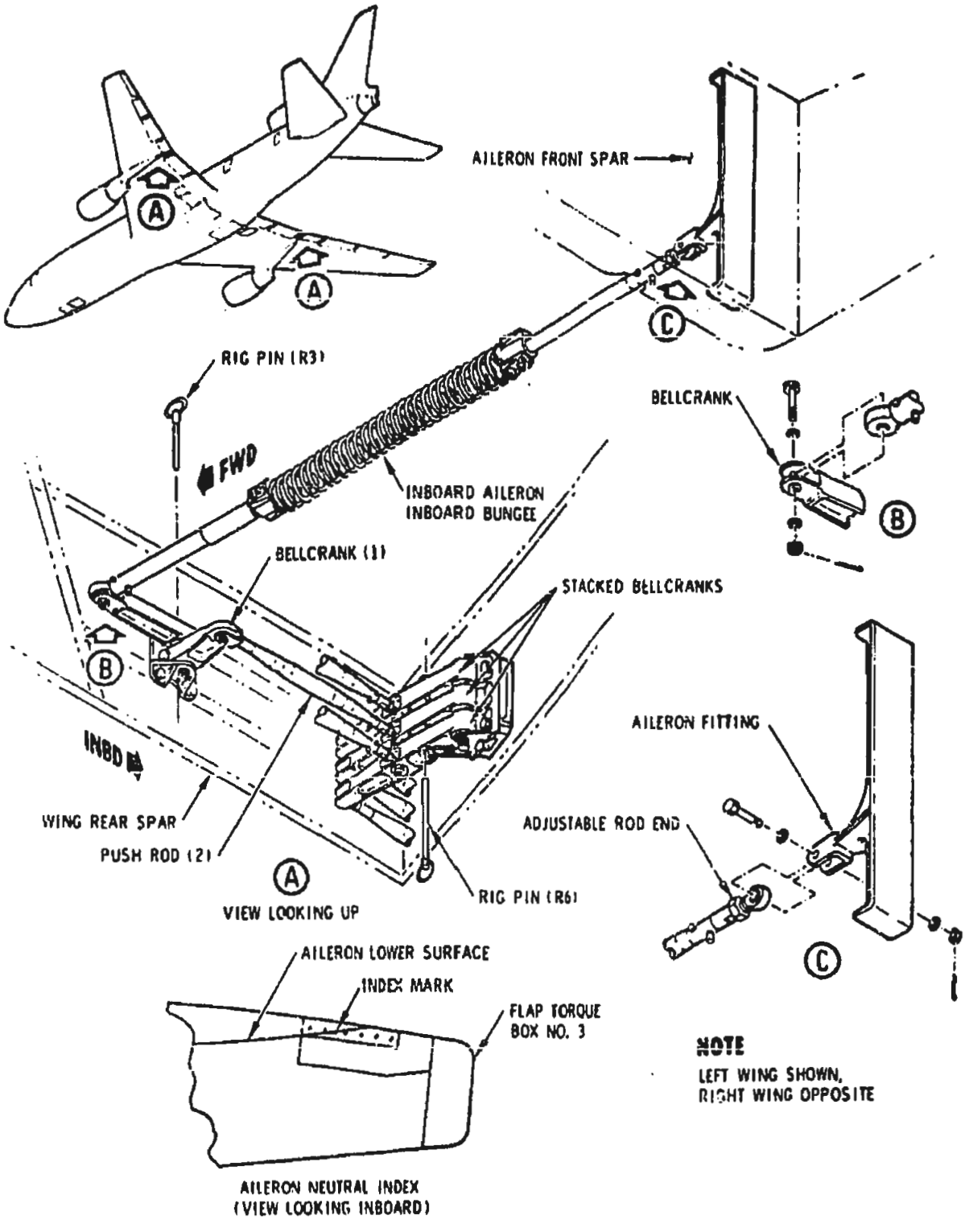
(8) Turn on hydraulic system B (Ref. 29-11-00).

(9) Slowly cycle ailerons from full up to full down several cycles, and visually verify normal operation of replacement bungee and associated linkage.

NOTE: On aircraft 001-006, with aileron full down, verify a minimum clearance of 0.010 inch exists between forward arm of bellcrank (1) and wing rear spar.

(10) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(11) Install access panel opened in Step 3A(1).



R Inboard Aileron Inboard Bungee Cartridge - Removal and Installation
R Figure 401

INBOARD AILERON OUTBOARD BUNGEE CARTRIDGE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin, 5/16-inch diameter by 3 inches long (R3) (part of Rig Pin Kit, PN B735)

Aileron Support Tool, BF90, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

2. Referenced Procedure

	6-40-00	Exterior Access Doors and Panels
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Remove applicable access panel 551CB or 651CB (Ref. 6-40-00).

NOTE: Access panel is the most outboard panel just forward of inboard aileron.

(2) On wing from which bungee is to be removed, manually move inboard and outboard ailerons to neutral position (±0.060 inch) and install aileron support tool (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or

R reestablished in accordance with 27-11-00,
R Maintenance Practices.

On aircraft without SB27-162,
inboard aileron neutral is with aileron faired.

On aircraft with SB27-162,
inboard aileron neutral is with aileron 1.5 degrees up from faired.

On aircraft 001-018, 021, 022,
outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

On aircraft 019, 020, 023-999,
outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(3) Remove cotter pin, nut, washer, and bolt with washer from bungee cartridge end attached to bellcrank (Ref. Fig. 401).

(4) Remove cotter pin, nut, washer, and bolt with washer from bungee cartridge end attached to aileron fitting and remove bungee cartridge.

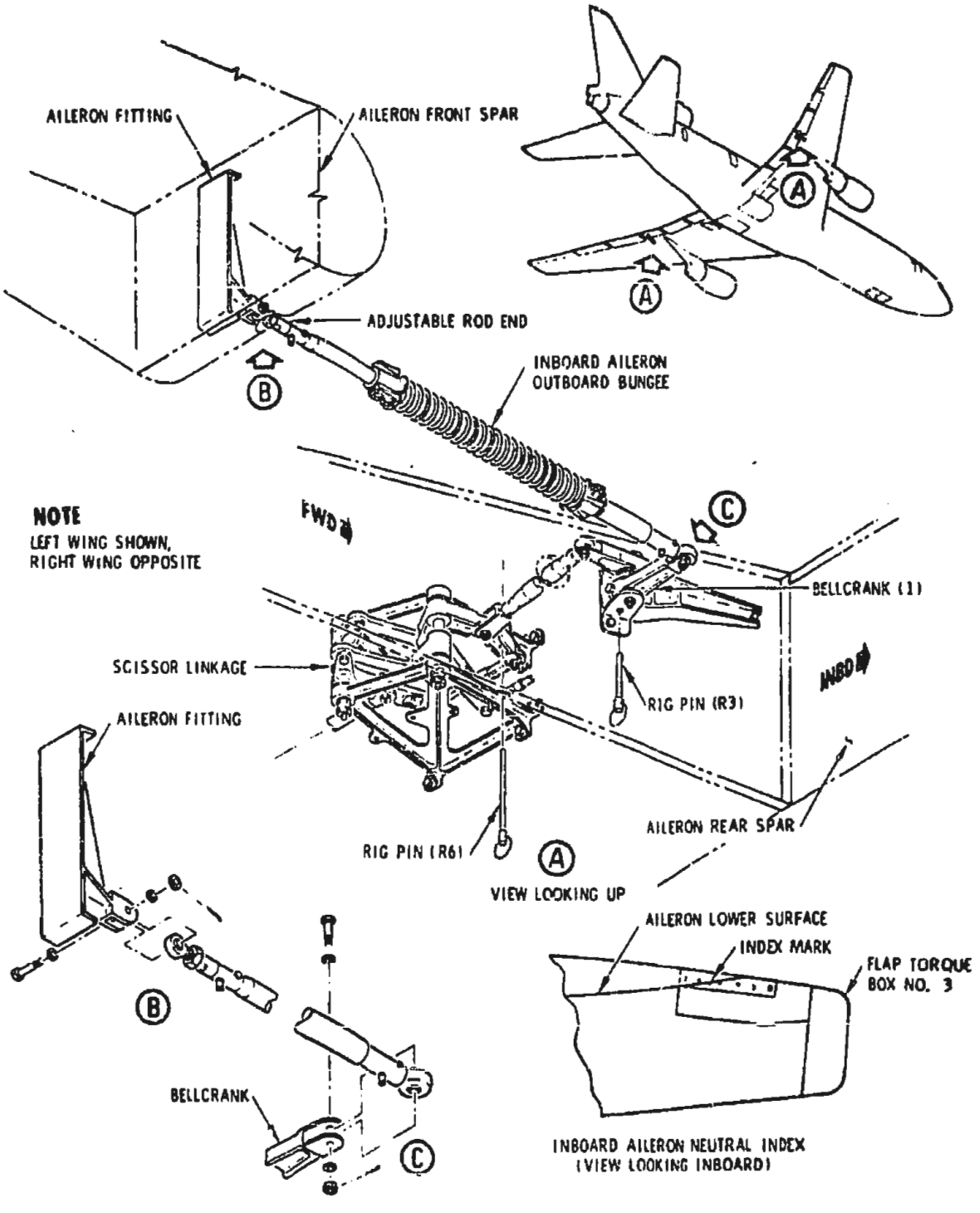
B. Installation

(1) Ensure inboard and outboard ailerons are in neutral position [Step 3A(2)].

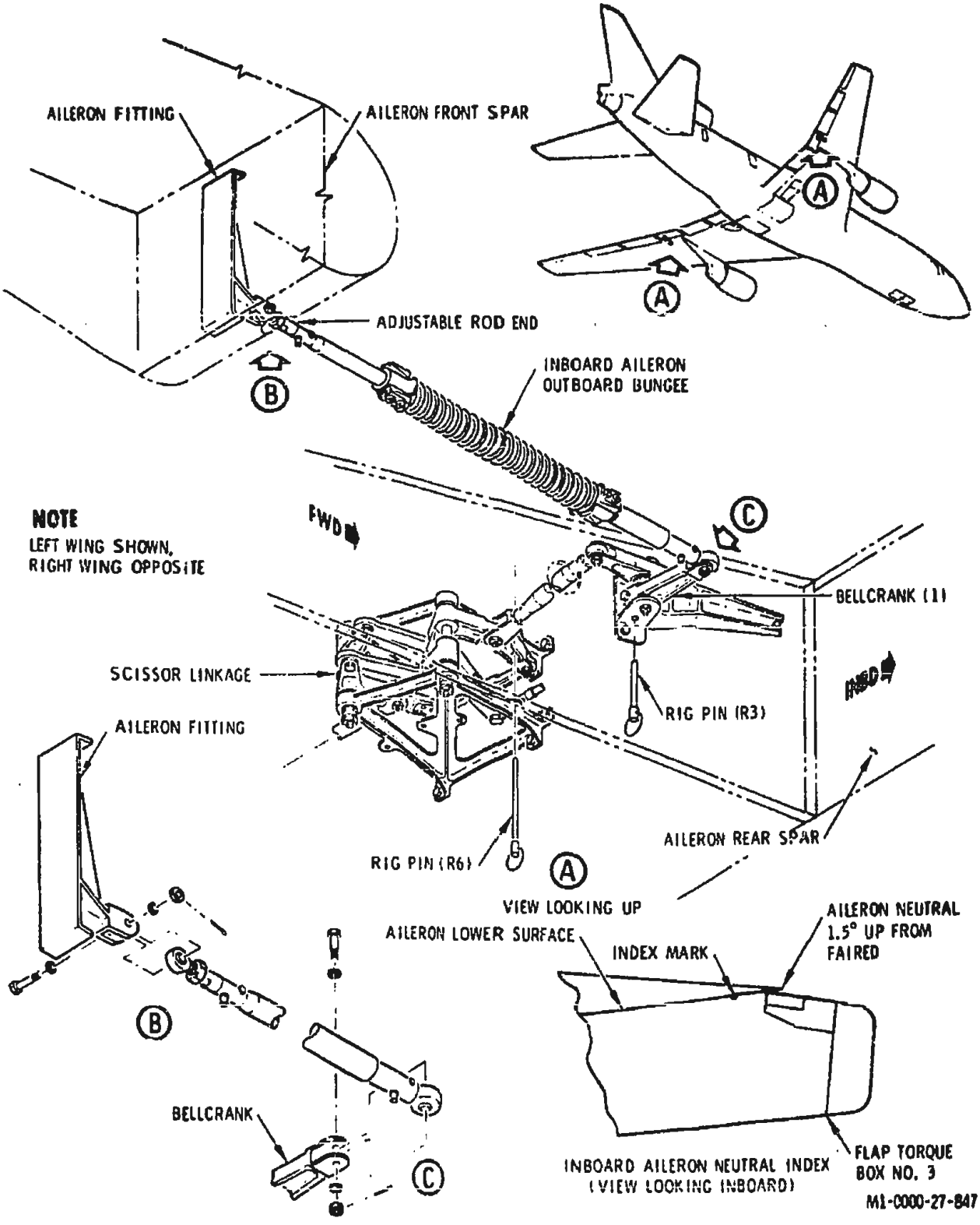
(2) Insert rig pin (R3) in rig pin hole of bracket and bellcrank (1).

(3) With ailerons in neutral (±0.060 inch) and rig pin installed in bellcrank (1), verify bungee fits between aileron fitting and bellcrank. If not, adjust length of bungee.

NOTE: If bungee rod end is adjusted, verify rod end locking key is properly engaged and locknut is tightened and lock-wired to locking key.



R Inboard Aileron Outboard Bungee Cartridge - Removal and Installation
R Figure 401



R Inboard Aileron Outboard Bungee Cartridge - Removal and Installation
R Figure 401

EFFECTIVITY: WITH SB27-162

(4) Install bungee cartridge to aileron fitting and bellcrank with bolt, washer, and nut. Tighten nut and secure each end with cotter pin. (Bungee is installed with adjustable rod end attached to aileron.)

(5) Remove rig pin installed in Step 3B(2). Verify there are no rig pins in any part of aileron control system.

(6) Remove placards from hydraulic control panels.

(7) Remove aileron support tools.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic system B (Ref. 29-11-00).

CAUTION: OPERATING OUTBOARD AILERONS AT A HIGH RATE CAN DAMAGE THE SURFACE DAMPER SEALS. OPERATE CONTROL WHEEL SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(9) Slowly cycle aileron from full up to full down several cycles, and visually verify normal operation of replacement bungee and associated linkage.

(10) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(11) Install access panels opened in Step 3A(1).

AILERON HINGE BEARING - REMOVAL AND INSTALLATION

1. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
	12-23-00	Flight Control Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

2. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

R (1) Remove access panel for associated hinge (Ref.
R 6-40-00):

R Inboard aileron - Hinge No. 1: 453H or 463H (pylon
R fairing), 551AB or 561AB, and 551BB or 651BB; hinge No.
R 2: 551CB or 561CB

Outboard aileron - Hinge No. 1: 571AB or 671AB; hinge No. 2: 571DB or 671DB; hinges No. 3 and No. 4: 571EB or 671EB

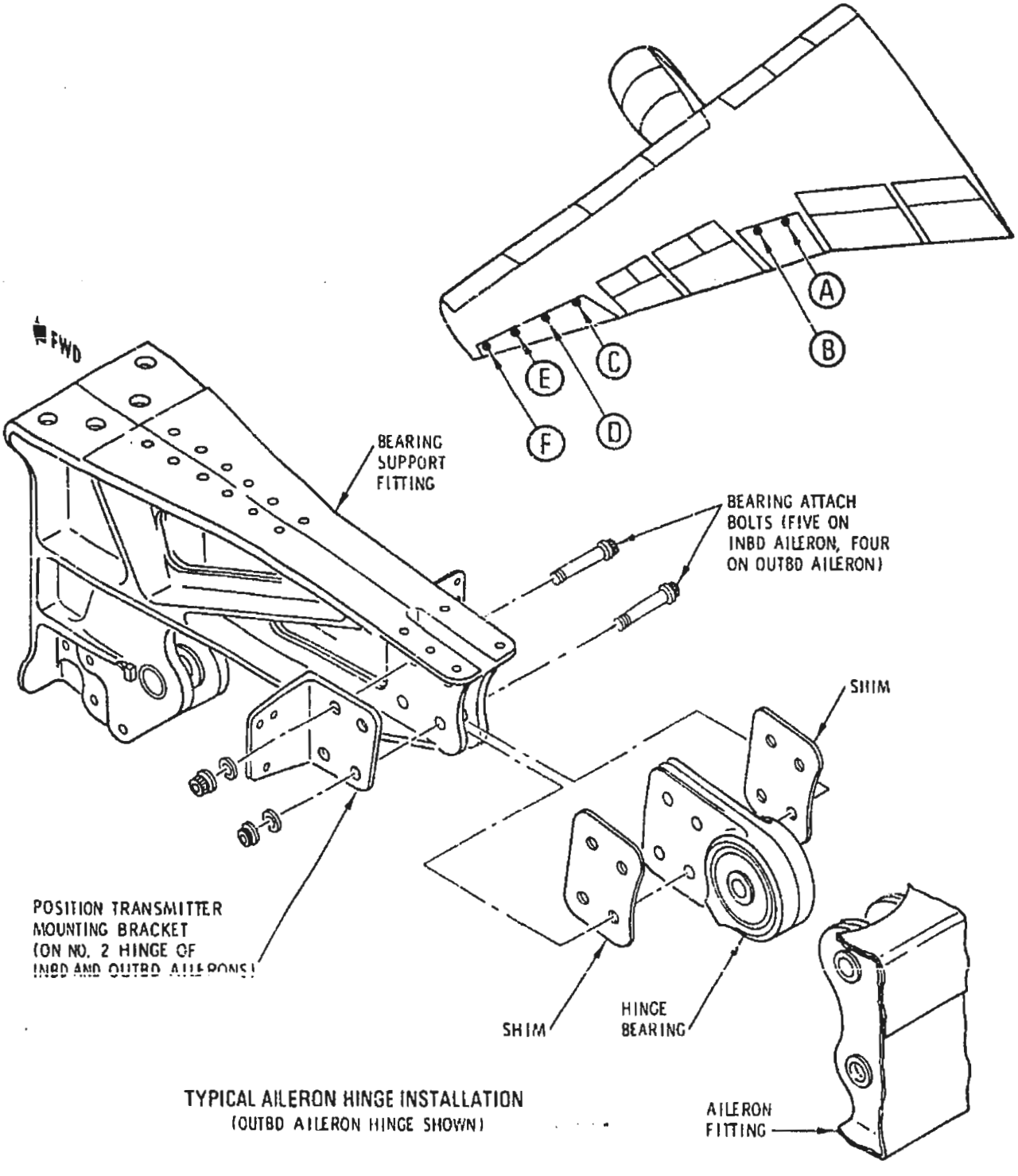
(2) Manually position aileron to full up position. Block aileron or install stand to hold aileron in full up position.

(3) Remove hinge pivot bolt from hinge bearing to be removed (Ref. Fig. 401).

(4) Remove hinge bearing attaching bolts. Remove hinge bearing. Retain shims.

B. Installation

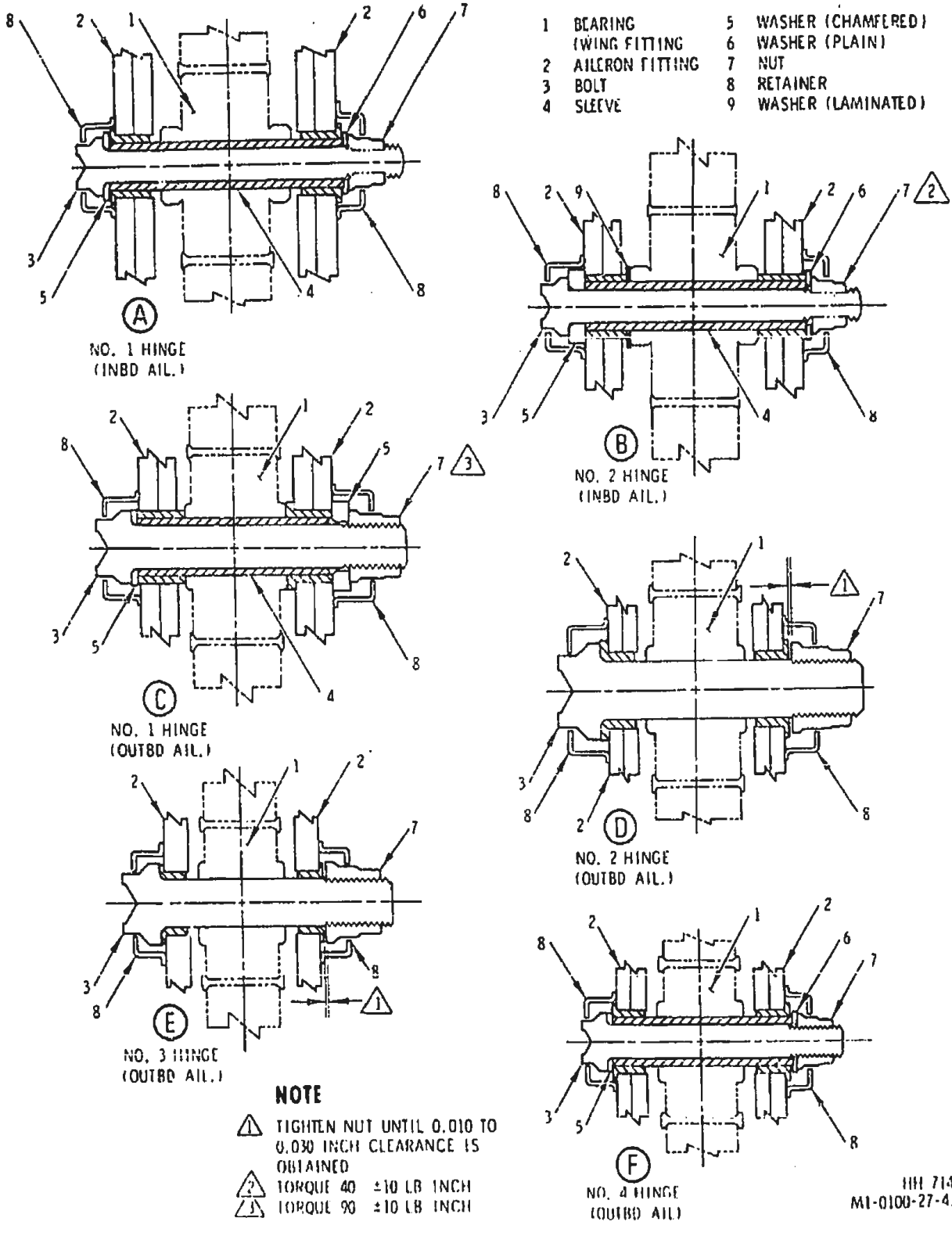
(1) Insert hinge bearing in hinge bracket. Maximum gap between bearing and hinge should be 0.002 inch. Insert shims to reduce gap to 0.002 inch, maximum.



TYPICAL AILERON HINGE INSTALLATION
(OUTBD AILERON HINGE SHOWN)

HH 7120
M1-0100-27-431

Aileron Hinge Bearing - Removal and Installation
Figure 401 (Sheet 1)



Aileron Hinge Bearing - Removal and Installation
Figure 401 (Sheet 2)

R R (2) Install hinge bearing to trailing edge fitting by installing bolts, washers, bonding jumpers, and nuts.

NOTE: On outboard hinge of inboard aileron and the No. 2 hinge of outboard aileron, install position transducer mounting bracket before installing washers and nuts.

R R R (3) Install hinge bearing-to-aileron attaching hardware (Ref. Fig. 401 (Sheet 2). Use bullet to align bearing and fitting.

(4) Lubricate hinge bearing (Ref. 12-23-00).

(5) Support aileron and remove aileron block or stand. Allow aileron to drift to full down position.

R (6) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on electrical power (Ref. 24-41-00).

(8) Turn on hydraulic system B (Ref. 29-11-00).

R R (9) Cycle flight station control wheel through five full roll applications.

(10) Check bearing installation for smooth operation.

(11) If outboard hinge of inboard aileron or No. 2 hinge on outboard aileron was replaced (position transmitter location), perform the following steps:

R (a) Close the SURF POS IND circuit breaker(J23) on the pilots overhead panel CB1, zone 210.

(b) While cycling aileron, check that transmitter linkage operates smoothly without binding and that aileron pointers on the surface position indicator

R on pilots center instrument panel, zone 210,
R follows aileron movement.

(12) Turn off hydraulic power (Ref. 29-11-00).

(13) Turn off electrical power (Ref. 24-41-00).

(14) Close access panels.

AILERON CONTROL TORQUE LIMITER POSITION DFDR POTENTIOMETER REMOVAL AND INSTALLATION

1. General

A potentiometer is mounted on the bottom of both the Captains and First Officers torque limiter. The removal and installation procedures are identical for either potentiometer unless noted.

2. Equipment and Materials

R Rivet, LS13971AD4

Sealant, PR1422A2 (MIL-S-8802, CL A-2), or equivalent

R Rig Pin KIT, PN B734, or equivalent

R Cotter Pin, MS24665-149

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
31-31-00	Digital Flight Data Recorder (DFDR) System

4. Removal/Installation

A. Removal

CAUTION: PROPER OPERATION OF LINKAGE DEPENDS ON CORRECT INSTALLATION OF LINKAGE COMPONENTS. NOTE POSITION OF ALL PARTS AND REINSTALL IN SAME ORDER (REF. FIG. 401).

R (1) Verify all four hydraulic systems are shut off and
R hydraulic control panels tagged (Ref. 29-11-00).

R (2) Verify following circuit breakers are open and tagged:

(a) On Flight Engineer/Second Officers aft circuit
R breaker panel CB3, zone 215: AIDS/FLT RCDR -
R DC(H10), A(H11), B(H12), C(H13).

(3) Open access door 112AB to gain access to forward electronic service center (Ref. 6-40-00).

R (4) Locate potentiometer on bottom of Captains or First Officers torque limiter (Ref. Fig. 401).

R (5) Disconnect potentiometer wires from terminal boards.

(6) On aircraft 001-031 without SB27-179, remove potentiometer as follows:

R (a) Remove rivet attaching alignment plate to bracket
R assembly (Ref. Fig. 401).

R (b) Support potentiometer arm from rotating, remove
R arm attaching nut and washer, and remove arm (Ref.
R Fig. 401).

R (c) Remove nut and lockwasher attaching potentiometer
R to bracket (Ref. Fig. 401).

R (d) Remove potentiometer with alignment plate.

R (6) On aircraft 001-031 with SB27-179 and 032-036,
R remove potentiometer as follows:

R (a) At potentiometer arm remove cotter pin, nut and
R washer and disconnect link from potentiometer arm.

R (b) Remove nut and washer and remove arm from
R potentiometer shaft.

R NOTE: Save all linkage components for
R reinstallation.

R (c) Loosen clamp screws and rotate clamps from flange
R and remove flange with potentiometer attached.

R (d) Remove nut and lockwasher and remove
R potentiometer.

B. Installation

(1) Verify that all hydraulic power is turned off.

R (2) Verify circuit breakers opened in Step 4A(2) are opened
R and tagged.

R (3) On aircraft 001-031 without SB27-179,
R install potentiometer as follows:

(a) Apply sealant inside both mounting hole and index pin hole of alignment plate.

(b) Place alignment plate over potentiometer shaft and seat firmly, engaging index pin of potentiometer to index hole on alignment plate (Ref. Fig. 401).

(c) Insert potentiometer shaft through bracket mounting hole and install lockwasher and nut on potentiometer shaft and tighten.

(d) Clamp alignment plate to bracket and install rivet (Ref. Fig. 401).

(e) Position flat on potentiometer so flat faces forward on Captains (left) torque limiter and flat faces aft on First Officers (right) torque limiter.

(f) Install arm, washer and nut on shaft and tighten.

NOTE: Verify flat on shaft is facing correctly [Ref. Step 4B(3)(b)].

(3) On aircraft 001-031 with SB27-179 and 032-999, install potentiometer as follows:

(a) Pass potentiometer and attached wiring harness through mounting hole of ring platform from inner side of bracket.

(b) Brushcoat inside surface of index hole and mounting hole of flange with sealant.

R (c) Install flange on ring platform with index hole located at 3 o'clock position and tighten all three clamps to secure flange.

(d) Insert potentiometer shaft through mounting hole, and verify index pin of potentiometer engages index hole of flange (Ref. Fig. 401).

(e) Install lockwasher and nut on potentiometer shaft and tighten.

R (f) Flat on potentiometer shaft must point at 12 o'clock position.

(g) Install arm on potentiometer shaft so shaft engages "D" shot in arm and install washer and nut and tighten (Ref. Fig. 401).

R R (h) Install link to potentiometer arm with washer, nut and cotter pin.

CAUTION: FREE OPERATION OF THE LINKAGE DEPENDS ON CORRECT ASSEMBLY AND INSTALLATION OF LINKAGE COMPONENTS.

R R (4) Connect potentiometer wires to terminal board (Ref. Fig. 401).

R R WARNING: VERIFY FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R R (5) Remove tags and close circuit breakers opened in Step 4A(2).

R (6) Remove tags from hydraulic control panels.

R (7) Turn on electrical power (Ref. 24-41-00).

R (8) Turn on hydraulic systems A and B (Ref. 29-11-00).

CAUTION: TO PREVENT DAMAGE TO ALLERON SURFACE DAMPERS, CYCLE ROLL CONTROLS SLOWLY, AT LEAST 4 SECONDS STOP TO STOP.

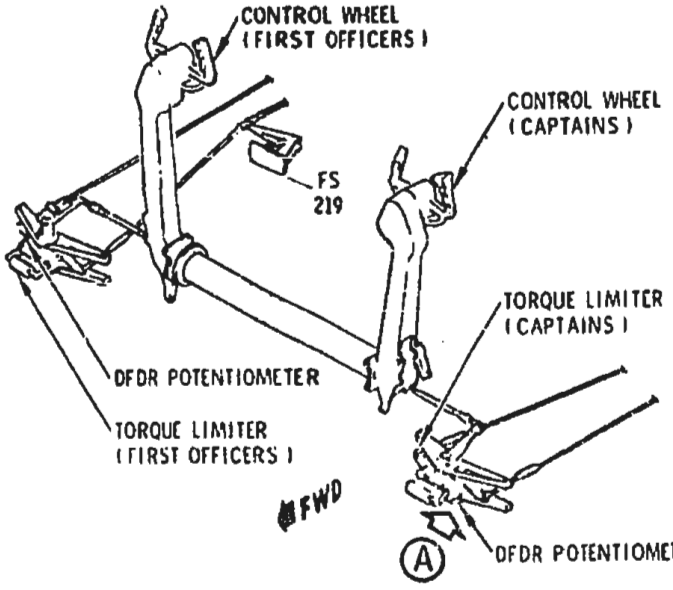
R R R (9) Cycle roll controls from full left roll to full right roll and back to neutral and visually verify normal operation of potentiometer arm.

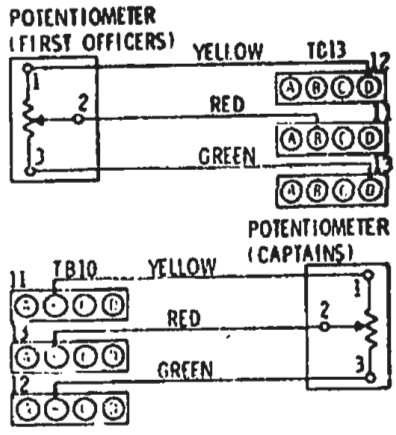
R (10) Check potentiometer for proper voltage and phase output (Ref. 31-31-00), Adjustment and Test, Table 501, signal codes 51-1 and 51-2).

R (11) Turn off hydraulic power (Ref. 29-11-00).

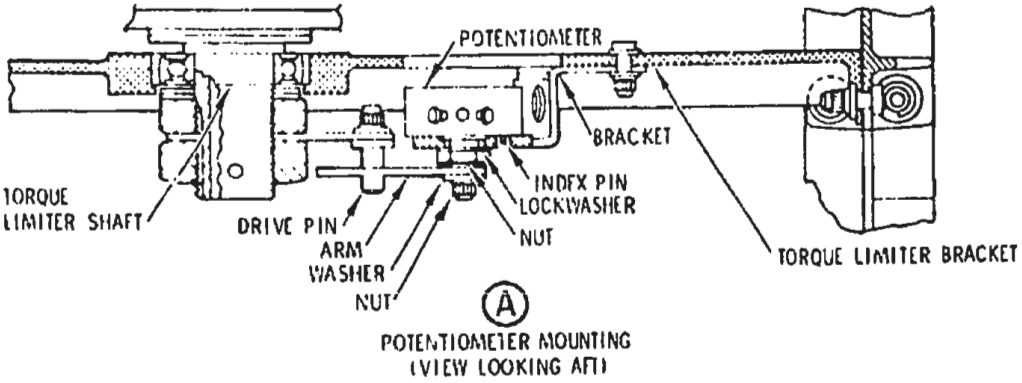
R (12) Turn off electrical power (Ref. 24-41-00).

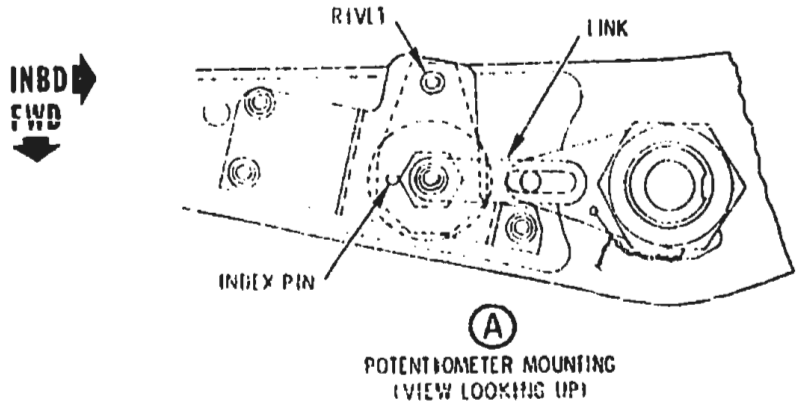
R (13) Close access door.





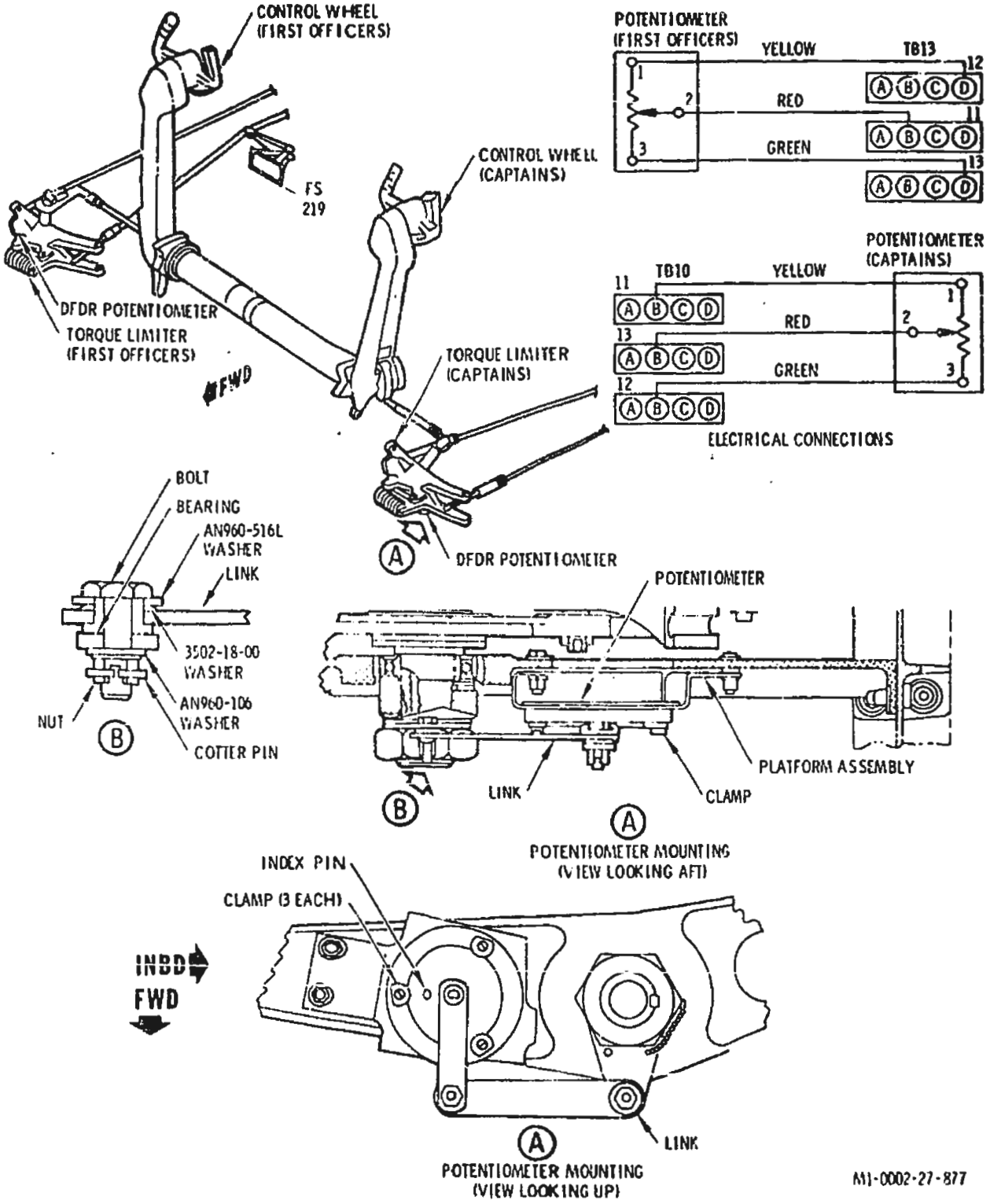
ELECTRICAL CONNECTIONS





M1-0002-27-384

R Torque Limiter Position DFDR Potentiometer
R Removal and Installation
R Figure 401



M1-0002-27-877

R Torque Limiter Position DFDR Potentiometer
R Removal and Installation
R Figure 401

EFFECTIVITY: 001-031 WITH SB27-179 AND 032-036

001B

LEFT INBOARD AILERON SERVO PRESSURE SWITCH REMOVAL AND INSTALLATION

1. Equipment and Materials

Container, 1 quart

Gasket Plate (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

2. Referenced Procedure

	6-40-00	Exterior Access Doors and Panels
R	22-12-00	APFDS Modes of Operation - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

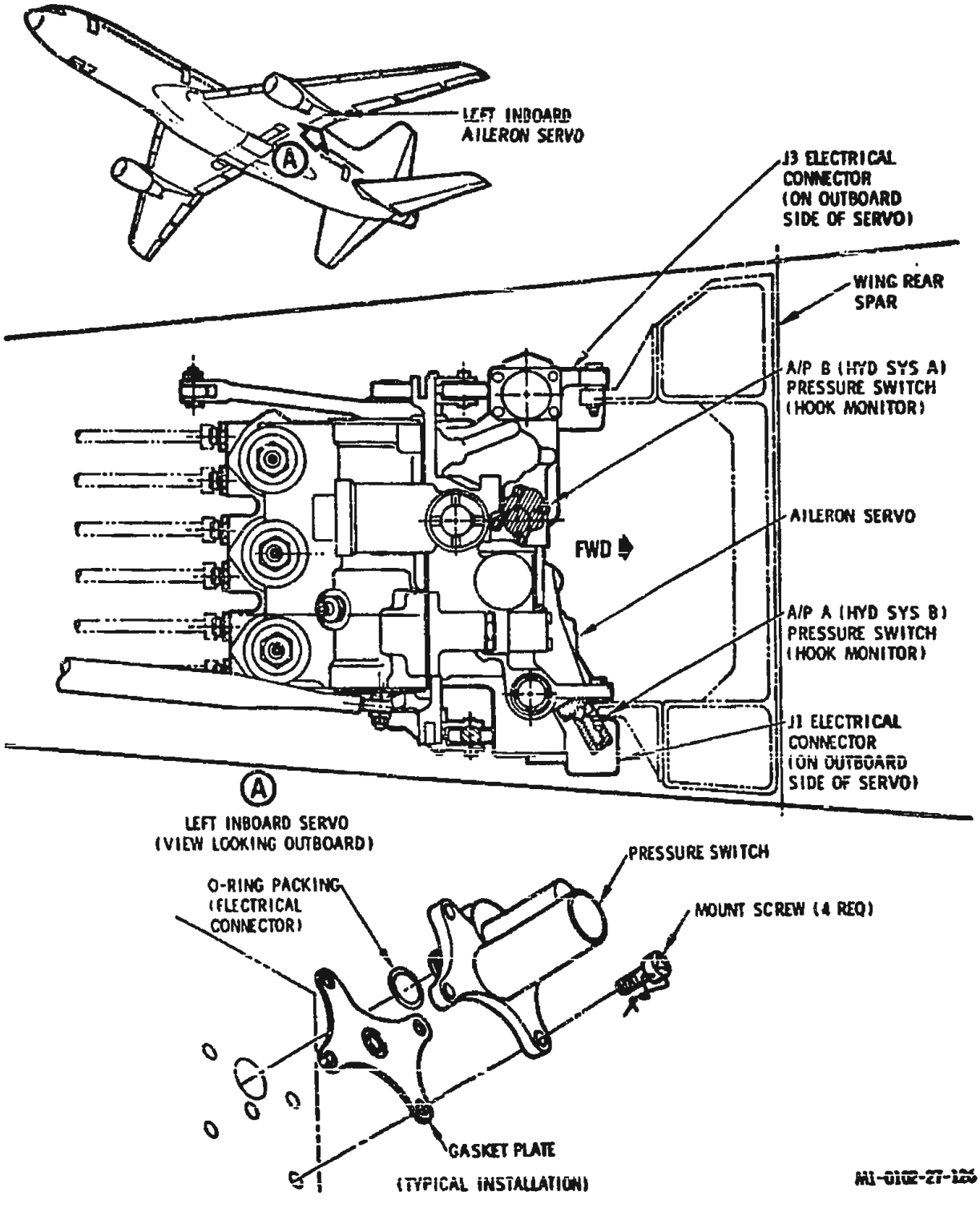
R A. Removal (Ref. Fig. 401)

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker: AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (A6) (hydraulic system B), or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (A24) (hydraulic system A). (See Fig. 401 for identification of pressure switches.)

(2) Gain access to left inboard aileron servo by removing pylon aft fairing 453H and wing lower access panel 551BB (Ref. 6-40-00).

(3) Place container under servo to catch oil spillage.

(4) Remove mount bolts and remove pressure switch (Ref. Fig. 401).


LEFT INBOARD AILERON SERVO
A
J3 ELECTRICAL CONNECTOR (ON OUTBOARD SIDE OF SERVO)
WING REAR SPAR
A/P B (HYD SYS A) PRESSURE SWITCH (HOOK MONITOR)
AILERON SERVO
FWD
A/P A (HYD SYS B) PRESSURE SWITCH (HOOK MONITOR)
J1 ELECTRICAL CONNECTOR (ON OUTBOARD SIDE OF SERVO)
A
LEFT INBOARD SERVO (VIEW LOOKING OUTBOARD)
PRESSURE SWITCH
O-RING PACKING (ELECTRICAL CONNECTOR)
MOUNT SCREW (4 REQ)
GASKET PLATE
(TYPICAL INSTALLATION)

R Left Inboard Aileron Servo Pressure Switch
R Removal and Installation
R Figure 401

B. Installation (Ref. Fig. 401)

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

(2) Install new preformed O-ring packing on switch electrical connection groove.

(3) Verify that pressure switch and servo electrical connectors are not contaminated with hydraulic oil. If they are, clean with approved solvent.

(4) Position new plate gasket on switch mounting surface and install switch on servo. Secure switch with mount screws and lock-wire.

(5) Remove tag and close circuit breaker opened in Step 3A(1).

(6) Remove tags from hydraulic control panels.

(7) Accomplish the Autopilot Setup, Para. 4B of 22-12-00, Maintenance Practices.

(8) On APFDS SELECT panel (on glareshield), position associated autopilot lever switch to CMD position (lever switch A for hydraulic system B; lever switch B for hydraulic system A). If autopilot lever switch remains in CMD position, proper operation of replaced R pressure switch is verified. (The pressure switch that malfunctions would cause lever switch to return to OFF position when released.)

(9) Check pressure switch for hydraulic leakage.

(10) Return autopilot lever switch to OFF position.

(11) Turn off the APFDS system.

(12) Install pylon fairing and access panel.

AILERON AUTOPILOT LIMITER SWITCH MECHANISM REMOVAL AND INSTALLATION

1. General

R R This procedure covers removal and installation of limiter switch mechanism and removal and installation of limiter switches. Limiter switch replacement and adjustment should normally be accomplished in the shop if shop facilities are available.

2. Equipment and Materials

Sealing compound, LCM40-1218 Type I, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
20-24-02	Crimped Electrical Contact - Removal and Installation
20-51-04	Environmental Sealing of L-1011 Aircraft
22-13-09	Wiring Diagram - APFDS Roll Sys 1
22-13-10	Wiring Diagram - APFDS Roll Sys 2
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

R R R WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL and NO. 2 SYSTEMS - PITCH & ROLL.

(2) Open access door 147AB (Ref. 6-40-00).

(3) Disconnect trim input rods from autopilot limiter switch assembly longer arms (Ref. Fig. 401).

R (4) Disconnect bungee rod assemblies from limiter assembly shorter arms.

(5) Remove limiter assembly mounting bolts and washers, and lower assembly.

(6) On aircraft with terminal modules on limiter assembly, tag and disconnect wires from terminal modules (Ref. 20-24-02). On aircraft with electrical connectors on limiter assembly, disconnect electrical connectors.

R B. Installation

R (1) Verify circuit breakers opened in Step 3A(1) are open and tagged.

(2) On aircraft with terminal modules on limiter assembly, connect ships wiring to terminal modules (Ref. 20-24-02). On aircraft with electrical connectors on limiter assembly, connect electrical connectors.

NOTE: For wiring connections, of terminal modules, see Figure 402.

(3) Place limiter assembly in mounting position and secure with bolts and washers (Ref. Fig. 401).

(4) Apply fillet seal around mounting points (Ref. 20-51-04).

R (5) Connect bungee rod assemblies to limiter assembly
R shorter arms with respective bolt, washer, and nut.
R Install cotter pins.

R (6) Connect trim input rods to limiter assembly longer arms with respective bolt, washer, and nut. Install cotter pins.

(7) Remove tags and close circuit breakers opened in Step 3A(1).

(8) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on hydraulic system B (Ref. 29-11-00).

R R (10) Slowly operate control wheel through several full left and right roll inputs. Verify roll control system operates smoothly throughout control range.

R (11) While operating control wheel, visually verify limiter switch assembly input arms operate smoothly without binding.

(12) Return control wheel to neutral.

R (13) Operate the roll trim control wheel through full left and right roll trim inputs. Verify roll trim control system operates smoothly without binding.

R R (14) While operating roll trim control wheel, visually verify limiter switch assembly trim input arms operate smoothly without binding.

(15) Return trim wheel to zero.

(16) Perform Rigging Check and Adjustment (Ref. 27-11-38, Adjustment and Test, Para. 6).

C. Removal of Autopilot Limiter Switch (Ref. Fig. 402)

R NOTE: The autopilot limiter switch replacement and adjustment should normally be accomplished in the shop but is presented here in the event shop facilities are not available and switch replacement is required for aircraft dispatch.

R R (1) Remove limiter switch assembly in accordance with Paragraph A.

R (2) Remove the two screws attaching switch to limiter arm.

(3) Remove the two wire harness cable clamps.

(4) On aircraft with terminal modules, remove switch wires from terminals. Remove switch and wiring harness assembly.

(5) On aircraft with electrical connector, remove four
R screws attaching electrical connector to angle plate.
R Remove switch and wiring harness assembly.

R D. Installation of Autopilot Limiter Switch

R (1) Install switch and cable clamp plate on limiter arm
R with the two screws, washers, and nuts.

R (2) Install cable clamp on wire harness and connect to
R cable clamp plate.

R (3) On aircraft with terminal modules, connect switch wiring in accordance with wiring diagram on Figure 402. Tie wires as necessary.

(4) On aircraft with electrical connectors, attach
R electrical connector to angle plate with the four
R screws and nuts.

R (5) Install cable clamp on wire harness and connect to
R angle plate. Verify a cable loop of 14 inches exists
R between angle plate cable clamp and switch to ensure unrestricted limiter arm movement.

(6) Check switch adjustment as follows (Ref. Fig. 402):

(a) Insert rig pin (R4) in bracket hole B and both aileron input arms (short arms).

(b) Operate trim input arm (long arm) to position switch roller on either cam BB or CC to close all normally open switches. Operate trim input arm to position switch roller on center cam surface AA. All normally open switch circuits must reset to normally open before cam roller returns to within 0.005 inch minimum of cam surface AA.

(c) Insert rig pin (R4) through bracket hole D and both aileron trim input arms (long arms).

(d) Remove rig pin (R4) from bracket hole B, position both aileron input arm to allow pin (R4) to be inserted through bracket hole C and both aileron input arms (short arms).

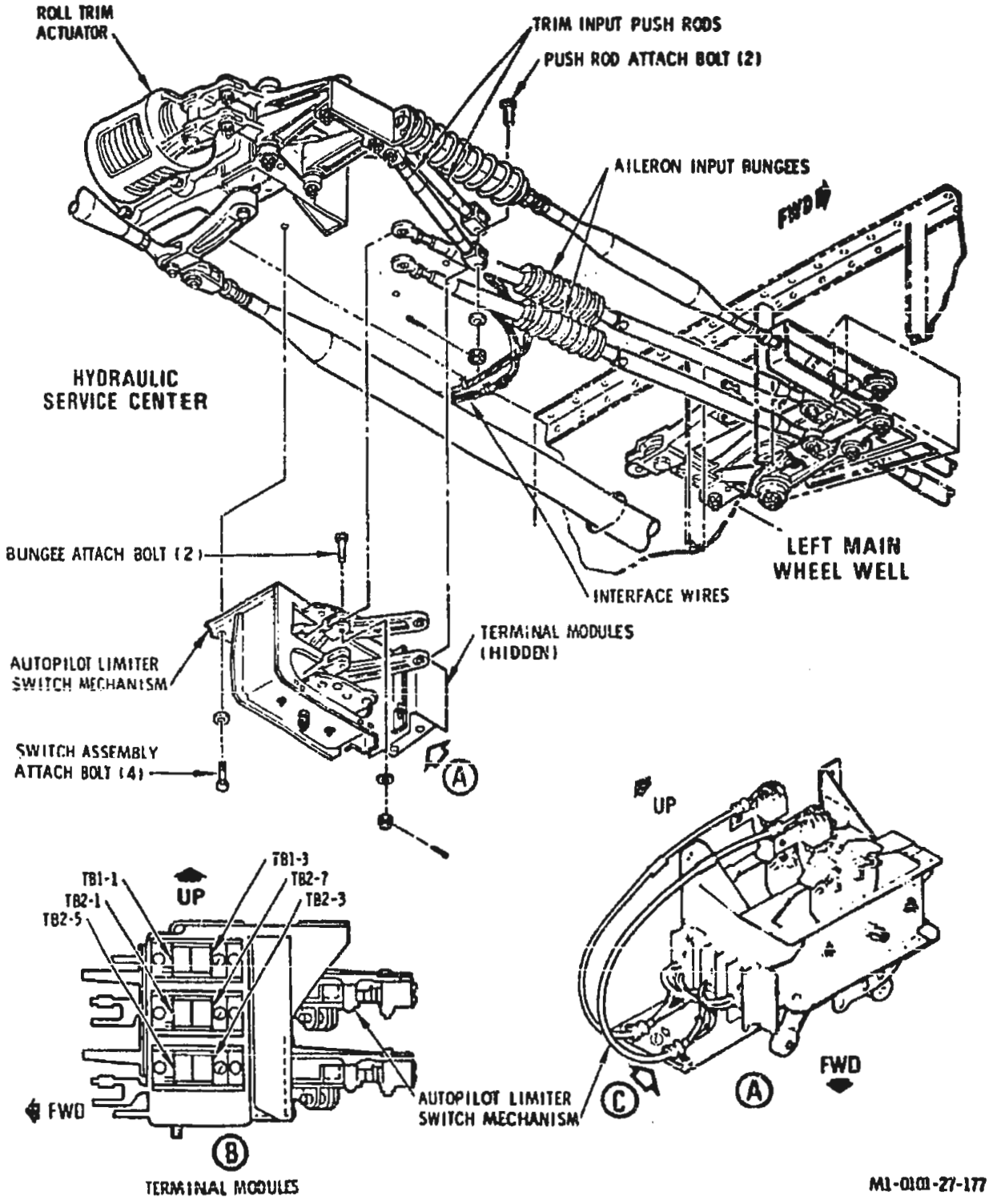
R (e) Using a multimeter, verify normally open switch circuits have now closed:

- On switch mechanism with terminal modules, there should be continuity between TB1-1 and TB2-7, and between TB2-7 and TB1-3 for the upper switch. There should be continuity between TB2-7 and 2B2-5, and TB2-7 and TB2-3 for the lower switch. Both switch circuits must close within 0.066 inch of rig pin location. If not, reposition cam BB by loosening locknut and adjusting cam position screw to meet above requirements. Tighten locknut after adjustment.

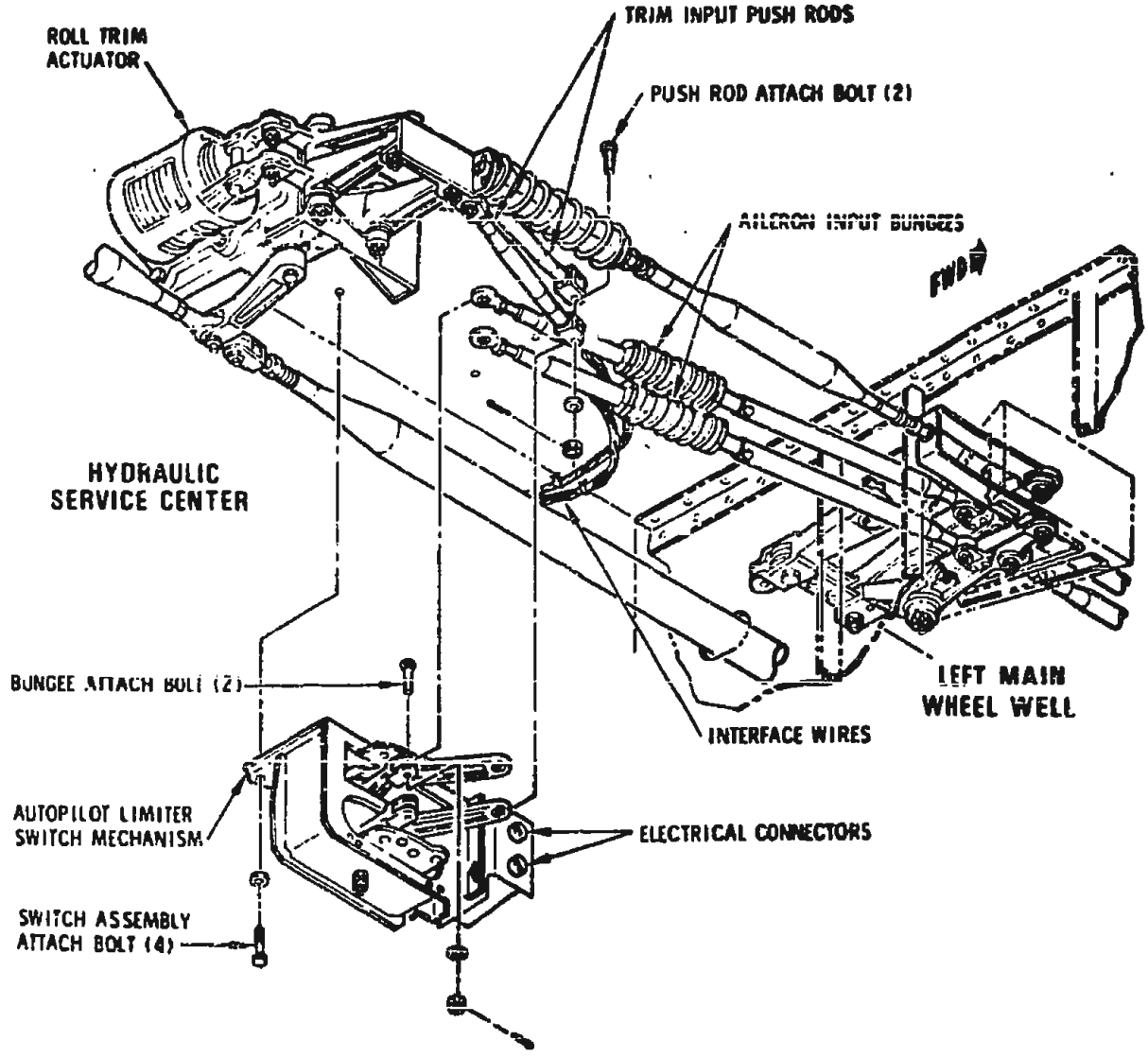
- On switch mechanism with electrical connector, there should be continuity between pins J23-3 and J23-4, and between pins J23-5 and J23-6 for the upper switch. There should be continuity between pins J22-3 and J22-4 and between J22-5 and J22-6 for the lower switch. Both switch circuits must close within 0.066 inch of rig pin position. If not, reposition cam BB by loosening locknut and adjusting cam position screw to meet above requirements. Tighten locknut after adjustment.

- Remove rig pin from bracket hole C and position both aileron input arms to allow insertion of rig pin in bracket hole A and both aileron input arms. Repeat Step (e) and if necessary adjust cam CC to meet Step (e) requirements.

(7) Reinstall limiter switch assembly in accordance with Paragraph B.

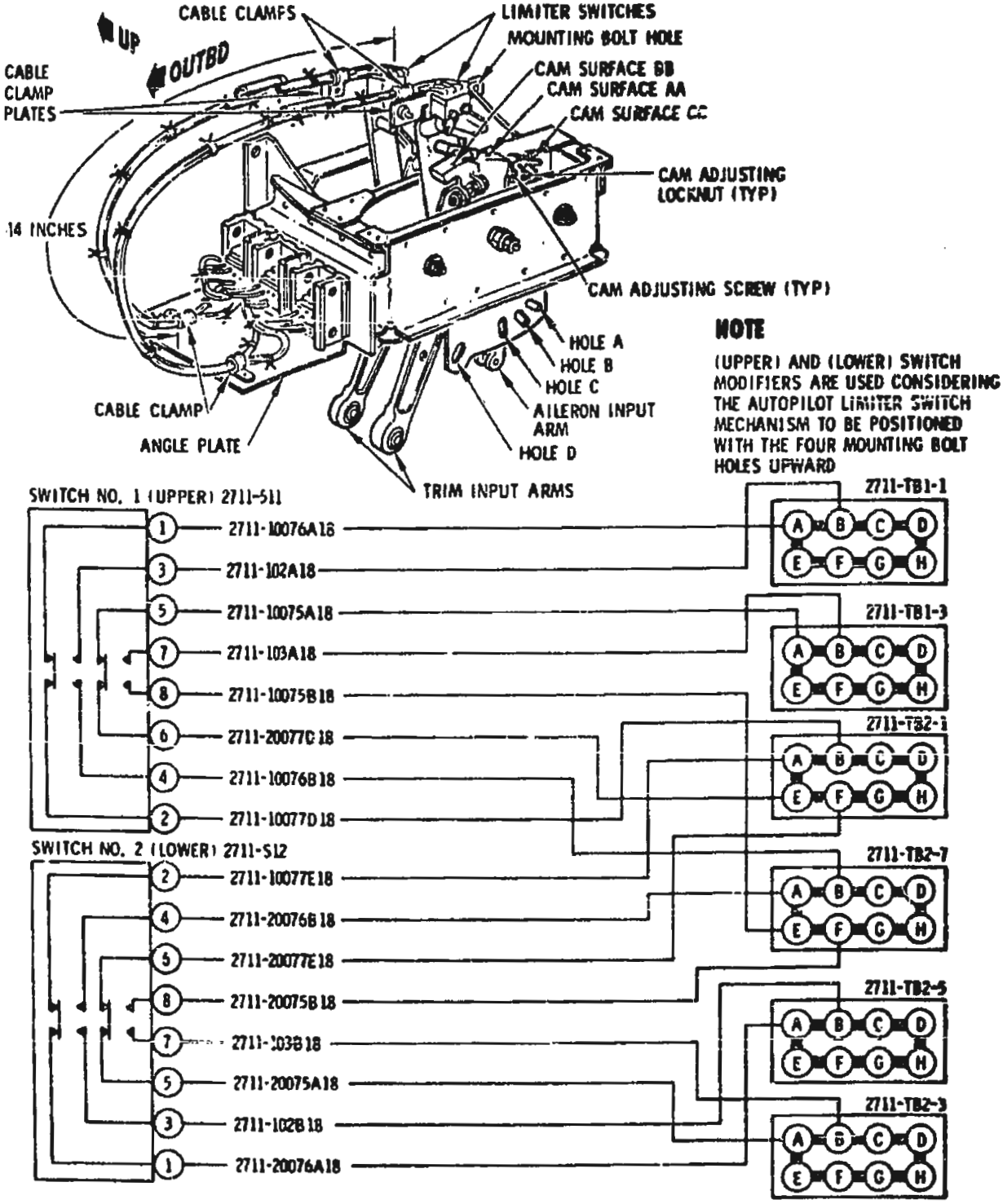


Aileron Autopilot Limiter Switch Mechanism
Removal and Installation
Figure 401

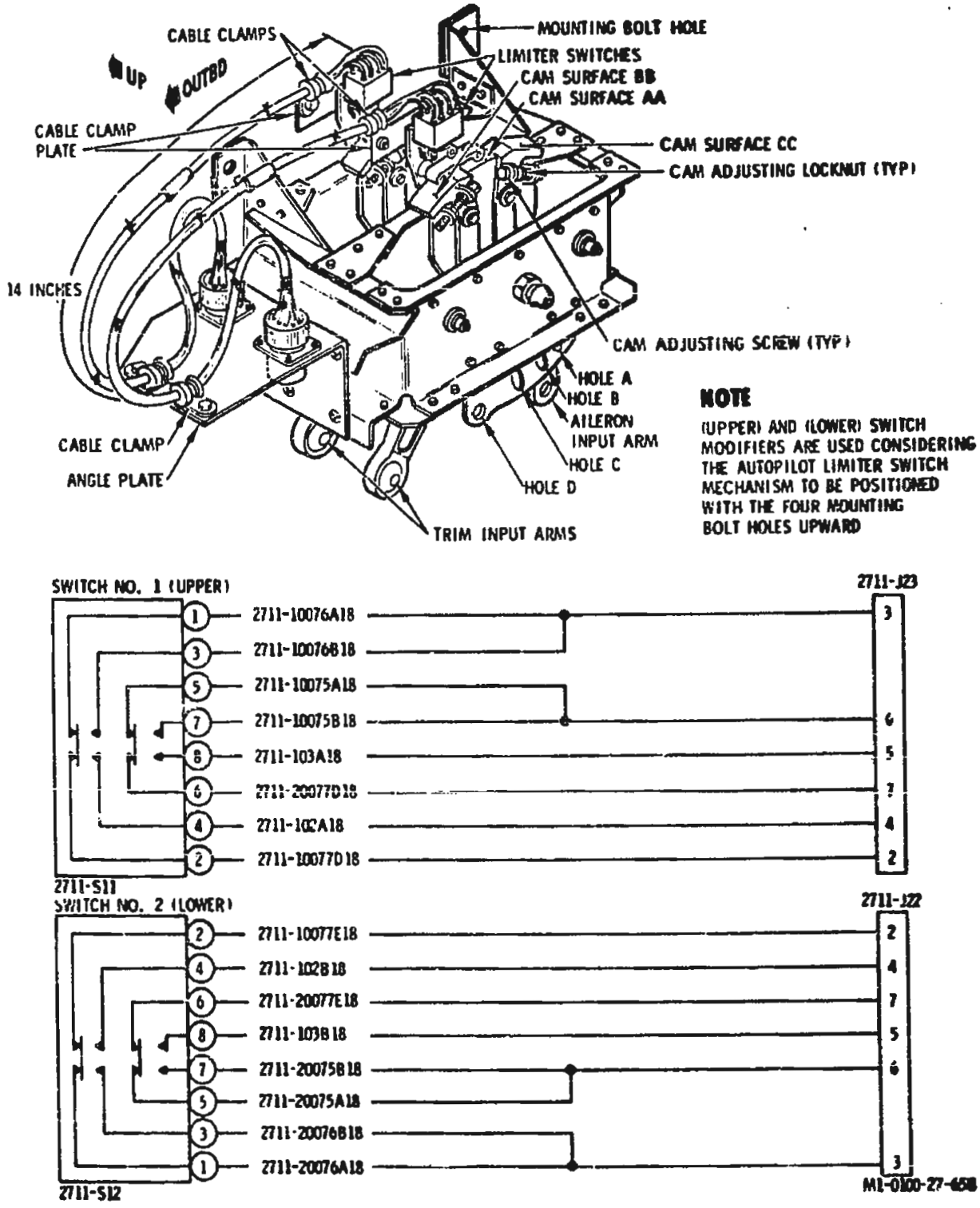


M3-0101-27-291

Aileron Autopilot Limiter Switch Mechanism
Removal and Installation
Figure 401



Aileron Autopilot Limiter Switch
Removal and Installation
Figure 402



Aileron Autopilot Limiter Switch Mechanism
Removal and Installation
Figure 402

AUTOPILOT LIMITER SWITCH MECHANISM - ADJUSTMENT AND TEST

1. Adjustment/Test

This section provides the procedures to perform an operational test (Ref. Para. 4), a functional test (Ref. Para. 5), and a rigging check and adjustment (Ref. Para. 6) of the autopilot limiter switch mechanism.

The autopilot limiter switch mechanism is located between and connected to the aileron trim actuator and the Captains aft cable bellcrank. The switch mechanism is accessible through the hydraulic service center. All tests and checks require two men: one in the flight station and one in the hydraulic service center.

2. Equipment and Materials

Rig Pins - 5/16-inch diameter by 2 inches long (R2), 3 inches long (R3), and 5 inches long (R5); 0.279-inch diameter by 5 inches long (R5A)

Aileron Support Tool - PN BF90, or equivalent

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	22-01-00	Autopilot Flight Director System
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Test

A. Autopilot Limiter Switch Mechanism

(1) Prepare autopilot flight director system for autopilot engagement (Ref. 22-01-00, Page 501).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open circuit breaker AVIONICS FLIGHT CONTROL SYSTEMS - NO. 2 SYSTEMS - PITCH & ROLL (A24). Verify NO. 1 SYSTEMS - PITCH & ROLL (A6) is closed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic system A and B (Ref. 29-11-00).

(4) Position roll trim control wheel to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of the alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on the decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(5) On APFDS ENGAGE panel, set autopilot engage switch A to CWS position. Verify that control wheels are approximately neutral.

CAUTION: ENSURE THAT THE CONTROL WHEELS ARE NOT MOVED THROUGHOUT OPERATIONAL TEST.

(6) At autopilot limiter switch mechanism, grasp lower input bungee arm at switch end and push arm outboard to compress bungee (Ref. Fig. 501). Verify that autopilot switch A drops to OFF as bungee is compressed. Release bungee compression.

(7) Set autopilot switch A to CWS.

(8) Push lower input bungee arm inboard to compress bungee. Verify that autopilot switch A drops to OFF. Release bungee compression.

(9) Set autopilot switch A to CWS.

(10) Push upper input bungee arm outboard to compress bungee. Verify that autopilot switch A drops to OFF. Release bungee compression.

(11) Set autopilot switch A to CWS.

(12) Push upper input bungee arm inboard to compress bungee. Verify that autopilot switch A drops to OFF. Release bungee compression.

(13) Close circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (CB1-A24).

R (14) Open circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (CB1-A6).

(15) On APFDS ENGAGE panel, set autopilot switch B to CWS.

(16) Repeat steps (6) through (12) for autopilot switch B.

(17) Close circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (CB1-A6).

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-41-00).

5. Functional Test

A. Autopilot Limiter Switch Mechanism

(1) Prepare autopilot flight director system for autopilot engagement (Ref. 22-01-00, Page 501).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open circuit breaker AVIONICS FLIGHT CONTROL SYSTEMS - NO. 2 SYSTEMS - PITCH & ROLL (A24). Verify circuit breaker NO. 1 SYSTEMS - PITCH & ROLL (A6) is closed.

(3) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic systems A and B (Ref. 29-11-00).

R NOTE: Inboard aileron neutral index mark is a red paint-filled dimple on flap torque box No. 3.
R Align aileron lower surface with index. (On
R aircraft without SB27-162, inboard aileron
R neutral is with aileron faired. On aircraft
R with SB27-162, inboard aileron neutral is with
R aileron 1.5 degrees up from faired.)

(5) Position roll trim wheel to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of the alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on the decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(6) Open access door 147AB to hydraulic service center.

(7) In hydraulic service center, verify following:

(a) Rig pin R5 fits freely through autopilot limiter switch bracket hole D (single rig pin hole) and dual trim input arms (6) (Ref. Fig. 501).

(b) Rig pin R5 fits freely through autopilot limiter switch bracket hole B and dual aileron input arms (8).

(c) If either (a) or (b) cannot be met, check rigging of autopilot limiter switch mechanism (Ref. Para. 6).

(d) Remove rig pins.

(8) On APFDS ENGAGE panel, zone 210, set autopilot engage switch A to CWS position. Switch must remain engaged. Check channel A as follows:

(a) In hydraulic service center, grasp lower input bungee (9) arm at switch assembly end and compress bungee until rig pin R5A fits freely through hole C and lower input arm (8). [If R5A rig pin (0.279-inch diameter) is not available, use a 1/4-inch diameter pin.] Autopilot engage switch A must disengage to OFF position. Remove rig pin and release bungee.

NOTE: The rig pin holes are 5/16-inch diameter. The 0.279-inch diameter rig pin (R5A) provides the switch actuation tolerance.

Limiter switch adjustment is a bench check. If switches do not function properly, replace limiter switch assembly.

(b) Reset autopilot engage switch A to CWS position. Switch must remain engaged.

(c) Compress lower bungee until rig pin R5A fits freely through hole A and lower input arm (8). Autopilot engage switch A must disengage to OFF position. Remove rig pin and release bungee.

(d) Reset autopilot engage switch A to CWS position. Switch must remain engaged.

(e) Grasp upper input bungee (9) arm and compress bungee until rig pin R5A fits freely through hole C arm and upper input arm (8). Autopilot engage switch A must disengage to OFF. Remove rig pin and release bungee (Ref. Fig. 501).

(f) Reset autopilot engage switch A to CWS position. Switch must remain engaged.

(g) Compress upper input bungee (9) arm until rig pin R5A fits freely through hole A and upper input arm (8). Autopilot engage switch A must disengage to OFF. Remove rig pin and release bungee.

(9) Open circuit breaker NO. 2 SYSTEMS - PITCH & ROLL (A6); close circuit breaker NO. 1 SYSTEMS - PITCH & ROLL (A24).

(10) Set autopilot engage switch B to CWS position. Switch must remain engaged.

(11) Repeat step (8) for autopilot engage switch B.

(12) Close circuit breaker NO. 2 SYSTEMS - PITCH & ROLL (A6).

(13) Turn off hydraulic power if no longer required (Ref. 29-11-00), or remove aileron support tool.

(14) Turn off electrical power if no longer required (Ref. 24-41-00).

(15) Close access door 147AB.

6. Rigging Check and Adjustment

A. Autopilot Limiter Switch Mechanism

(1) Open access door 147AB to hydraulic service center (Ref. 6-40-00).

(2) Shut off all four hydraulic systems (Ref. 29-11-00).

(3) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

(4) Manually position both inboard ailerons to faired (±0.060 inch) and install aileron support tool (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron neutral index is a red paint-filled dimple on flap torque box No. 3. Align aileron lower surface with index. (On aircraft without SB27-162, inboard aileron neutral is with aileron faired. On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.)

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R Maintenance Practices.

(5) In rear corner of left wheel well, install rig pin (R3) through bracket and bellcrank (4) or (5) to lock aileron control system in neutral.

(6) Position roll trim wheel to neutral aileron position.

NOTE: To position ROLL trim wheel to neutral aileron position (rig pin position), check decal on underside of the alternate landing gear control cover (on aft end of pedestal, next to floor). If decal calls out zero trim, position ROLL trim wheel to zero. If decal calls out any RWD trim, position ROLL trim wheel LWD to same number of marks specified on the decal (Ref. Roll Trim Bias, 27-11-00, Adjustment and Test, Para. 5 NOTE).

(7) In hydraulic service center, install rig pin R2 in bracket and the aileron trim output bellcrank (2) (Ref. Fig. 501).

(8) Verify that aileron position indicator pointer on idler bellcrank (3) is at the 0-index mark (aileron neutral).

(9) On autopilot limiter switch assembly, rig pin R4 must fit freely through bracket hole D (single rig hole) and dual trim input arms (6). If not, adjust pushrods (7).

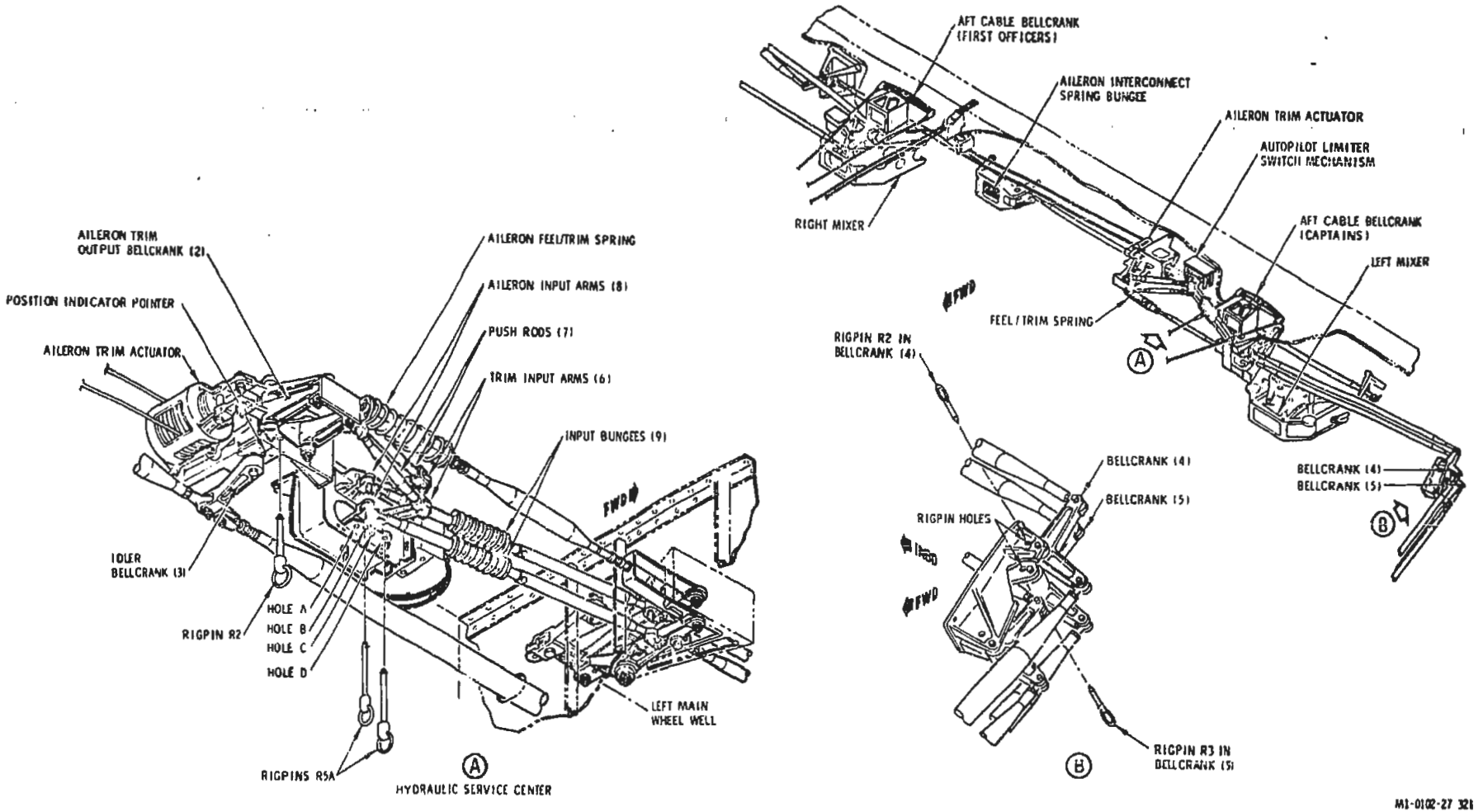
(10) On autopilot limiter switch assembly, rig pin R4 must fit freely through bracket hole B (center hole) and dual aileron input arms (8). If not, adjust length of dual input bungees (9).

(11) Remove all rig pins.

(12) Remove inboard aileron support tools and allow ailerons to droop.

(13) Remove warning tags from hydraulic control panels.

(14) Perform functional test (Ref. Para. 5).



Autopilot Limiter Switch Mechanism - Adjustment and Test
Figure 501 with aileron faired.

R EFFECTIVITY: ALL
R
001B

R ROLL DISCONNECT HANDLE LIGHT SWITCH - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Lock-wire, Fed Spec QQ-W-390, TEMP A, 0.020-inch diameter, or
R equivalent

R 2. Referenced Procedures

R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	25-11-01	Captains Seat Assembly - Removal and Installation
R	25-11-02	First Officers Seat Assembly - Removal and Installation
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Removal/Installation

R WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

R (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, Zone 215, verify that circuit breaker IND LT PILOTS (J2) is open and tagged.

R (2) Remove Captains and First Officers seats (Ref. 25-11-01 and 25-11-02).

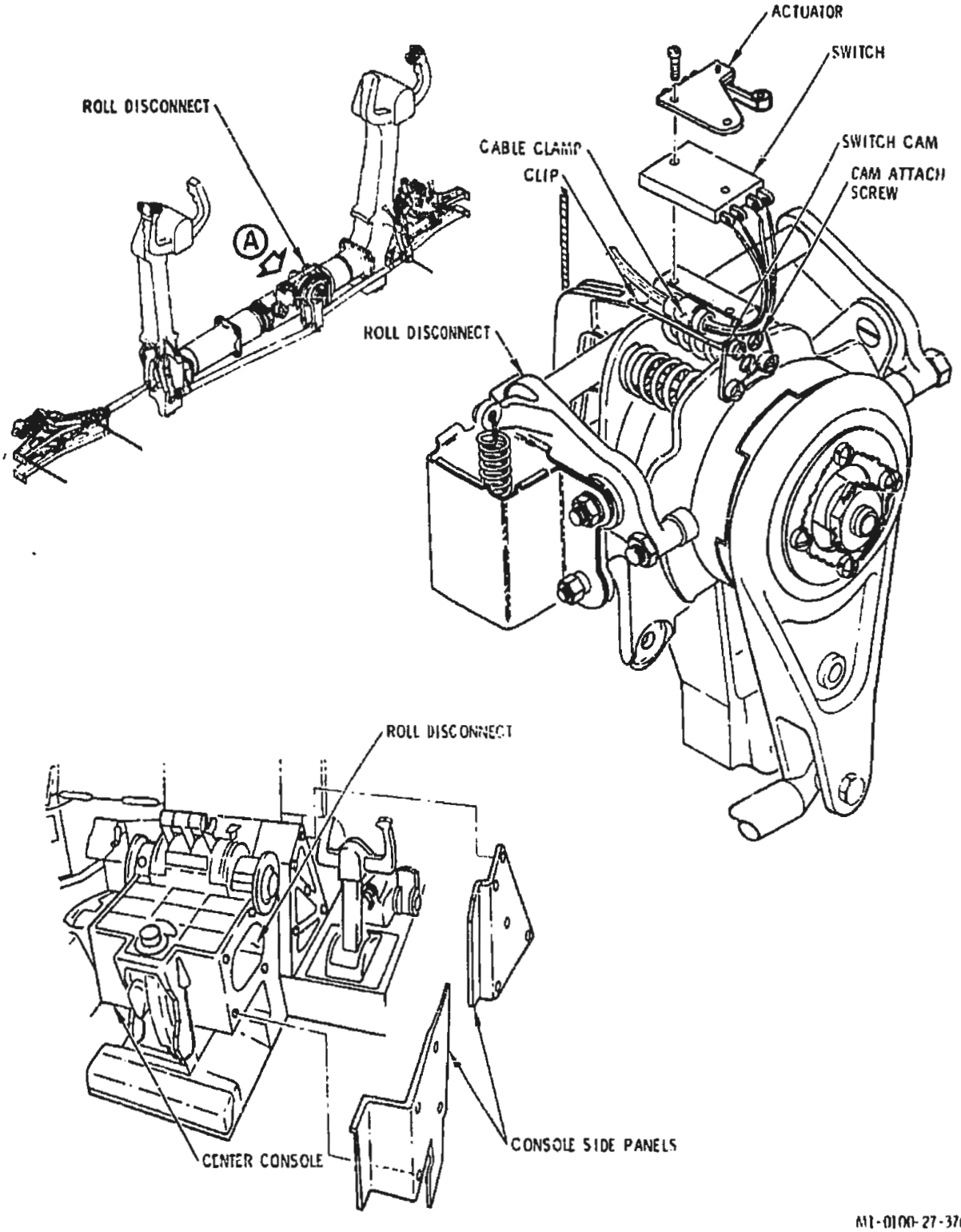
R (3) Remove the center console forward and aft trim panels on both sides of the console (Ref. Fig. 401).

R (4) Verify that ROLL DISC handle on console is not actuated (handle should be retracted against console).

R (5) Remove plastic cover over roll and pitch disconnect.

R NOTE: Two men, one working from each side of console, are required to replace switch.

R (6) Remove wire clamp holding switch wires to clip.



M1-0100-27-376

R Roll Disconnect Handle Switch - Removal and Installation
R Figure 401

(7) Tag for identification and disconnect switch wires.

R R NOTE: On aircraft 001-023, roll disconnect switch wires are routed to terminal module in forward electronic service center (FESC) at FS175, WL180, BL25R.

R R NOTE: On aircraft 024-999, roll disconnect switch wires are routed to terminal board mounted on console structure just forward and to the left of roll disconnect.

(8) Remove lock-wire and two screws holding switch actuator and switch to bracket. Remove switch.

B. Installation

(1) Install switch actuator and switch on mounting bracket with two screws. Lock-wire screws.

(2) Reconnect switch electrical wires to switch [Ref. Step A(7)].

(3) Install wire clamp to clip.

(4) Check switch adjustment as follows:

(a) With roll disconnect fully engaged (ROLL DISC handle retracted against console), measure clearance between end of one clutch tooth and bottom of opposite tooth (Ref. Fig. 401).

(b) Slowly pull up on ROLL DISC handle until clearance equals Step (a) plus 0.075 (±0.005) inch. At this point switch should just actuate. If not, loosen cam attach screws, adjust cam and retighten attach screws. Lock-wire screws.

NOTE: Cam holes are slotted to allow horizontal adjustment.

(5) Close circuit breaker IND LT PILOTS (CB2-J2).

(6) Turn on electrical power (Ref. 24-41-00).

(7) Pull up and lock ROLL DISC handle. Verify that handle lights come on.

(8) Release ROLL DISC handle and allow handle to retract against console. Verify that handle lights go out.

(9) Install pitch and roll disconnect plastic cover.

(10) Cycle ROLL DISC handle and verify that roll disconnect cable clears plastic cover.

(11) Verify that console area is clear of tools and equipment.

(12) Install console side panels.

(13) Install Captains and First Officers seats (Ref. 25-11-01 and 25-11-02).

(14) Turn off electrical power if not needed (Ref. 24-41-00).

CR BEARING HOUSING INSTALLATION - AFT AILERON BELLCRANKS
CR INSPECTION/CHECK

CR 1. General

CR A. Late production parts have locating pins installed in the
CR support assys. and mating holes drilled in bearing housing.
CR Parts which do not have locating pins and holes are
CR susceptible to mislocating the upper and lower bearing
CR housing.

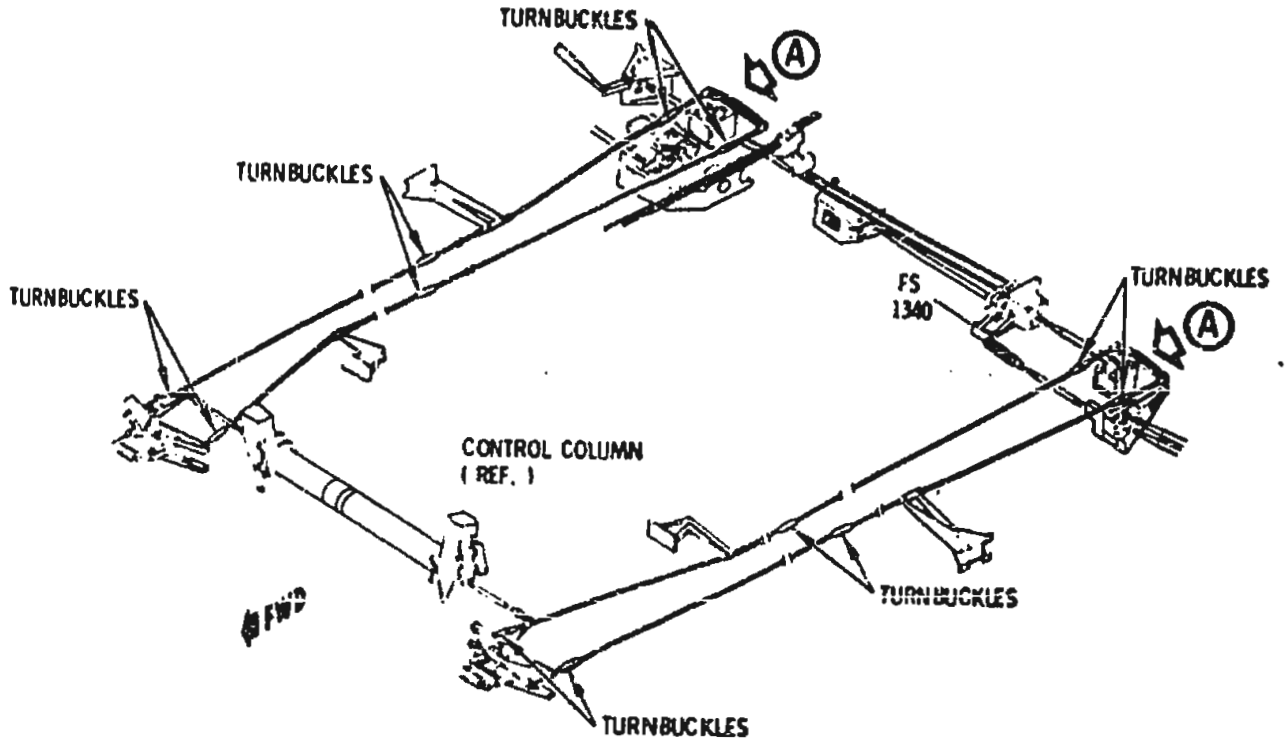
CR 2. Inspection/Check

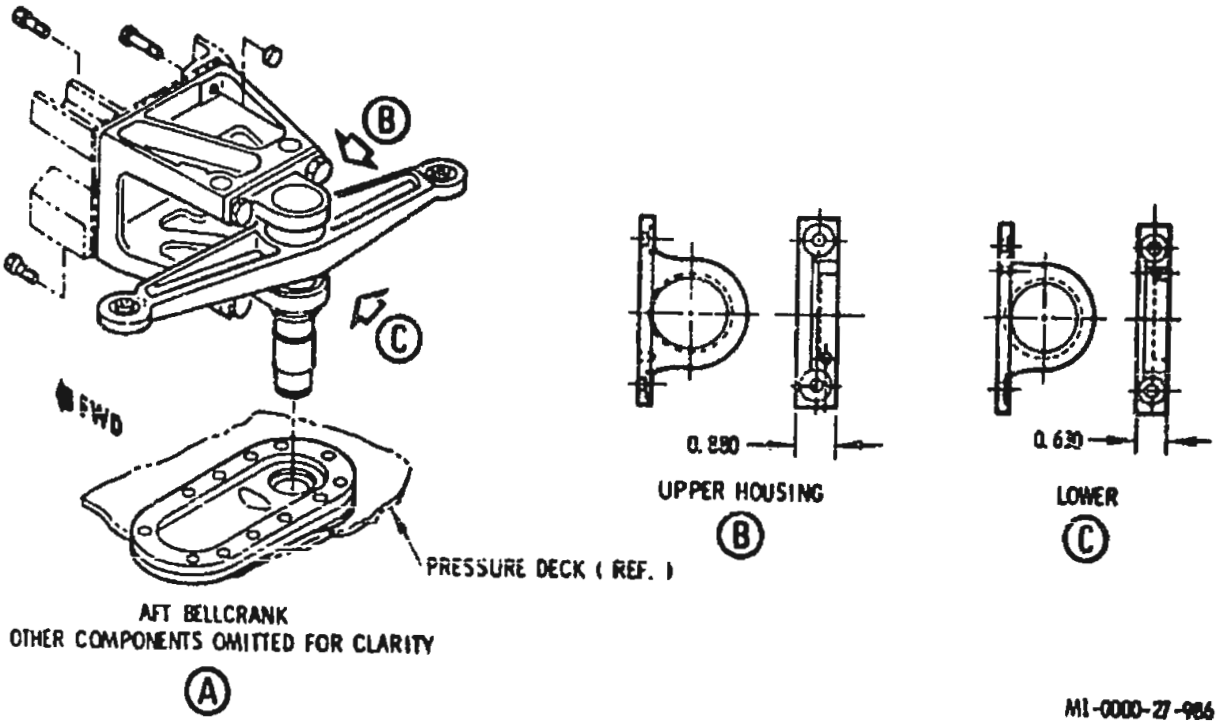
CR Refer to Fig. 601 and assure that:

CR A. The thick (.880) bearing housing is installed at the upper
CR location.

CR B. The thin (.630) bearing housing is installed at the lower
CR location.

CR C. The bearing housings are installed with the counterbores
CR facing to prevent migration of the bearing.





MI-0000-27-986

CR Bearing Housing Installation - Aft Aileron Bellcranks
CR Inspection and Check
CR Figure 601

R # AILERON SERVO STATIC CAVITY RELIEF VALVE

R 1. General

R On left inboard aileron servo, some outflow from static cavity
R relief valves under specific conditions is normal. Operation of
R servo with one hydraulic system deactivated allows coupler
R piston in servo to be displaced. Pressurization of deactivated
R system or activation of all systems after complete shutdown of
R servo drives coupler piston and forces excess hydraulic fluid
R out pressure relief valve. Maximum flow caused by this
R condition is approximately 7.0 cc.

R 2. Equipment and Materials

R Fluid Container, 1 quart or larger

R O-ring PN. 31-914-906, or equivalent

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter or
R equivalent

R 3. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	27-11-00	Aileron Control System - Adjustment and Test
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 4. Removal and Installation

R A. Removal of Left Inboard Aileron Servo Static Cavity Relief
R Valve

R WARNING: ENSURE HYDRAULIC SYSTEMS A, B, AND C ARE OFF (REF.
R 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL AND HYDRAULIC SERVICE
R CENTER HYDRAULIC SERVICING PANEL.

R (1) In hydraulic service center, depressurize hydraulic
R systems A, B, and C accumulators (Ref. 29-11-00).
R Verify zero pressure on hydraulic service panel.

R (2) Open access doors 551 AT and 551 BB on wing upper and
R lower surfaces (Ref. 6-40-00).

(3) Disconnect overboard drain line from static cavity relief valve (Ref. Fig. 401).

(4) Loosen static cavity relief valve to relieve any residual pressure.

NOTE: Step 4A(4) is a precautionary step, there should be no residual pressure.

(5) Position container to catch approximately 0.25 gallons of hydraulic fluid outflow.

(6) Remove static cavity relief valve.

R B. Installation of Left Inboard Aileron Servo Static Cavity Relief Valve

(1) Verify hydraulic systems A, B, and C are off, accumulators are depressurized and hydraulic control panels are tagged (Ref. 29-11-00).

(2) Install static cavity relief valve (Ref. Fig. 401). Torque 43 to 48 lb in. and install lock-wire.

(3) Attach overboard drain line to relief valve. Use new O-ring.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic systems A, B, and C.

(5) Remove screw from bleed port (Ref. Fig. 401).

CAUTION: RAPID CYCLING OF AILERONS CAN DAMAGE THE OUTBOARD AILERON DAMPER SEALS. CYCLE AILERONS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(6) In flight station, cycle aileron control wheel until leakage from bleed port stabilizes.

R NOTE: Flow from bleed port should stabilize at
R approximately 1 drop per second.

R (7) Reinstall screw in bleed port. Torque 35 to 50 lb in.
R and install lock-wire.

R (8) Perform Left Inboard Aileron Servo Autopilot
R Operational Test (Ref. 27-11-00).

R (9) Perform applicable reservoir fill, air check and air
R bleed procedures in accordance with RESERVOIR SERVICE
R INSTRUCTIONS placard (Ref. 29-11-00).

R (10) Turn off hydraulic power (Ref. 29-11-00).

R (11) Close access panels opened in Step 4A(2).

R C. Removal of Right Inboard Aileron Servo Static Cavity Relief
R Valve

R WARNING: ENSURE HYDRAULIC SYSTEMS B, C, AND D ARE OFF (REF.
R 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL AND HYDRAULIC SERVICE
R CENTER HYDRAULIC SERVICING PANEL.

R (1) In hydraulic service center, depressurize hydraulic
R systems B, C, and D accumulators (Ref. 29-11-00).
R Verify zero pressure on hydraulic service panel.

R (2) Open access doors 651 AT and 651 BB on wing upper and
R lower surfaces (Ref. 6-40-00).

R (3) Disconnect overboard drain line from static cavity
R relief valve (Ref. Fig. 401).

R (4) Loosen static cavity relief valve to relieve any
R residual pressure.

R NOTE: Step 4C(4) is a precautionary step, there should
R be no residual pressure.

R (5) Position container to catch small amount of hydraulic
R fluid outflow.

R (6) Remove static cavity relief valve.

R D. Installation of Right Inboard Aileron Servo Static Cavity
R Relief Valve

R (1) Verify hydraulic systems B, C, and D are off,
R accumulators are depressurized and hydraulic control
R panels are tagged (Ref. 29-11-00).

R (2) Install static cavity relief vave (Ref. Fig. 401).
R Torque 43 to 48 lb in. and install lock-wire.

R (3) Attach overboard drain line to relief valve. Use new
R O-ring.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (4) Turn on hydraulic systems B, C, and D.

R (5) Remove screw from bleed port (Ref. Fig. 401).

R CAUTION: RAPID CYCLING OF AILERONS CAN DAMAGE THE OUTBOARD
R AILERON DAMPER SEALS. CYCLE AILERONS SLOWLY
R (MINIMUM 4 SECONDS STOP-TO-STOP).

R (6) In flight station, cycle aileron control wheel while
R observing fluid level in servo through bleed port.
R Fluid level will rise and fall with aileron movement.
R Continue cycling Ailerons until fluid level no longer
R falls at end of cycle.

R (7) Reinstall screw in bleed port. Torque 35 to 50 lb in.
R and install lock-wire.

R (8) Perform applicable reservoir fill, air check and air
R bleed procedures in accordance with RESERVOIR SERVICE
R INSTRUCTIONS placard (Ref. 29-11-00).

R (9) Turn off hydraulic power (Ref. 29-11-00).

R (10) Close access panels opened in Step 4C(2).

R E. Removal of Left Outboard Aleron Servo Static Cavity Relief
R Valve

R CAUTION: ENSURE HYDRAULIC SYSTEMS A AND B ARE OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

R (1) In hydraulic service center, depressurize hydraulic systems A and B accumulators (Ref. 29-11-00). Verify zero pressure on hydraulic service panel.

R (2) Open access door 571 CB on wing lower surface (Ref. 6-40-00).

R (3) Disconnect overboard drain line from static cavity relief valve (Ref. Fig. 402).

R (4) Loosen static cavity relief valve to relieve any residual pressure.

R NOTE: Step 4E(4) is a precautionary step, there should be no residual pressure.

R (5) Position container to catch small amount of hydraulic fluid outflow.

R (6) Remove static cavity relief valve (Ref. Fig. 402).

R F. Installation of Left Outboard Aileron Servo Static Cavity Relief Valve

R (1) Verify hydraulic systems A and B are off, accumulators are depressurized and hydraulic control panels are tagged (Ref. 29-11-00).

R (2) Install static cavity relief valve (Ref. Fig. 402). Torque 43 to 48 lb in. and install lock-wire.

R (3) Attach overboard drain line to relief valve. Use new O-ring.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUN EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) *Turn on hydraulic systems A and B*

CAUTION: RAPID CYCLING OF AILERONS CAN DAMAGE THE OUTBOARD AILERON DAMPER SEALS. CYCLE AILERONS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(5) In flight station, cycle ailerons approximately six cycles stop-to-stop.

(6) Perform applicable reservoir fill, air check and air bleed procedures in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 29-11-00).

(7) Turn off hydraulic power (Ref. 29-11-00).

(8) Close access panel opened in Step 4E(2).

R R G. Removal of Right Outboard Aileron Servo Static Cavity Relief Valve

WARNING: ENSURE HYDRAULIC SYSTEMS B AND D ARE OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYTEM PANEL AND HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

(1) In hydraulic service center, depressurize hydraulic systems B and D accumulators (Ref. 29-11-00). Verify zero pressure on hydraulic service panel.

(2) Open access door 671 CB on wing lower surface (Ref. 6-40-00). (3) Disconnect overboard drain line from static cavity relief valve (Ref. Fig. 402).

(4) Loosen static cavity relief valve to relieve any residual pressure.

NOTE: Step 4G(4) is a precautionary step, there should be no residual pressure.

(5) Position container to catch small amount of hydraulic fluid outflow.

(6) Remove static cavity relief valve.

H. Installation of Right Outboard Aileron Servo Static Cavity Relief Valve

(1) Verify hydraulic systems B and D are off, accumulators are depressurized and hydraulic control panels are tagged (Ref. 29-11-00).

(2) Install static cavity relief valve (Ref. Fig. 402). Torque 43 to 48 lb in. and install lock-wire.

(3) Attach overboard drain line to relief valve. Use new O-ring.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic systems B and D.

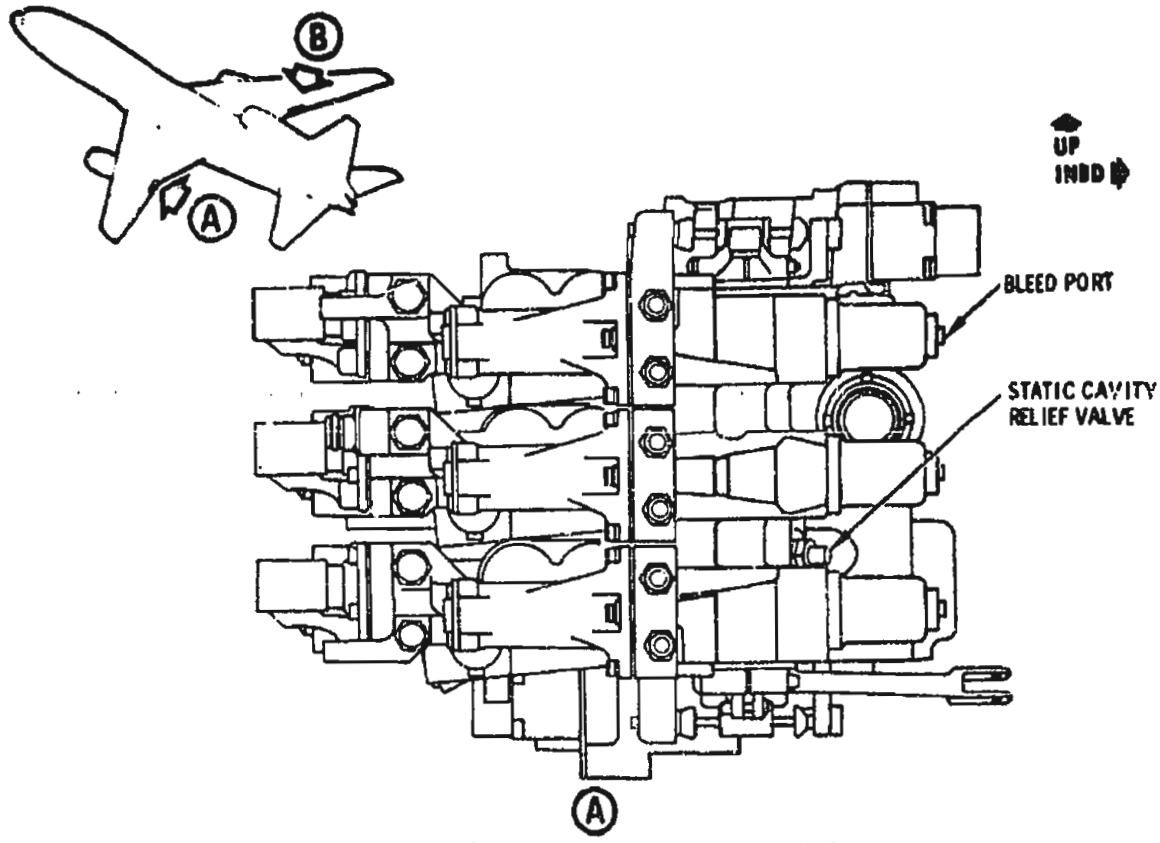
CAUTION: RAPID CYCLING OF AILERONS CAN DAMAGE THE OUTBOARD AILERON DAMPER SEALS. CYCLE AILERONS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(5) In flight station, cycle ailerons approximately six cycles stop-to-stop.

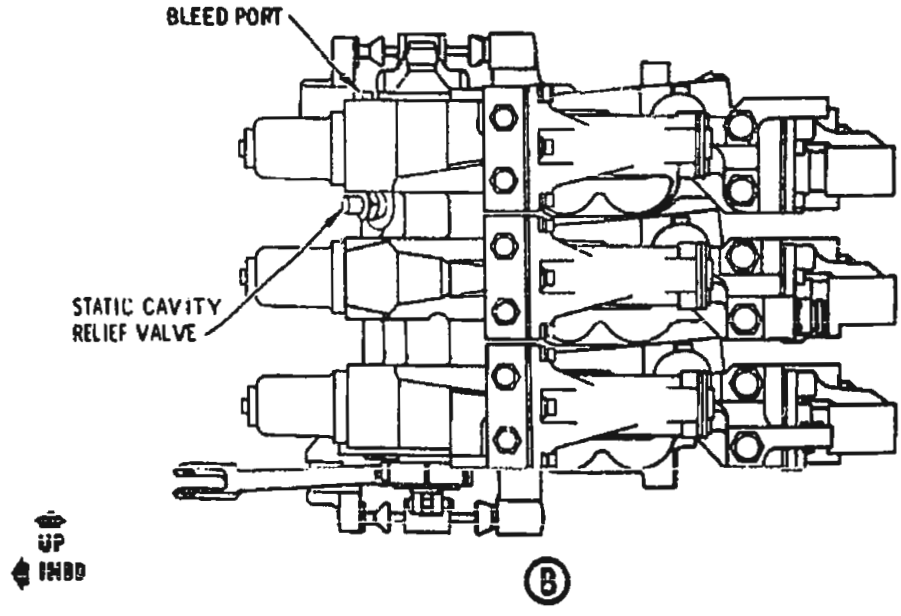
(6) Perform applicable reservoir fill, air check and air bleed procedures in accordance with RESERVOIR SERVICE INSTRUCTIONS placard (Ref. 29-11-00).

(7) Turn off hydraulic power (Ref. 29-11-00).

(8) Close access doors opened in Step 4G(2).



LEFT INBOARD SERVO - LOOKING FORWARD

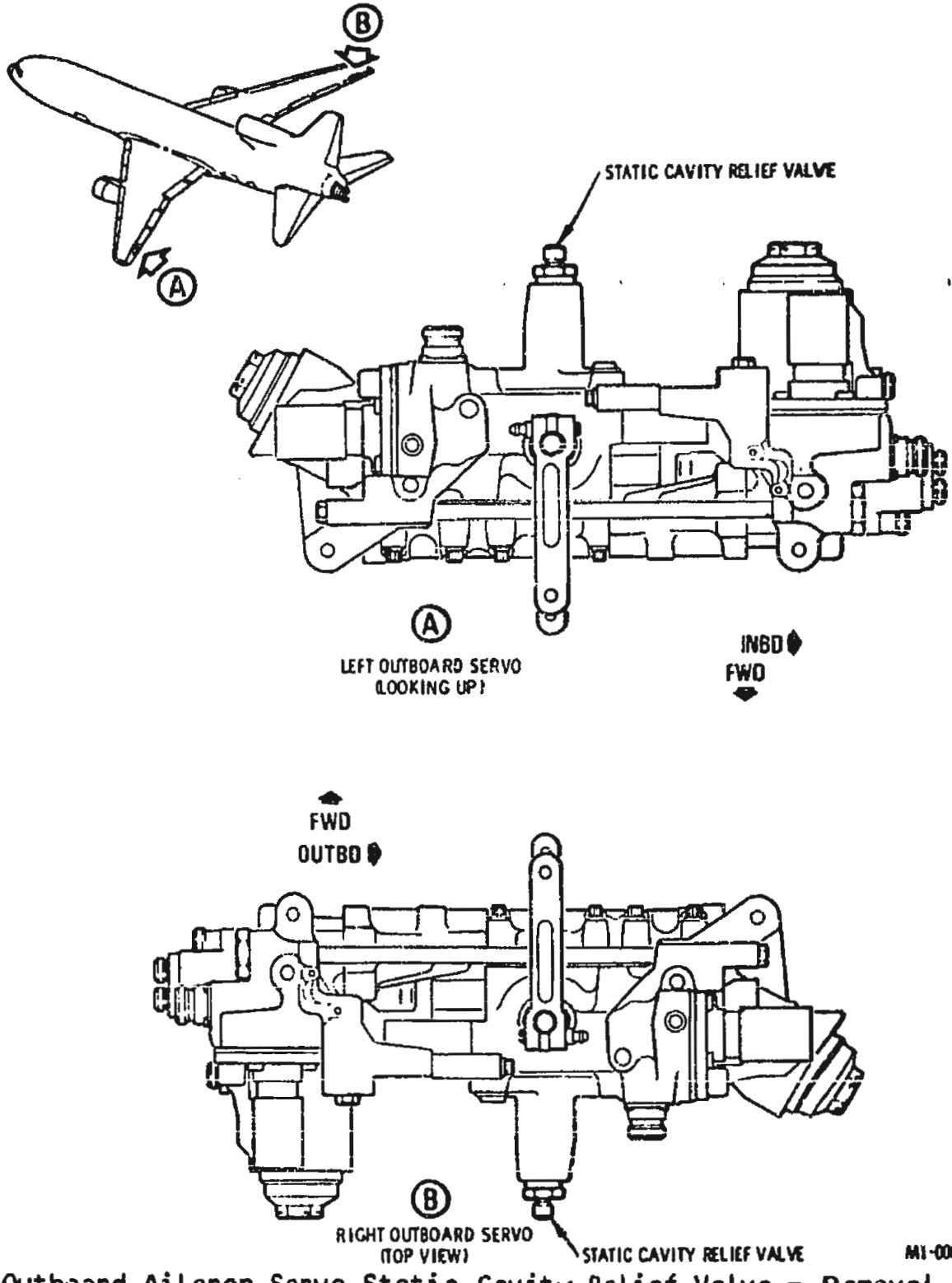


RIGHT INBOARD SERVO - LOOKING FORWARD

M1-0000-27-1005

R Inboard Aileron Servo Static Cavity Relief Valve - Removal and
R Installation
R figure 401

R EFFECTIVITY: ALL



R Outboard Aileron Servo Static Cavity Relief Valve - Removal and
R Installation
R Figure 402

R EFFECTIVITY: ALL

001B

AILERON TRIM CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

The aileron trim control system allows the pilot to introduce small manual inputs into the aileron control system and trim the roll axis (Ref. Fig. 1). Trim inputs are applied to the Captains aileron control path, which produces a position command to the left inboard (master) servo.

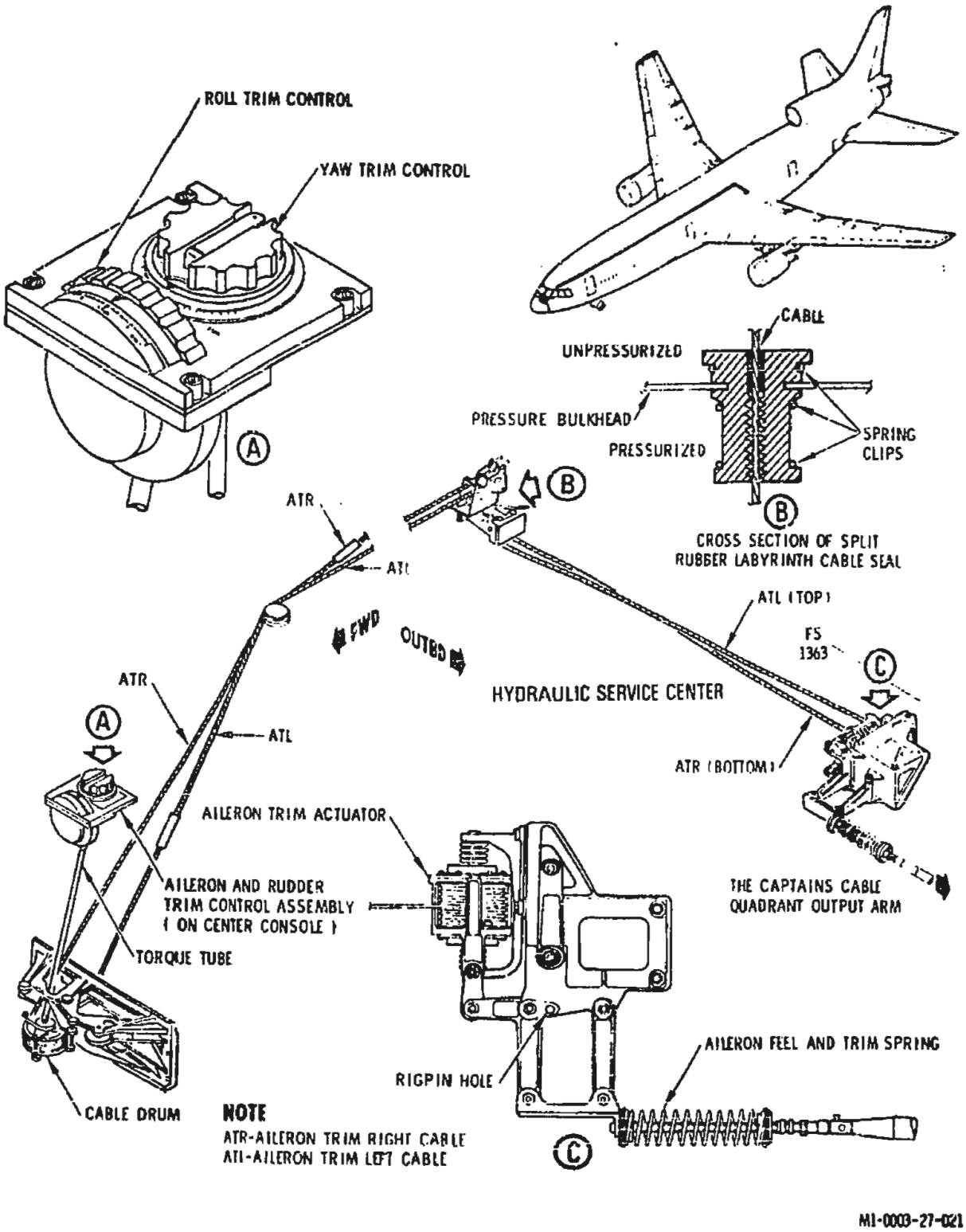
R Fixed stops in the roll trim control assembly normally limit
R roll trim to ±7 degrees (±10 marks). However, a fairlead roller
R stop (in the forward cargo compartment) may be contacted by the
R trim cable turnbarrel on those aircraft requiring a RWD trim
R bias (Ref. SB 11-028). RWD trim will be reduced by the amount
R of trim bias in excess of 1.4 marks. For instance, a trim bias
R of 2.0 marks RWD will limit RWD trim to approximately 9.4 marks
R instead of 10.

2. Operation

Aileron trim is accomplished by rotating a roll trim control wheel on the aileron and rudder trim control assembly mounted on the rear of the center console, zone 210. A torque tube, with two universal couplings, transmits the output of the trim control assembly to a cable drum located beneath the cockpit floor.

From the cable drum, two 3-32 inch diameter cables run beneath the cabin floor to the mechanical trim actuator mounted to the ceiling of the hydraulic service center, near the rear bulkhead, zone 147. A split rubber labyrinth pressure seal is used where the cables go through the ceiling pressure deck. The output of the trim jackscrew actuator is applied through a trim and feel spring bungee to the Captains aileron control system. The trim and feel spring force, shifts the neutral force position of the trim and feel spring and applies a manual input into the left inboard (master) servo. Consequently, trim inputs results in the aileron control system positioning the ailerons to the new neutral force position.

Since the right inboard aileron servo is slaved to the left inboard aileron, and the outboard aileron servos are slaved to their respective inboard aileron, an input into the Captains aileron control path would cause all four ailerons to respond. With maximum trim applied the pilots control wheels would be rotated 30 degrees from neutral.



M1-0003-27-021

R R Aileron Trim Control System
Figure 1

3. Aileron and Rudder Trim Control Assembly

A. Description and Operation

The aileron and rudder trim control mechanisms are housed in a single assembly (Ref. Fig. 2). The roll control mechanism is in the forward section of the housing. Roll trim is applied by a notched trim control wheel that is mounted horizontally, with the wheel protruding approximately one inch above the control housing. A drum, containing an indicator pointer, is driven by the control wheel through a gear reduction to indicate degrees of trim on an adjacent
R fixed scale. The scale indicates roll trim from 10 marks (7
R degrees) left to 10 marks (7 degrees) right. (Each mark
R represents 0.7 degree of roll trim.)

A 90-degree bevel-gear mechanism transmits the horizontal trim control wheel rotation to a vertical output shaft that extends from the bottom of the control assembly. The output shaft is splined and coupled to a vertical torque tube that contains two universal couplings. The lower end of the torque tube is also splined and engages the cable drum shaft mating spline. Normal rim force required to operate the 5-inch trim control wheel is 2.5 pounds. Full trim from 7 degrees left to 7 degrees right requires 7 revolutions of the trim control wheel. Trim control wheel rotation is
R limited to plus or minus 10 marks by stops which are actuated by the indicator drum.

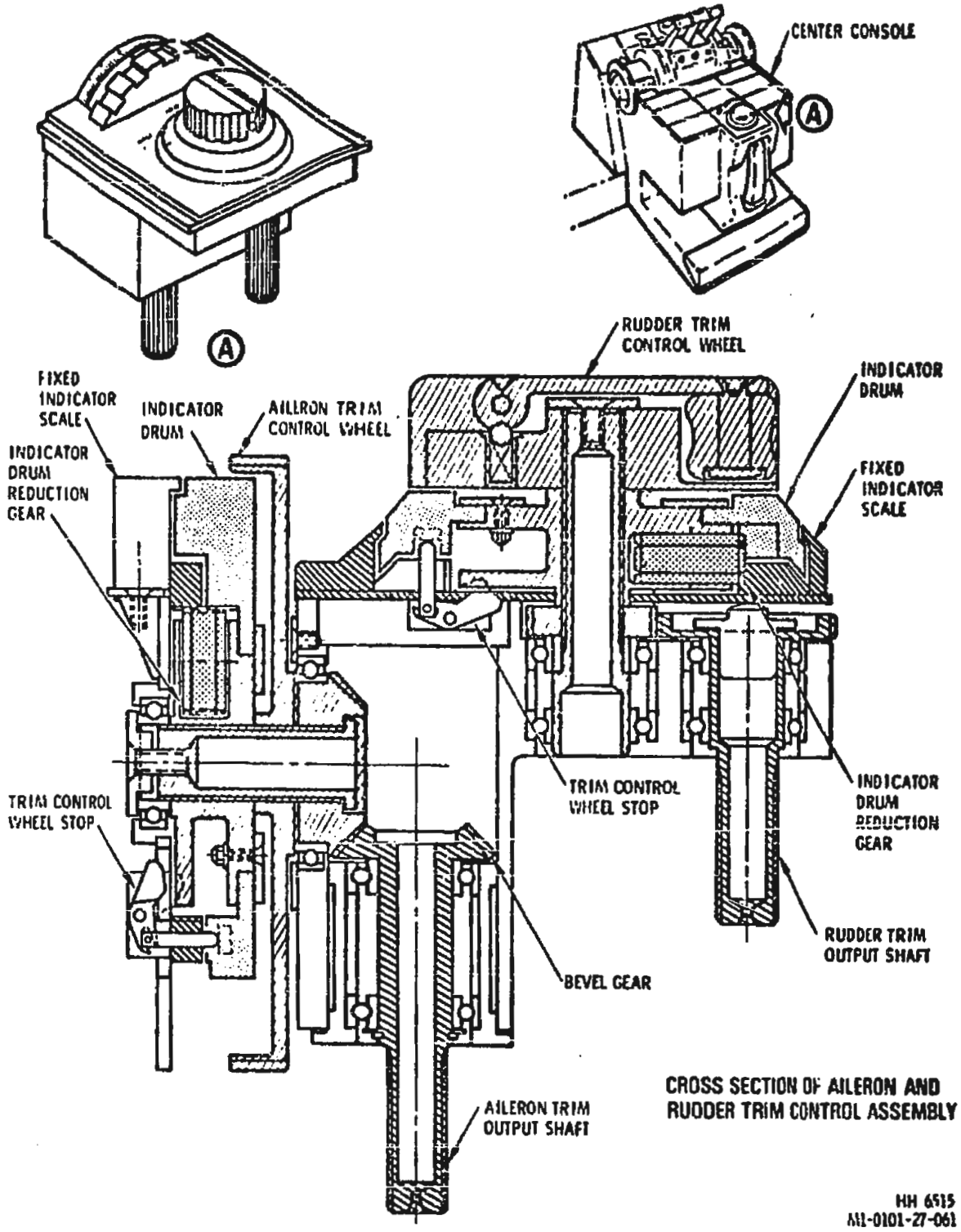
4. Aileron Trim Actuator

1. Description and Operation

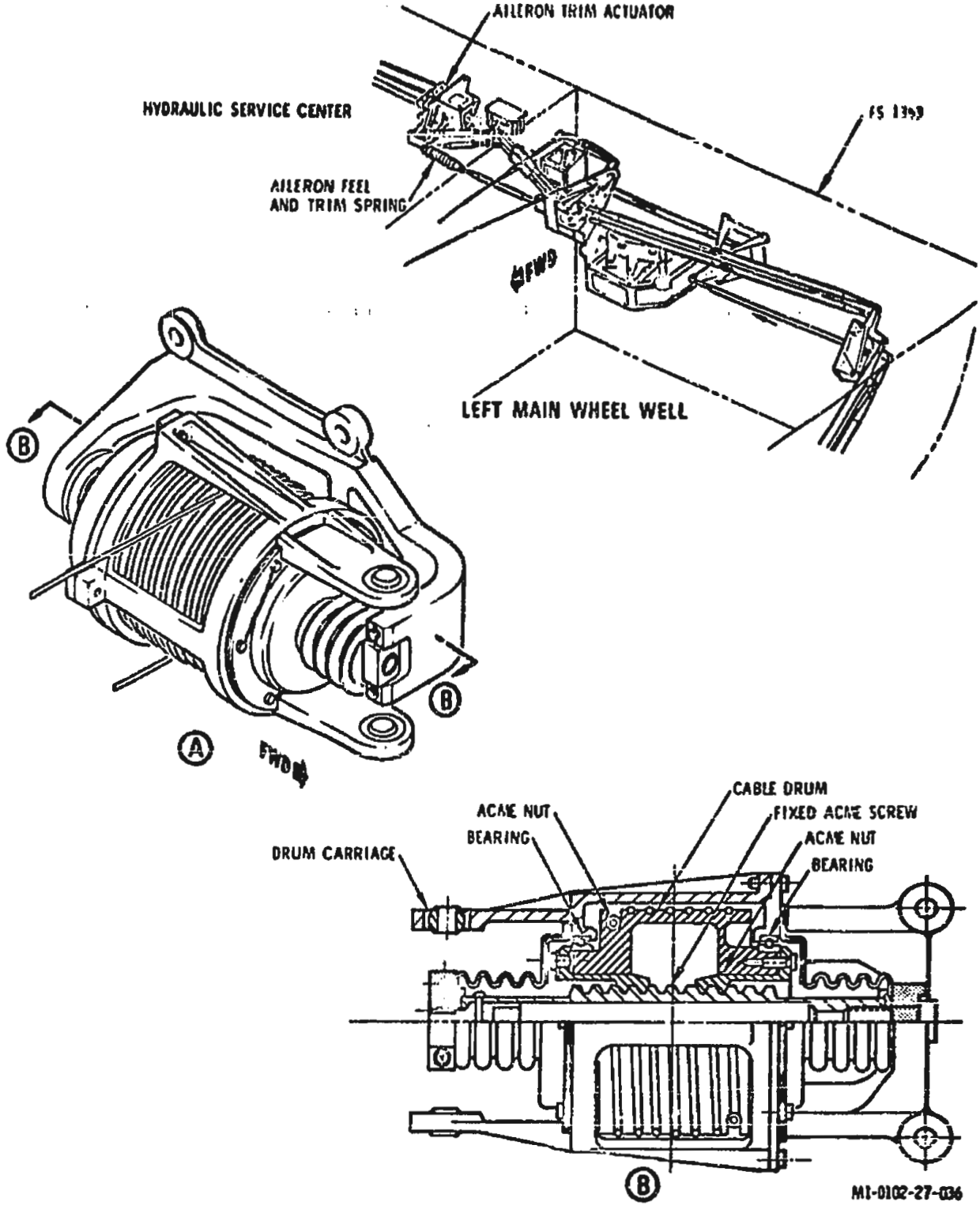
The mechanical aileron trim actuator converts the trim actuator cable drum rotational motion to lineal outputs. The trim actuator outputs are applied to the Captains aileron control system through the trim and feel spring bungee. The trim actuator consists of a cable drum running on an acme screw that drives two output arms (Ref. Fig. 3).

The manually driven cables enter the drum near the center and winds in spiral grooves, one in each direction to the drum ends where the cables are secured by clamps attached to the drum. Cable motion causes the drum to rotate and wind the cable on one end of the drum while it unwinds from the other.

An acme nut in the center of the drum translates rotary motion into linear motion. The nut and drum travel along a screw which is held fixed by the housing. The pitch of the screw and the pitch of the cable are the same, so the drum



Aileron and Rudder Trim Control Assembly
Figure 2



R
R

Aileron Trim Actuator
Figure 3

EFFECTIVITY: ALL

001B

moves at the same rate as the cable advances; thus, the plane through the cable remains fixed with respect to the mounting. The output motion of the drum is transmitted through bearings to the drum carriage. Attached to the carriage are the two output arms that contain self-aligning bearings. The drum strokes approximately one and three-quarter inches.

AILERON TRIM CONTROL - ADJUSTMENT AND TEST

1. Adjustment/Test

A. General

These procedures must be used to perform an operational test (Ref. Para. 4) and a rigging check and adjustment (Ref. Para. 5) of the aileron trim control system.

B. Trim Limits

The L-1011 flight control system is designed and adjusted to provide straight and level flight with the aileron trim indicator between plus and minus 2 marks. Reports of trim discrepancies in excess of these values require maintenance action to correct abnormal conditions.

R R (1) Aileron trim less than plus or minus 2 marks - These trim limits are normal and any aircraft with trim reports up to these amounts should not require any maintenance action other than a visual check of flight control surfaces for obvious damage.

R (2) Aileron trim more than plus or minus 2 marks - If these trim limits are exceeded, accomplish the following checks as soon as practicable:

(a) Check aileron trim rigging (Ref. Para. 5).

(b) Visually check spoilers for damage, floating or misrigging.

(c) Visually check flaps and slats for damage or misrigging, particularly for proper retract position.

(d) Visually check ailerons for damage or misrigging.

(e) Visually check external structure of the wings, horizontal and vertical stabilizer.

(f) Visually check fuselage external structure.

(g) Perform an operational check of the primary flight control system. Confirm that surfaces respond properly to control inputs.

NOTE: Surface throw checks are not required. Visually check operation of surface and the

R surface position indicator with respect to
R control inputs.

2. Equipment and Materials

Tensiometer, Pacific Scientific PN 1601009, or equivalent

5/16-inch-diameter rig pins, 2 and 3 inches long (part of B735 rig pin kit)

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Test

A. Aileron Trim Control System

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breaker SURF POS IND is closed.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the four AILERON SERVO circuit breakers are closed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on electrical power (Ref. 24-41-00).

(3) Turn on hydraulic systems A and B (Ref. 29-11-00).

(4) Operate ROLL trim control wheel from full left to full right three times. Verify that trim control system operates smoothly (no binding).

R (5) Position ROLL trim wheel to full left (No. 10).

R (a) To minimize the effect of friction hysteresis
R rotate control wheel full left and allow wheel to
R freely rotate back to trim position.

R (b) Verify that AIL pointers on surface position indicator show left aileron up 7 degrees and right aileron down 7 degrees.

R (6) Apply full right roll with aileron control wheel and release wheel. Verify that control wheels return to approximately trim position.

R (7) Position ROLL trim wheel to full right (No. 10).

R (a) To minimize the effect of friction hysteresis
R rotate control wheel full right and allow wheel to
R freely rotate back to trim position.

R (b) Verify that AIL pointers on surface position indicator show right aileron up 7 degrees and left aileron down 7 degrees.

NOTE: On those aircraft requiring RWD trim bias (Ref. 27-11-00 Adjustment/Test, Table 501), right roll will be reduced by RWD trim bias in excess of 1.4 marks. For instance, a RWD trim bias of 2.0 marks will limit right roll trim to approximately 9.4 marks instead of 10.0 (6.6 degrees instead of 7).

R (8) Apply full left roll with aileron control wheel and release wheel. Verify that control wheels return to approximately trim position.

(9) Position ROLL trim wheel to zero.

(10) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(11) Turn off electrical power if no longer required (Ref. 24-41-00).

5. Rigging Check and Adjustment

A. Aileron Trim Control System

(1) Open following access doors (Ref. 6-40-00):

(a) 112 AB to forward electronic service center.

(b) 147AB to hydraulic service center.

(2) Position ROLL trim wheel to neutral rig position (Ref. Roll Trim Bias Table 501, 27-11-00 Adjustment and Test). Rig pin R3 must fit freely through aileron trim cable drum (1) (Ref. Fig. 501) and bracket. If not, perform the following:

(a) Loosen screws holding aileron and rudder trim control to console, and raise trim control to disengage drive spline from shaft.

NOTE: Raising trim control will disengage both aileron and rudder shafts.

(b) Position aileron trim cable drum to allow installation of rig pin R3 through bracket and cable drum (1) (beneath flight station floor).

(c) Position rudder trim cable drum to allow installation of rig pin R3 through bracket and cable drum (2) (beneath flight station floor).

(d) Position YAW trim control wheel on trim control to zero.

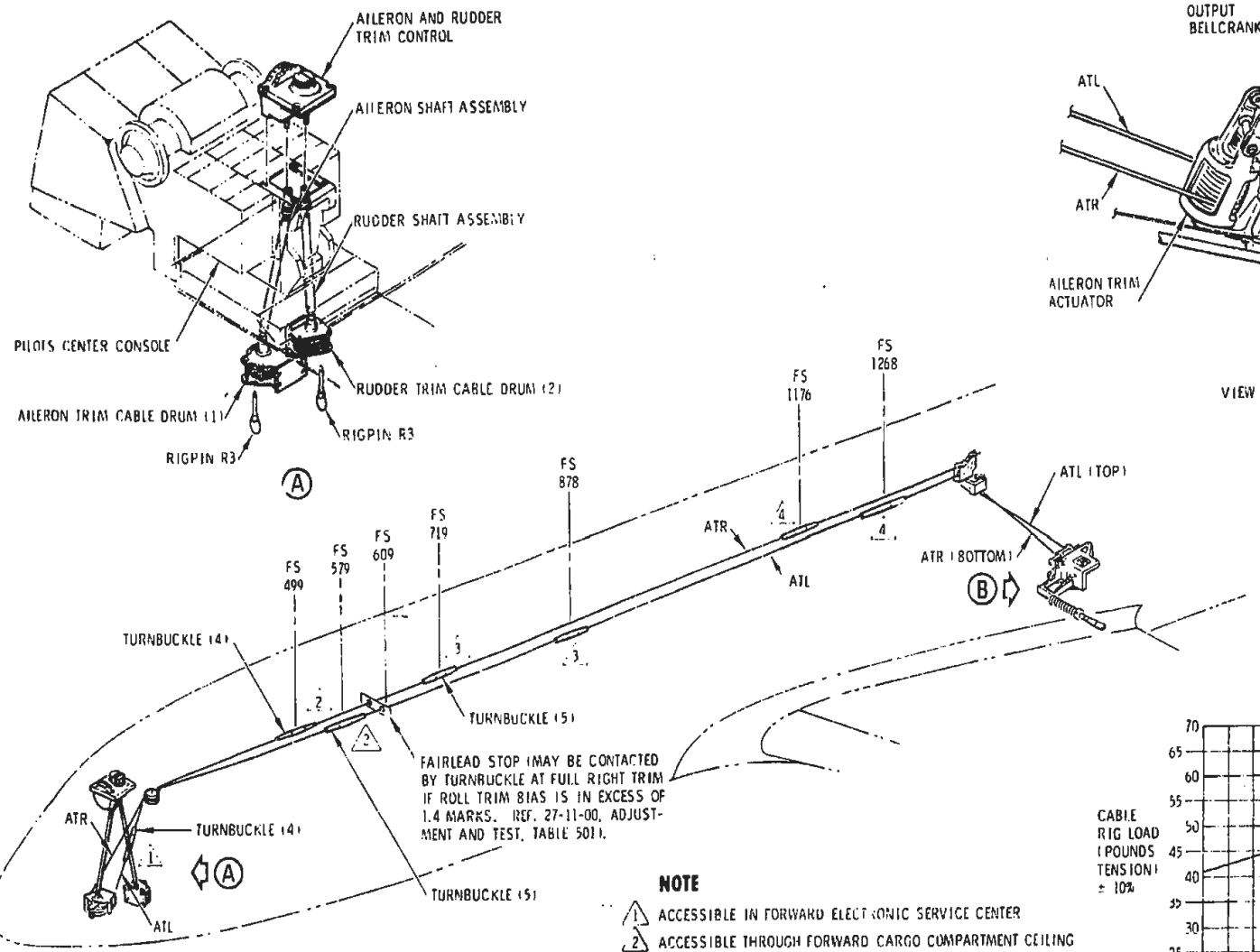
(e) Position ROLL trim control wheel on trim control to the neutral rig position (Ref. Roll Trim Bias Table 501).

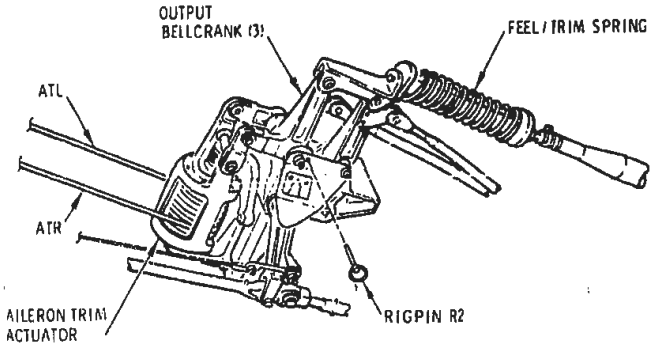
(f) Engage trim control roll and yaw output spline drives with aileron and rudder shaft splines. Tighten trim control attachment screws.

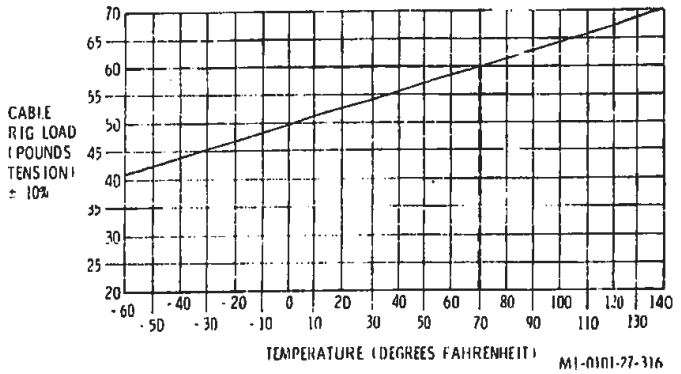
(g) Verify that yaw trim control wheel still read zero and that roll trim control wheel is at neutral rig position (Ref. Roll Trim Bias Table 501).

R (h) Remove rig pin from rudder trim cable drum.

(3) With rig pin R3 in aileron trim cable drum, rig pin R2 must fit freely through the aileron trim actuator output bellcrank (3) and bracket, and trim cable tension must conform to temperature compensation chart (Ref. Fig. 501). If not, adjust turnbuckles (4) and (5).







NOTE

1. ACCESSIBLE IN FORWARD ELECTRONIC SERVICE CENTER
2. ACCESSIBLE THROUGH FORWARD CARGO COMPARTMENT CEILING
3. ACCESSIBLE THROUGH GALLEY CEILING
4. ACCESSIBLE THROUGH PASSENGER COMPARTMENT FLOOR

ATL - AILERON TRIM LEFT

ATR - AILERON TRIM RIGHT

R Aileron Trim Control System - Rigging Check and Adjustment
R Figure 501

EFFECTIVITY: ALL

001B

NOTE: If a cable adjustment is made, remove all rig pins and operate roll trim wheel through three cycles to stabilize cables before making a final rigging check.

(4) Remove all rig pins.

(5) If a rigging adjustment is made, perform an operational test (Ref. Para. 4).

(6) Close access doors opened in Step 5A(1).

AILERON AND RUDDER TRIM CONTROL - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin (2 each), 5/16-inch diameter by 3 inches long (R3) (Part of Rig Pin Kit, PN B735)

2. Referenced Procedures

24-41-00	External Power/Ground Service Systems - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker AFT CONSOLE R (M4).

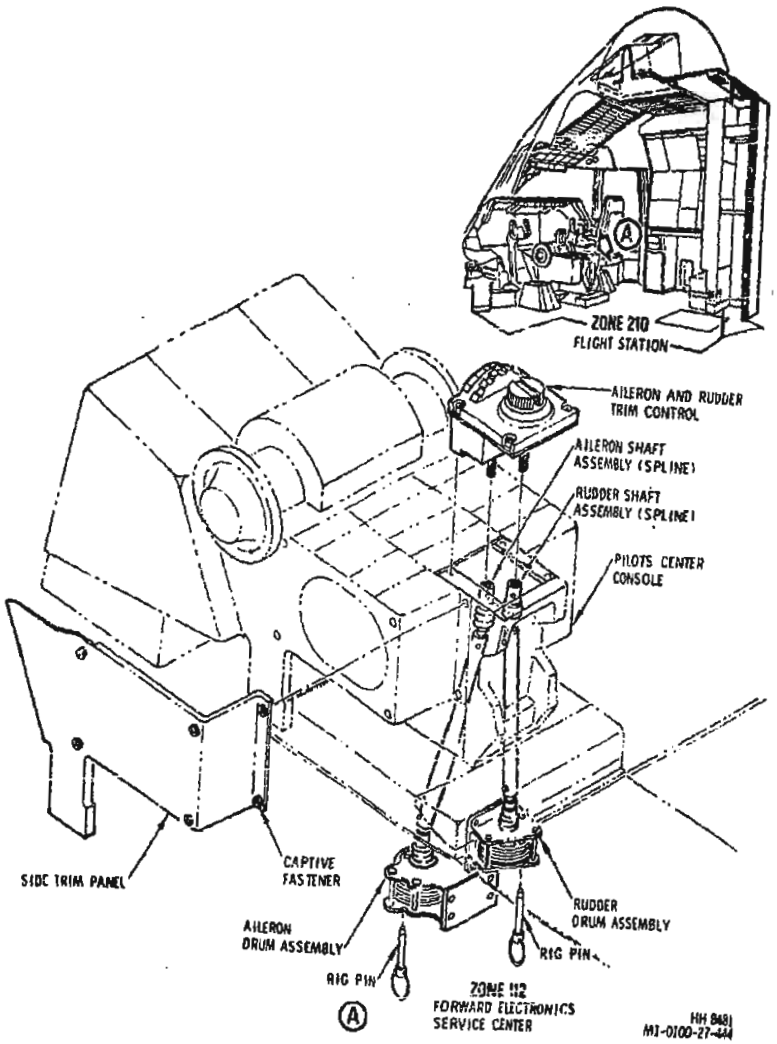
(2) Open forward electronics service center access door 112AB.

(3) On the pilots center console, zone 210, loosen attaching screws and remove aft upper side trim panel.

(4) Rotate ROLL trim control wheel to align rig pin holes on aileron trim cable drum (Ref. Fig. 401). (On aircraft with roll trim bias, the ROLL trim pointer will indicate some LWD trim.)

(5) From forward electronic service center, insert rig pin R3 into aileron trim cable drum.

R (6) On aircraft 001,
R rotate YAW trim control wheel to .5 mark NOSE L, to
R align rig pin holes on rudder trim cable drum.



Aileron and Rudder Trim Control - Removal and Installation
Figure 401

R NOTE: On aircraft 001,
R the adjustment of the YAW trim w
R biased to provide straight and l
R the YAW trim wheel at zero. A d
R the left underside of the altern
R control cover specifies .5 mark
R aircraft 001. It should be note
R .5 mark NOSE R bias specified, t
R wheel is set to .5 mark NOSE L w
R in the YAW cable drum. Removing
R positioning the YAW trim wheel t
R a NOSE R bias.

R (6) On aircraft 002-999,
R rotate YAW trim control wheel to 0 posi
rig pin holes on rudder trim cable drum

(7) From forward electronic service center,
R3 into rudder trim cable drum.

(8) Disconnect trim control electrical conn
just below forward end of trim control.

(9) Release fasteners attaching aileron and
control to pilots center console.

(10) Pull aileron and rudder trim control fr
console while disengaging trim control
from aileron and rudder trim shafts.

B. Installation

(1) Verify that circuit breaker opened in s
open and tagged.

(2) Rotate ROLL trim control wheel to 0.

NOTE: On aircraft with roll trim bias,
trim wheel to neutral rigging p
27-11-00, Adjustment and Test,

R (3) On aircraft 001,
R rotate YAW trim control wheel to .5 ma
R align rig pin holes on rudder trim cab

R (3) On aircraft 002-999,
R rotate YAW trim control wheel to 0.

(4) Install trim control on pilots center
splines with aileron and rudder shaft
console. Secure trim to console with

(5) Connect trim control electrical connector.

(6) On trim control, verify that ROLL trim control wheel is at neutral position indicated by Table 501 (Ref. 27-11-00, Adjustment and Test). Verify that YAW trim control wheel is at 0.

NOTE: For aircraft 001, verify that YAW trim control wheel is 1/2 mark NOSE L.

(7) Remove rig pins from rudder trim drum assembly and aileron trim drum assembly.

(8) Install aft upper side trim panel on the pilots center console.

(9) Remove tag and close circuit breaker opened in Step 3A(1).

(10) Remove placards from hydraulic control panels.

(11) Turn on electrical power (Ref. 24-41-00).

(12) Verify illumination of yaw and roll dials.

(13) Rotate YAW trim control wheel 10 left to 10 right and back to zero. Yaw trim control must operate smoothly throughout range without binding. While operating YAW trim wheel, visually verify from forward electronic service center that rudder trim cable drum rotates with trim wheel operation.

(14) Rotate ROLL trim control wheel 10 left to 10 right and back to zero. Roll trim control must operate smoothly throughout range without binding. Visually verify from forward electronic service center that aileron trim cable drum rotates with trim wheel operation.

NOTE: On those aircraft requiring RWD trim bias, right roll will be reduced by RWD trim bias in excess of 1.4 marks. For instance, a RWD trim bias of 2.0 marks will limit right roll trim to approximately 9.4 marks instead of 10.0.

(15) Turn off electrical power (Ref. 24-41-00).

(16) Close forward electronic service center access door.

AILERON TRIM ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032 inch diameter, or equivalent

Rig Pin Kit, Wing Controls, PN B735, or equivalent

2. Referenced Procedures

	6-50-00	Interior Access Doors and Panels
R	27-11-00	Aileron Control System - Adjustment and Test
R	27-12-00	Aileron Trim Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) Turn off all hydraulic power (Ref. 29-11-00).

(2) Tag Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147 (Ref. 29-11-00).

(3) Open access door 147BB to hydraulic service center.

(4) Operate roll trim control cables in hydraulic service center until feel/trim spring cartridge (connected to trim actuator) is in the caged (unloaded) position.

R (5) Disconnect the two trim actuator output arms from the
R two output links by removing the bottom connecting bolt
R and retainer and then the top connecting bolt (Ref. Fig. 401).

(6) Open access door 112AB to forward electronic service center to provide access to aileron trim forward cable drum.

(7) Open forward cargo compartment door (C1), and forward cargo compartment ceiling access panels 125DL and 125PL to expose trim cable turnbuckles (Ref. 6-50-00).

(8) Loosen turnbuckles in aileron trim right (ATR) and the aileron trim left (ATL) cables to remove cable tension.

(9) In hydraulic service center, remove the four aileron trim actuator attach bolts. Remove actuator from bracket.

(10) Tag and identify the trim cables in the hydraulic service center. (ATL is the cable wrapped over top of drum; ATR is cable wrapped around bottom of drum.)

(11) Pull either cable on actuator drum until cable is fully unwrapped.

(12) Remove unwrapped cable ball lockscrew. Slip ball from keyhole slot and remove cable.

(13) Pull on other cable until cable is fully unwrapped.

(14) Remove other cable ball lockscrew. Slip ball from keyhole slot and remove cable. Remove trim actuator.

B. Installation

(1) Verify that hydraulic power is turned off and hydraulic control panels tagged.

(2) In hydraulic service center, hold trim actuator in position to install with output arms facing forward.

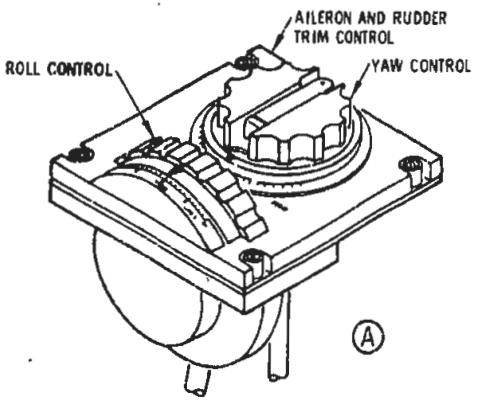
(3) Rotate cable drum until the keyhole slot on the forward end of the drum is positioned to approximately the 11 o'clock position (as viewed from the front, looking aft).

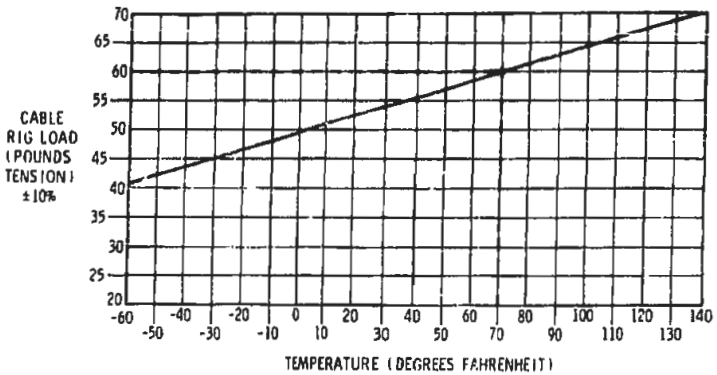
(4) Engage cable ball on ATL cable in keyhole slot. Install retaining screw.

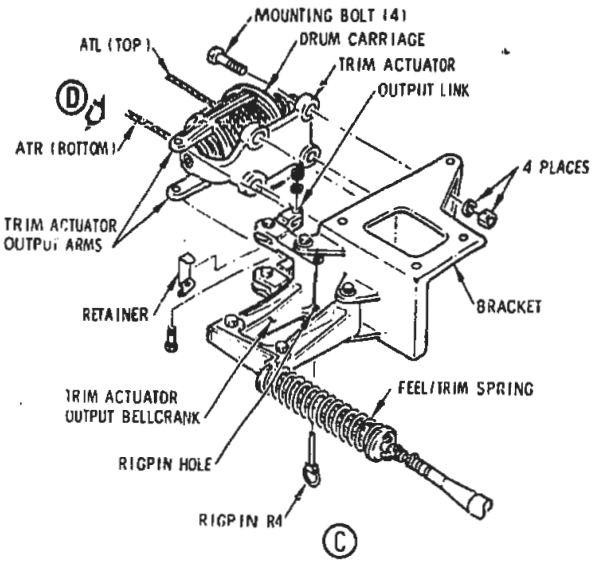
(5) Rotate cable drum clockwise (as viewed from front, looking aft) wrapping the ATL cable completely on the drum until the keyhole slot on the rear of the drum is positioned to approximately the 7 o'clock position.

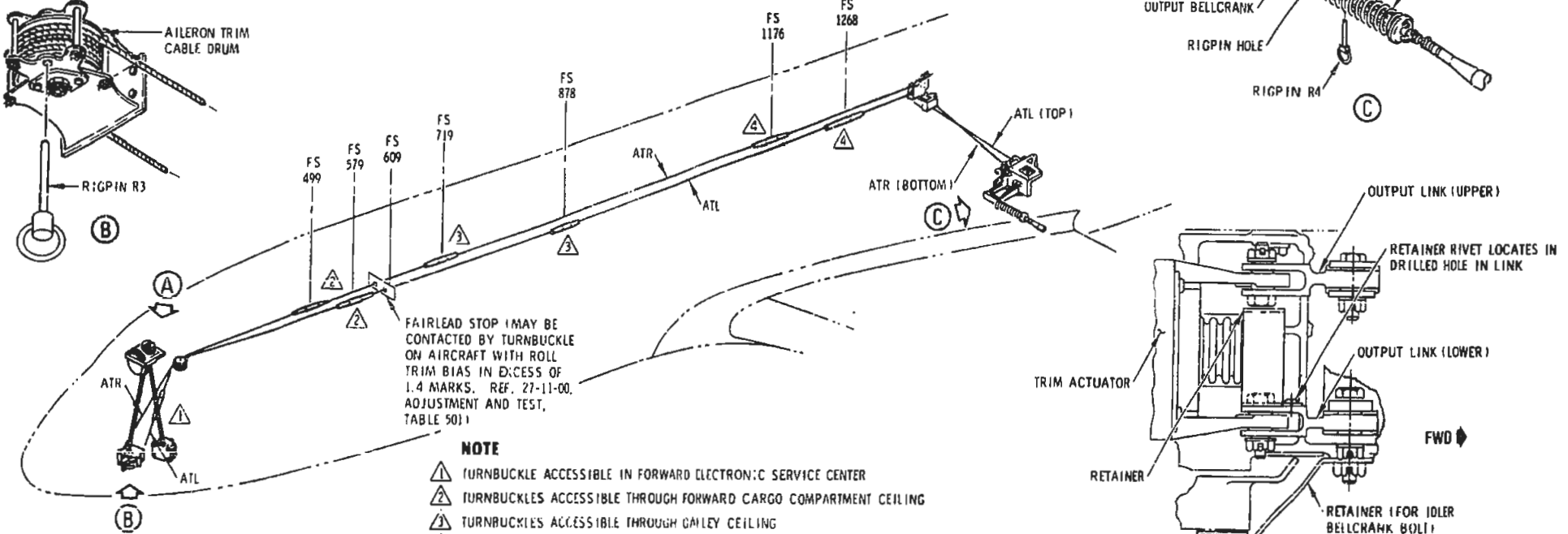
(6) Engage cable ball on ATR cable in keyhole slot. Install retaining screw.

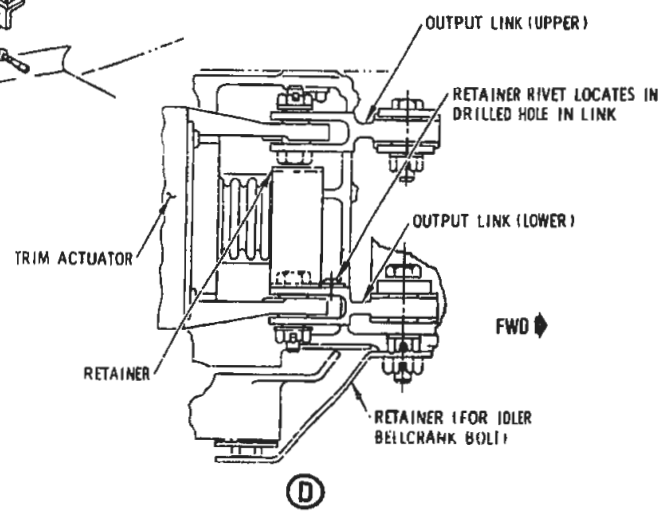
(7) Pull on ATL cable to wrap ATR cable on drum. Pull until both ATR and ATL cables between pulleys on hydraulic service center ceiling and actuator have approximately equal slack.











NOTE

1. TURNBUCKLE ACCESSIBLE IN FORWARD ELECTRONIC SERVICE CENTER
2. TURNBUCKLES ACCESSIBLE THROUGH FORWARD CARGO COMPARTMENT CEILING
3. TURNBUCKLES ACCESSIBLE THROUGH GALLEY CEILING
4. TURNBUCKLES ACCESSIBLE THROUGH PASSENGER COMPARTMENT FLOOR

ATL - AILERON TRIM LEFT
ATR - AILERON TRIM RIGHT

M1-0102-27-429

R Aileron Trim Actuator - Removal and Installation
R Figure 401

CAUTION: VERIFY THAT CABLES ARE NOT WRAPPED OVER DRUM CARRIAGE.

(8) Install trim actuator on mounting bracket by installing the four mounting bolts, washers, and nuts.

(9) Connect the two actuator output arms to the output links as follows (Ref. Fig. 401):

(a) Install the upper connecting bolt (with bolt head down), washer, nut, and cotter pin.

(b) Install reatiner, lower connecting bolt, washer, nut, and cotter pin. Lock-wire bolt to link.

(10) Insert 5/16-inch diameter by 3.0 inch-long rig pin (R3) in aileron trim cable drum and bracket, located beneath flight station floor. Roll trim control indicator
R should be at neutral aileron position.

R NOTE: To position ROLL trim wheel to neutral aileron
R position (rig pin position), check decal on
R underside of the alternate landing gear control
R cover (on aft end of pedestal, next to floor).
R If decal calls out zero trim, position ROLL trim
R wheel to zero. If decal calls out any RWD trim,
R position ROLL trim wheel LWD to same number of
R marks specified on the decal (Ref. Roll Trim
R Bias, 27-11-00, Adjustment and Test, Para. 5
R NOTE).

(11) Tighten turnbuckles in ATR cable (FS 499) and ATL cable (FS 579) until the following conditions are met:

(a) Cable tension conforms to temperature compensation chart in Fig. 401.

(b) Rig pin (R4) can be inserted freely through trim actuator output bellcrank and bracket.

(12) Remove both rig pins.

(13) Operate roll trim control wheel through several full left and right cycles. Verify that full roll trim is available (10 marks LWD to 10 marks RWD). While operating roll trim control, visually determine that trim actuator operates smoothly and that cables are properly seated in drum grooves.

NOTE: On aircraft requiring RWD roll trim bias (Ref. Table 501, 27-11-00), right wing trim is reduced by trim bias in excess of 1.4 marks by a trim

cable stop; for example: RWD trim bias of 2.0 marks will reduce RWD trim from 10.0 to 9.4 marks (7 to 6.58 degrees).

(14) Recheck cable rigging by performing Steps (10) and (11).

(15) Remove all rig pins.

(16) Perform Operational Test (Ref. 27-12-00).

(17) Close access doors and panel opened in Steps A(3), (6) and (7).

AILERON POSITION INDICATING SYSTEM - DESCRIPTION AND OPERATION

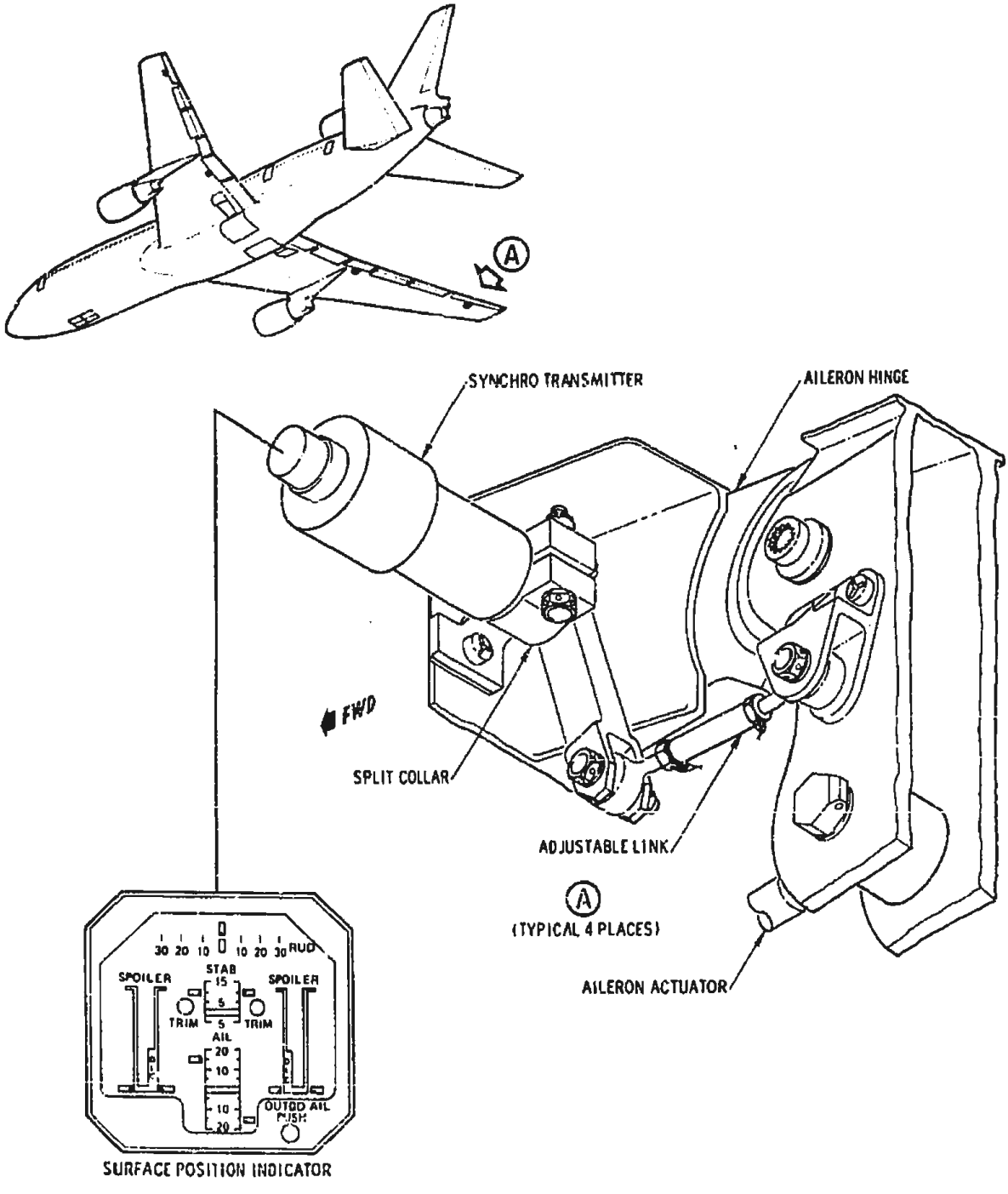
1. General

The aileron position indicating system consists of a synchro transmitter coupled to each aileron surface and a surface position indicator (Ref. 27-00-00) mounted on the pilots main instrument panel (Ref. Fig. 1 and 2).

The position indicator has a vertical scale and two pointers. The pointers show the position of the inboard ailerons. When the position indicator pushbutton switch marked OUTBD AIL PUSH is depressed, the pointers will show the position of the outboard ailerons. The indicator scale is marked from plus 20 degrees to minus 20 degrees.

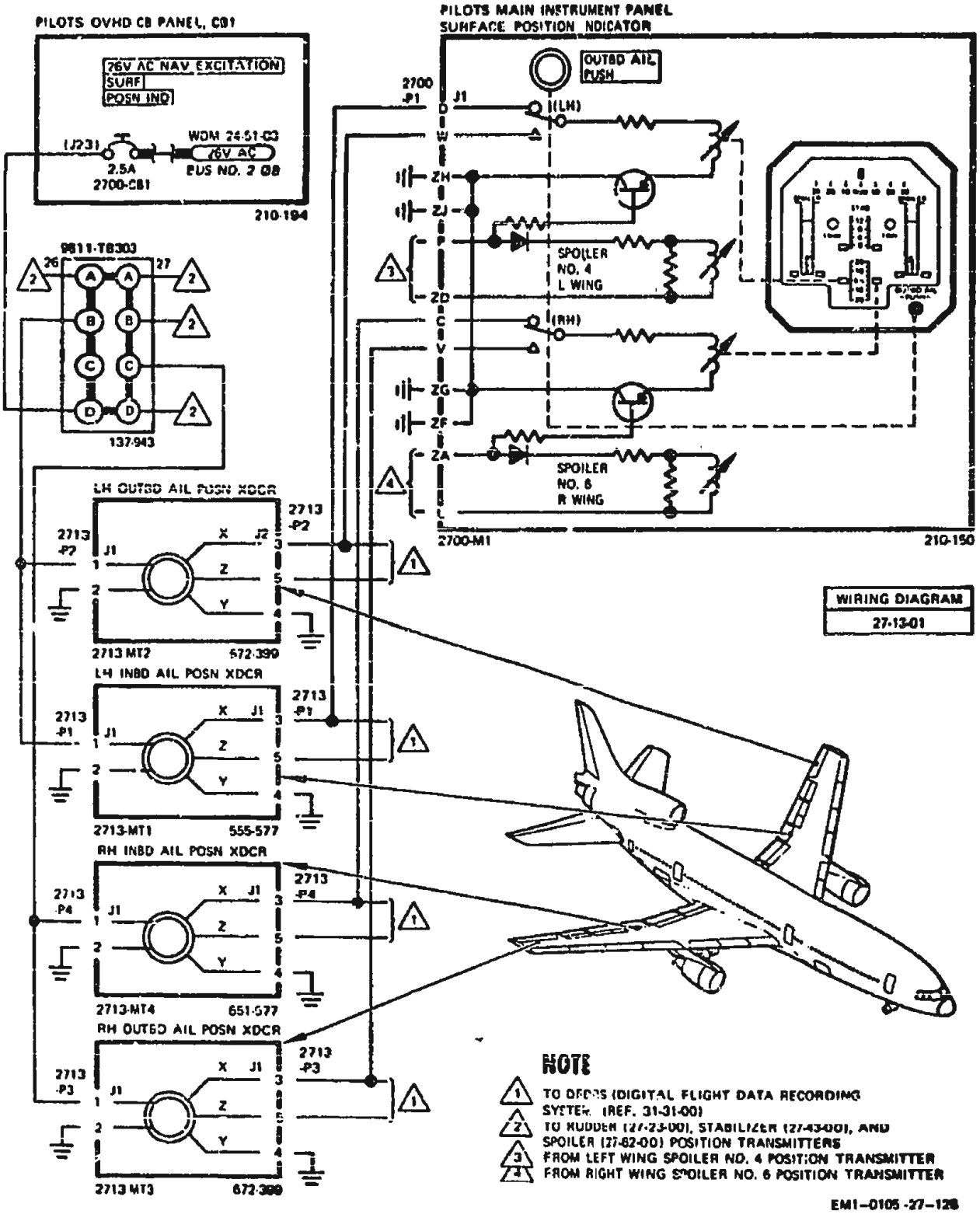
The transmitter installation consists of a synchro, bracket-mounted to the wing trailing edge structure, and an actuation link coupled to the aileron surface (Ref. Fig. 1). The synchro is mounted to the bracket by a split collar arrangement. Null adjustment of the synchro can be made by loosening the collar clamping bolt and rotating the synchro.

R The inboard aileron transmitter installation is located next to
R the number two hinge. Number one hinge being the inboard hinge.
R The outboard aileron transmitter installation is located under
R second lower trailing edge panel in from wing tip.



HH 6516
M1-A00-27-073

Aileron Position Indicating System
Figure 1



R Aileron Position Indicating System Electrical Schematic
R Figure 2

R AILERON POSITION INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for
R fault isolation any time a fault is reported or suspected. The
R PREREQUISITES listed at the top of each fault isolation diagram
R must be satisfied prior to starting fault isolation. Uncommon
R abbreviations are defined on the using fault code diagram or
R schematic.

R If the flight crew reports a fault using a fault code number,
R the code number can be found in the Fault Isolation Reference
R Table in the Chapter 27 Fault Code Index. The index specifies
R the exact maintenance manual section, fault isolation diagram,
R and block number on the diagram where the fault isolation
R procedure should start. Schematics are included at the end of
R the section to supplement the fault code diagrams or as an aid
R in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed
R discussion of the Fault Isolation Reporting Method (FIRM) and
R use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in
R this section.

R Table 101

FIGURE	TITLE
101	Component Locator Index
102	Component Locator Diagram
103	Aileron Position Indicating System Malfunction
SCHEM 1	Aileron Position Indicating System Schematic

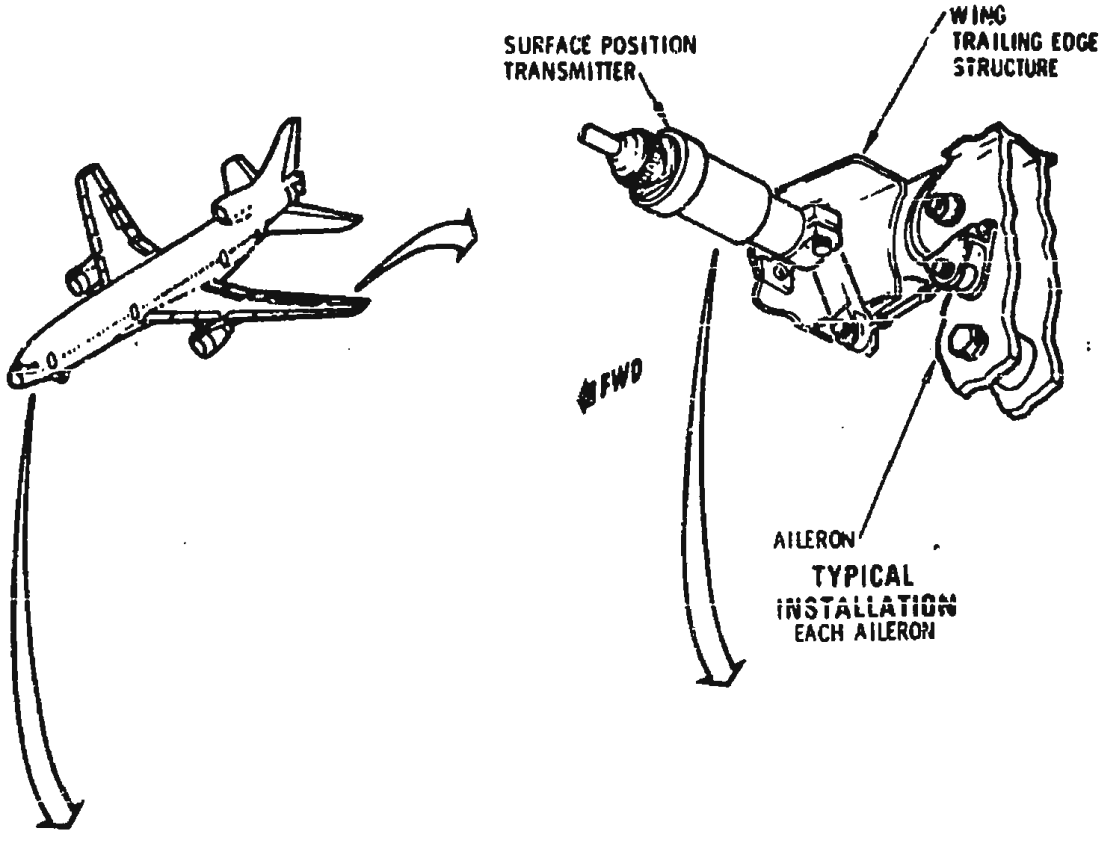
COMPONENT	QTY	AREA/ACCESS	REFERENCE
SURFACE POSITION INDICATOR	2	FLIGHT STATION, ZONE 210	27-00-01
AILERON SURFACE POSITION TRANSMITTER	4	AT EACH AILERON, LH AND RH WING	27-13-01

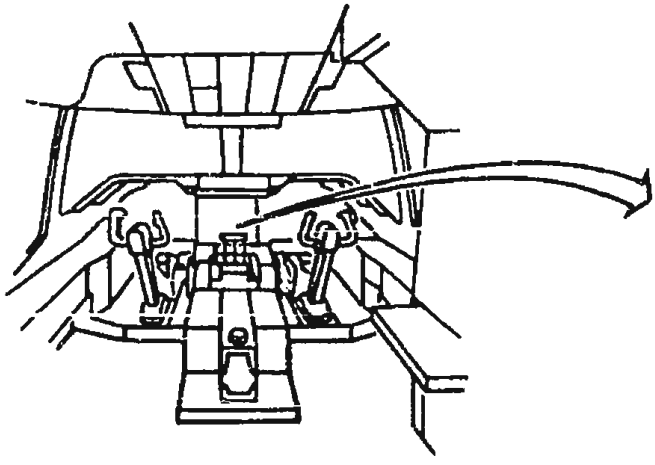
M1-0000-27-932

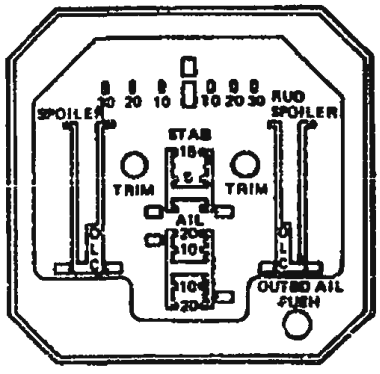
R Component Locator Index
R Figure 101

EFFECTIVITY: ALL

001B





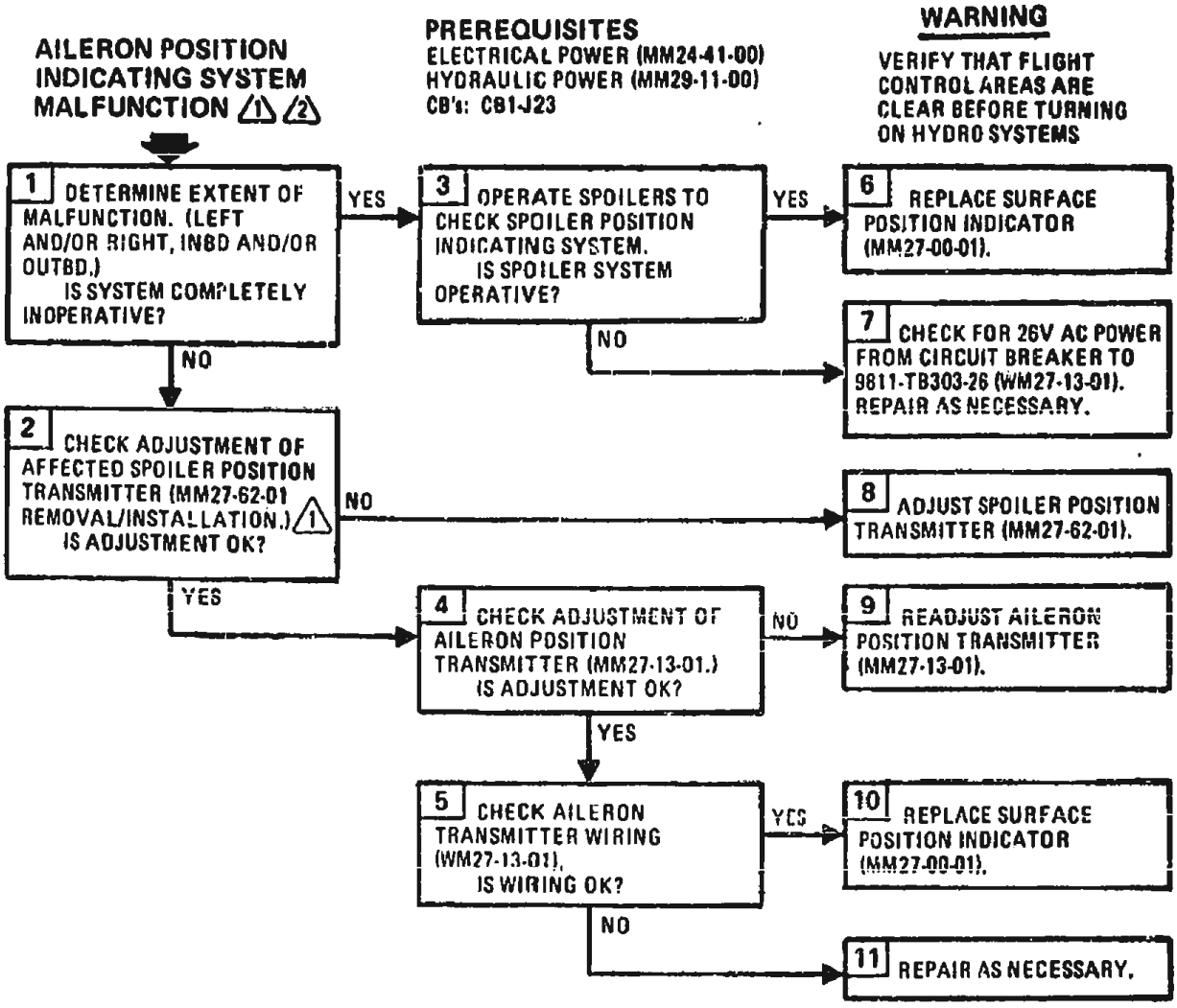


SURFACE POSITION INDICATOR

MI-0000-27-869

R Component Locator Diagram
R Figure 102

R EFFECTIVITY: ALL
R
001B

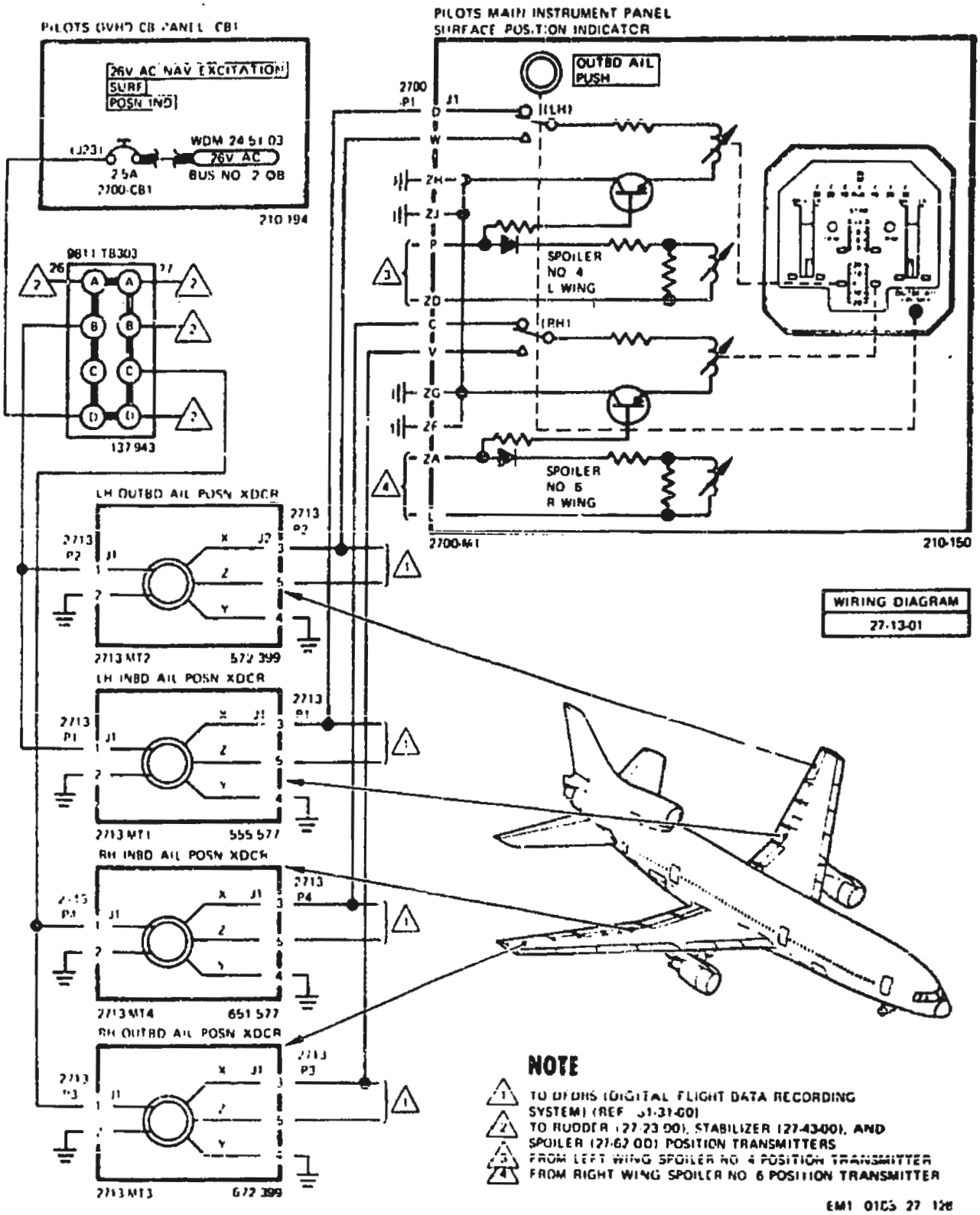

AILERON POSITION INDICATING SYSTEM MALFUNCTION (1) (2)
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00)
CB's: CB1-J23
WARNING
VERIFY THAT FLIGHT CONTROL AREAS ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS
1 DETERMINE EXTENT OF MALFUNCTION. (LEFT AND/OR RIGHT, INBD AND/OR OUTBD.) IS SYSTEM COMPLETELY INOPERATIVE?
YES
NO
2 CHECK ADJUSTMENT OF AFFECTED SPOILER POSITION TRANSMITTER (MM27-62-01 REMOVAL/INSTALLATION.) (1) IS ADJUSTMENT OK?
NO
YES
3 OPERATE SPOILERS TO CHECK SPOILER POSITION INDICATING SYSTEM. IS SPOILER SYSTEM OPERATIVE?
YES
NO
4 CHECK ADJUSTMENT OF AILERON POSITION TRANSMITTER (MM27-13-01.) IS ADJUSTMENT OK?
NO
YES
5 CHECK AILERON TRANSMITTER WIRING (WM27-13-01). IS WIRING OK?
YES
NO
6 REPLACE SURFACE POSITION INDICATOR (MM27-00-01).
7 CHECK FOR 26V AC POWER FROM CIRCUIT BREAKER TO 9811-TB303-26 (WM27-13-01). REPAIR AS NECESSARY.
8 ADJUST SPOILER POSITION TRANSMITTER (MM27-62-01).
9 READJUST AILERON POSITION TRANSMITTER (MM27-13-01).
10 REPLACE SURFACE POSITION INDICATOR (MM27-00-01).
11 REPAIR AS NECESSARY.

(1) NOTE
THE LEFT NO. 4 SPOILER TRANSMITTER PROVIDES A REFERENCE SIGNAL FOR LEFT AILERON INDICATION AND THE RIGHT NO. 6 SPOILER TRANSMITTER PROVIDES A REFERENCE SIGNAL FOR RIGHT AILERON INDICATION.

(2) AN ASSOCIATED SPOILER OR AILERON POSITION SYNCHRO ADJUSTED TO THE WRONG NULL (E-Z 180 DEGREES OUT OF PHASE) WILL RESULT IN OPPOSITE AILERON DEFLECTION ON THE SURFACE POSITION INDICATOR.

M1-0004-27-618

R R Aileron Position Indicating System Malfunction
Figure 103



NOTE

1. TO DFDRS (DIGITAL FLIGHT DATA RECORDING SYSTEM) (REF 31-31-00)
2. TO RUDDER (27-23-00), STABILIZER (27-43-00), AND SPOILER (27-62-00) POSITION TRANSMITTERS
3. FROM LEFT WING SPOILER NO 4 POSITION TRANSMITTER
4. FROM RIGHT WING SPOILER NO 6 POSITION TRANSMITTER

EM1 01C5 27 126

R Aileron Position Indicating System Schematic
R SCHEM 1

EFFECTIVITY: ALL

001B

AILERON SURFACE POSITION TRANSMITTER (SINGLE) REMOVAL AND INSTALLATION

1. Equipment and Materials

Aileron support tool, PN BF90, or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker 28 VAC NAV EXCITATION - SURF POSN IND (J23).

(2) Open applicable wing lower surface access panel (Ref. 6-40-00):

Inboard Aileron: panel 551CB (left wing) or 651CB (right wing)

Outboard Aileron: panel 571DB (left wing) or 671DB (right wing)

(3) Disconnect electrical connector from transmitter (Ref. Fig. 401).

(4) Remove clamp bolt from arm at transmitter shaft end.

(5) Remove transmitter mount clamp bolt and remove transmitter.

B. Installation (Ref. Fig. 401)

(1) Verify circuit breaker opened in Step 3A(1) is open and tagged.

WARNING: VERIFY ALL HYDRAULIC POWER IS TURNED OFF AND HYDRAULIC CONTROL PANELS TAGGED.

(2) Manually position aileron to neutral (±0.060 inch) and install aileron support tool (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

On aircraft 001-019, 021, 022, outboard aileron is in neutral position when the lower inboard surface of aileron is aligned with lower surface of the adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

On aircraft 019, 020, 023-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(3) Verify EZ (electrical zero) index mark on transmitter shaft is aligned with EZ index mark on housing.

(4) Insert transmitter partially into mount clamp to allow clearance to connect arm. Insert transmitter so EZ mark is visible.

(5) Hold arm in position and insert transmitter into mount clamp and transmitter shaft into arm. Verify EZ marks are still aligned.

CAUTION: TRANSMITTER MUST BE ALIGNED SINCE INTERNAL STOPS WILL BE DAMAGED IF SHAFT IS ROTATED BEYOND 90 DEGREES FROM EZ MARK.

(6) Install bolt, washer, and nut in arm. Tighten bolt.

(7) Verify bolt groove in transmitter housing is aligned with mount clamp bolt holes. Install bolt, washers, and nut in transmitter mount clamp. Temporarily tighten bolt.

(8) Turn on electrical power (Ref. 24-41-00).

R (9) Verify aileron is still in neutral position(±0.060 inch).

(10) Adjust transmitter as follows:

C (a) With aileron in neutral position verify that
C aileron pointer on surface position indicator is
C centered on zero degree graduation; if not, rotate
C transmitter housing to center.

C NOTE: Reference Paragraph 3 B(2) for aileron
C neutral position.

C (b) Torque mount clamp bolt 30 to 35 pound inch.
C Verify that aileron position is still centered.

(11) Remove aileron support tool.

(12) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(13) Turn on hydraulic system B (Ref. 29-11-00).

CAUTION: THE OUTBOARD AILERONS INCORPORATE HYDRAULIC DAMPERS. RAPID CYCLING OF CONTROLS CAN DAMAGE DAMPER SEALS. CYCLE CONTROLS SLOWLY (MINIMUM 4 SECONDS, STOP-TO-STOP).

(14) Slowly operate control wheel full left. Verify AIL pointer on surface position indicator follows aileron travel. Verify left AIL pointer moves up and right aileron pointer moves down.

NOTE: To read outboard aileron position, depress and hold OUTBD AIL PUSH switch on surface position indicator.

(15) Slowly operate control wheel full right. Verify AIL pointer on surface position indicator follows aileron travel. Verify left AIL pointer moves down and right aileron pointer moves up. Allow control wheel to return to neutral.

(16) Check aileron position transmitter linkage for interference during aileron operation.

(17) Verify flaps are positioned to full up (to enable spoilers 5 and 6).

(18) Position speedbrake lever full aft to maximum spoiler position. Verify the four SPOILER pointers move full up.

(19) Repeat Steps 3B(14) and 3B(15).

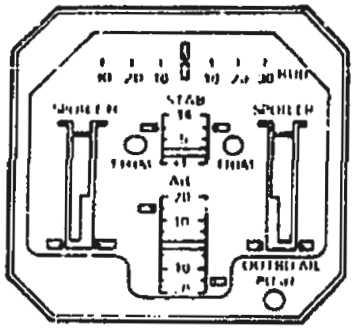
NOTE: The spoiler position transmitter supplies a phase reference signal to the aileron position circuit. Checking aileron position signals with spoilers deflected verifies correct spoiler reference signals.

(20) Position speedbrake lever full forward to zero degrees.

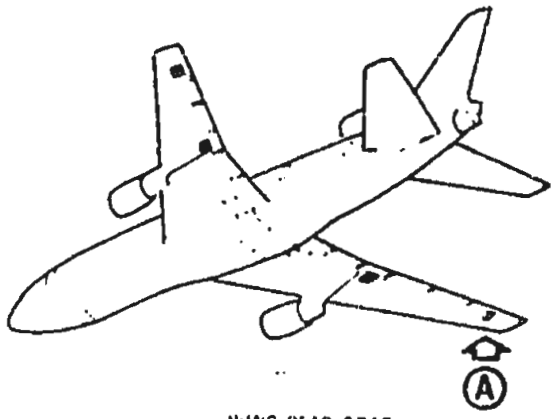
(21) Turn off hydraulic power if no longer required (Ref. 29-11-00).

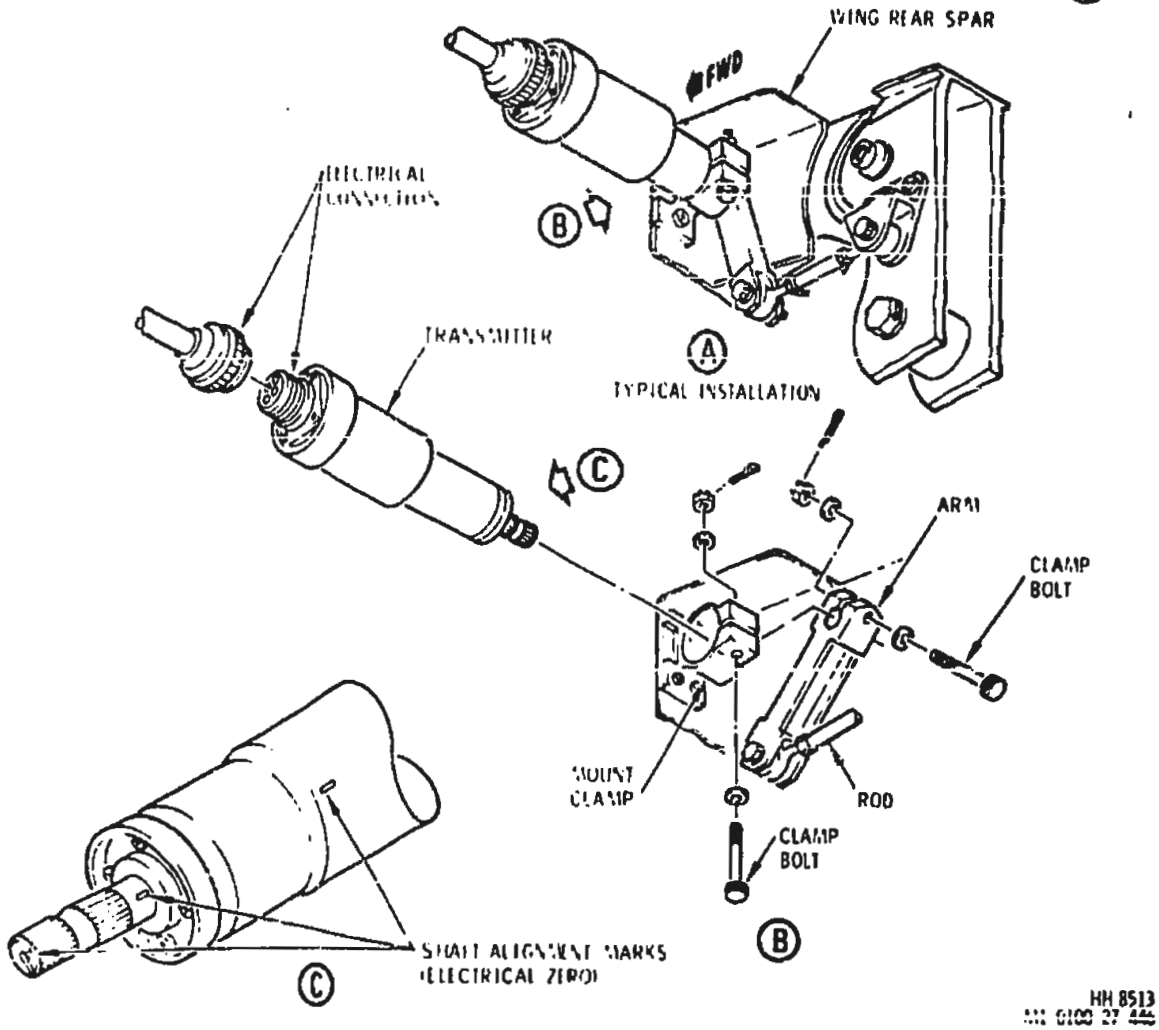
(22) Turn off electrical power if no longer required (Ref. 24-41-00).

(23) Close wing access panel.



SURFACE POSITION INDICATOR
(PILOTS MAIN INSTRUMENT PANEL)





HH 8513

R Aileron Surface Position Transmitter (Single)
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

0018

RUDDER CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

A single rudder provides yaw control of the aircraft. The rudder is positioned by two dual hydraulic actuators and controlled by a triple servo module. Conventional dual flight station rudder pedals are interconnected and drive a single cable control system (Ref. Fig. 1 and 2). The cable system terminates at the rear cable quadrant in the afterbody, zone 313. A short linkage system connects the rear cable quadrant to the servo module located in the base of the vertical stabilizer, zone 324. The servo is supplied by hydraulic systems A, B, and C (Ref. Fig. 3). External stops on rudder servo limit servo input arm displacement which hydraulically limits rudder deflection to 30.5 degrees left and right from neutral.

In addition to manual inputs from the Captain and First Officer, the rudder servo accepts electrical inputs from autopilot system and yaw stability augmentation system (SAS) (Ref. 22-15-00). Rudder position is displayed on surface position indicator on pilots main instrument panel, zone 210.

Rudder deflection and rudder power are designed to provide the necessary rudder response at lower air speeds. At higher air speeds, rudder deflection and power are reduced. A load relieving system (LRS) computer senses airspeed and flap position (Ref. 27-51-06). The LRS computer signals both the rudder servo and a pressure regulator to reduce hydraulic flow and pressure to the rudder servo to control rudder power (Ref. Fig. 4). The LRS computer also uses airpseed and flap position inputs to control the mechanical limiter actuator and thus control rudder deflection. (Mechanical limiters are installed
R on aircraft 001-017) (Ref. Fig. 17).

2. Operation

A. Manual Operation

Rudder pedal movement is transmitted by cables and linkages to the rudder servo dual input arms. Rotation of servo input arms displaces the three parallel-acting power control valves and meters hydraulic pressure and flow to the two dual-tandem actuators. Differential hydraulic pressures across actuator pistons cause pistons to stroke in opposite directions and displace rudder. Rudder movement is transmitted back to servo through dual-feedback pushrods.

R When rudder reaches the position commanded by the pilot, the
R feedback rods reposition control valves to neutral,
R hydraulically locking the rudder in a commanded position.
R To maintain rudder in a commanded position, the pilot must
R maintain pressure on the pedal to overcome the feel spring.

R When the pilot releases the pedal, the feel spring positions
R three control valves back to the previous trim position.
R Hydraulic flow to actuators is reversed, and rudder is
R positioned back to trim position. When rudder reaches trim
R position, feedback rods again neutralize the control valves
R and the rudder is hydraulically locked in trim position.

B. Autopilot and SAS Operation

Autopilot and SAS input signals are applied to the rudder servo through a plate-mounted electrohydraulic servo valve (EHV) and an internal modulating piston. Autopilot and SAS electrical signals are converted to hydraulic differentials by the EHV and applied to the modulating piston. The modulating piston mechanically positions the three parallel-acting control valves.

Yaw SAS is operational during all flight modes to stabilize
R the aircrafts yaw axis (Ref. 22-15-00). The SAS inputs are
R applied in parallel with pilots manual inputs. The two
R inputs are mechanically summed by servo internal linkage and
applied to the control valves.

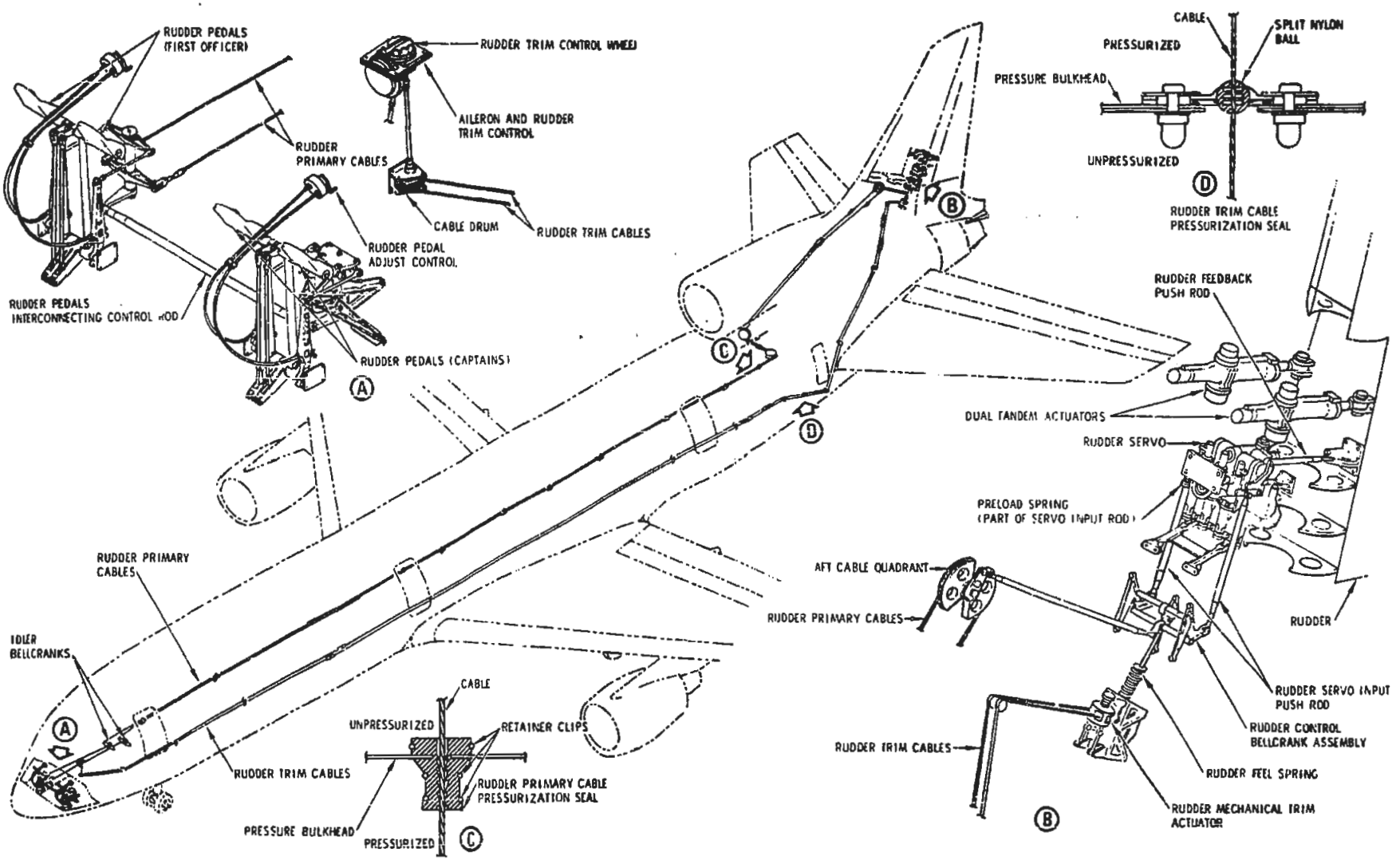
R The autopilot function provides runway alignment and rollout
R in autoland mode. Autopilot inputs are applied to the
R rudder servo through the same EHV that receives SAS inputs.
R When autopilot is engaged, both autopilot signals and SAS
R signals are simultaneously applied to the rudder servo. The
R autopilot and SAS signals are electrically summed in the yaw
R computer and resultant composite signal applied to the EHV.

R When autopilot is engaged, an engaging cam in rudder servo
R locks out pilots manual inputs. However, if a malfunction
R in the SAS or autopilot system overcontrols the rudder, the
R pilot can apply enough rudder pedal force to override
R autopilot engaging cam and assume immediate control of
rudder.

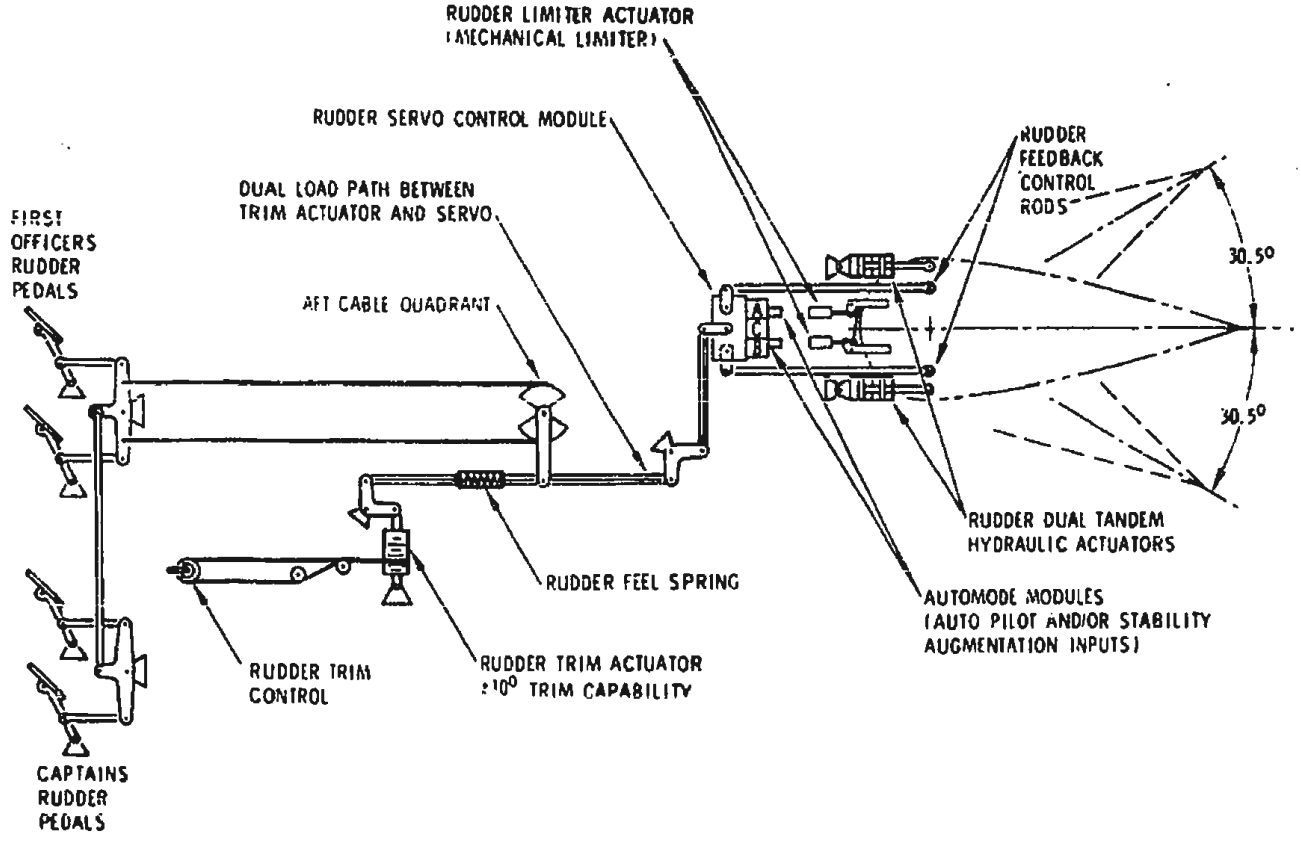
R C. Rudder Limiter Operation

R (1) Hydraulic Limiter

R On aircraft 001-018, 021, 022,
R at airspeeds up to 164 knots, all three hydraulic
R systems (A, B, and C) are supplying pressure to the
R rudder servo. At airspeeds between 164 knots and 260

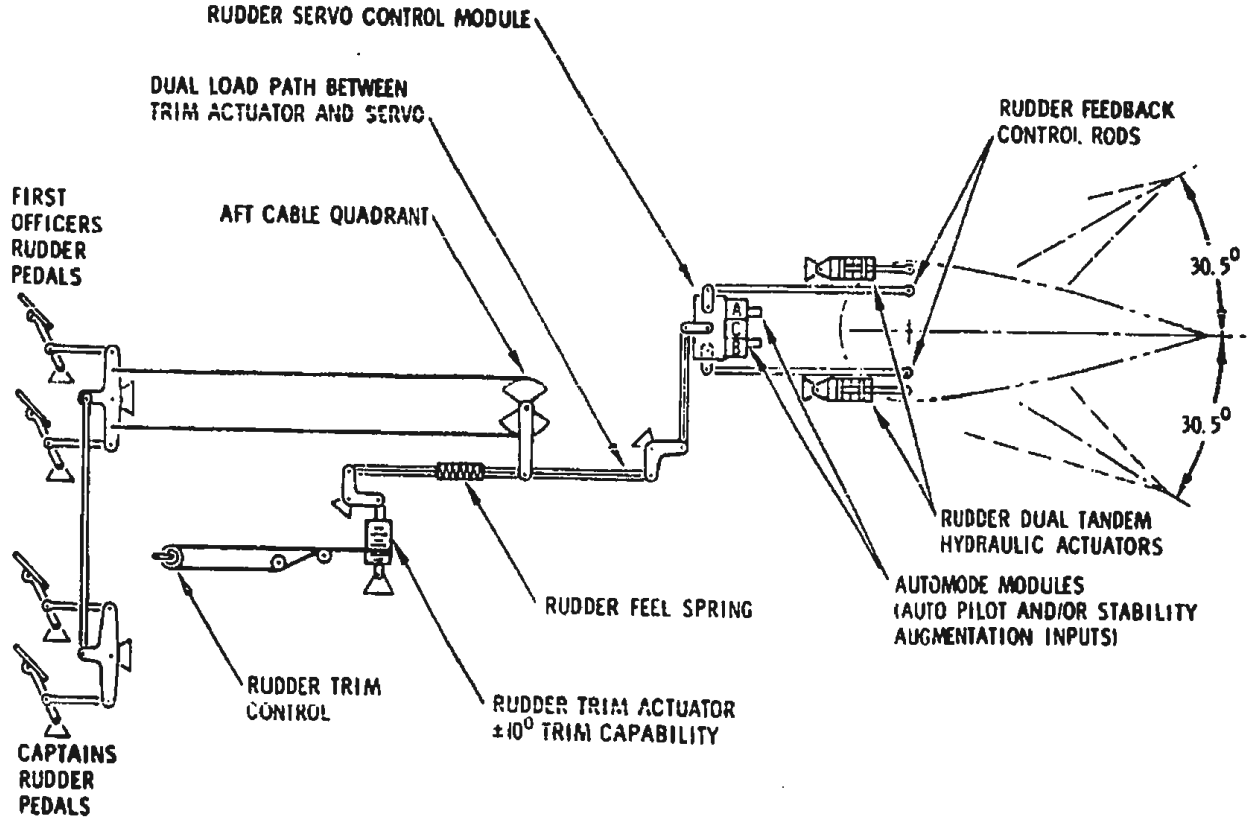


Rudder Control System
Figure 1



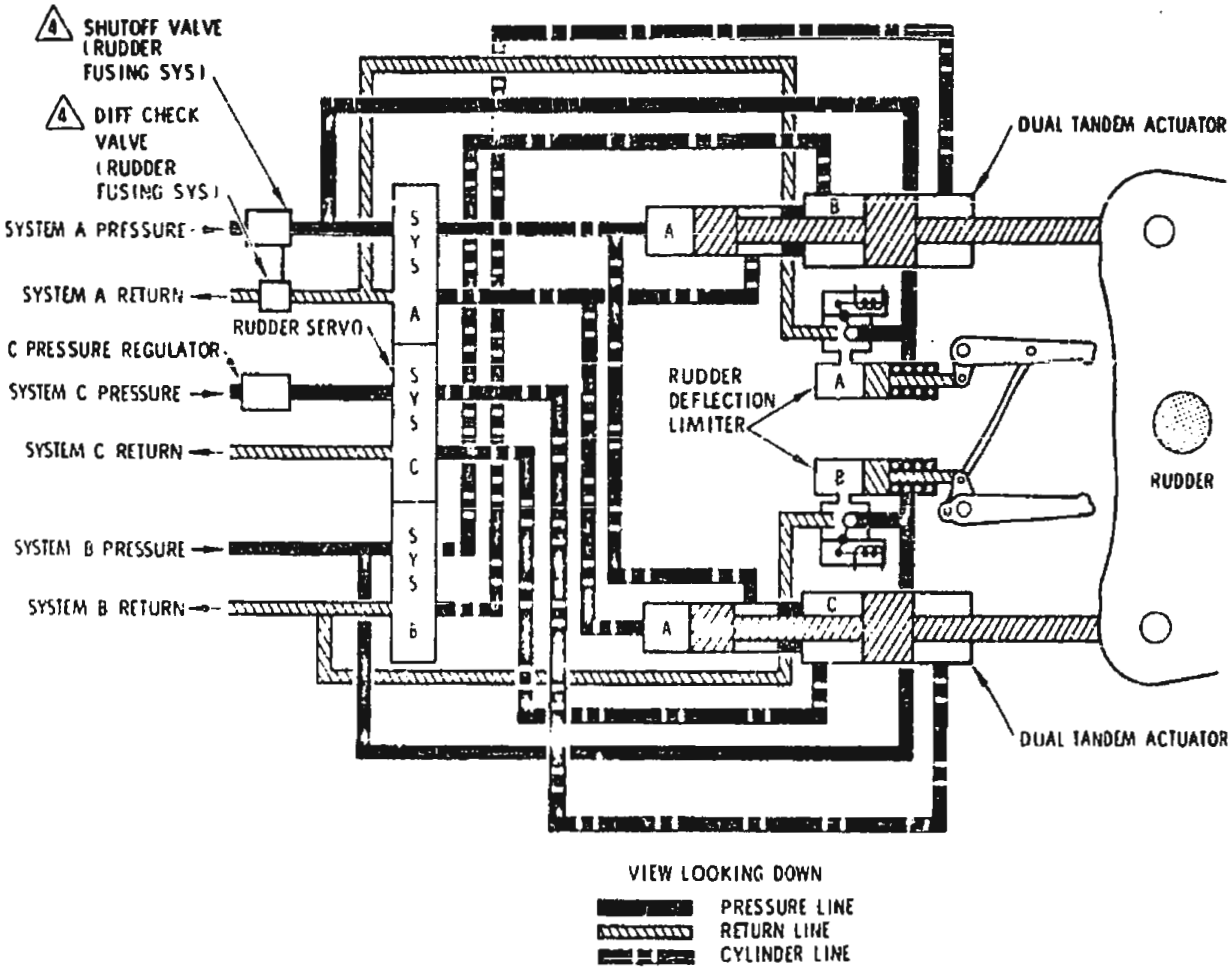
M1-0102-27-006

Rudder Control System Schematic
Figure 2


RUDDER SERVO CONTROL MODULE
DUAL LOAD PATH BETWEEN TRIM ACTUATOR AND SERVO
RUDDER FEEDBACK CONTROL RODS
FIRST OFFICERS RUDDER PEDALS
AFT CABLE QUADRANT
30.5°
30.5°
RUDDER DUAL TANDEM HYDRAULIC ACTUATORS
AUTOMODE MODULES (AUTO PILOT AND/OR STABILITY AUGMENTATION INPUTS)
RUDDER FEEL SPRING
RUDDER TRIM CONTROL
RUDDER TRIM ACTUATOR ±10° TRIM CAPABILITY
CAPTAINS RUDDER PEDALS

M1-0000-27-663

Rudder Control System Schematic
Figure 2

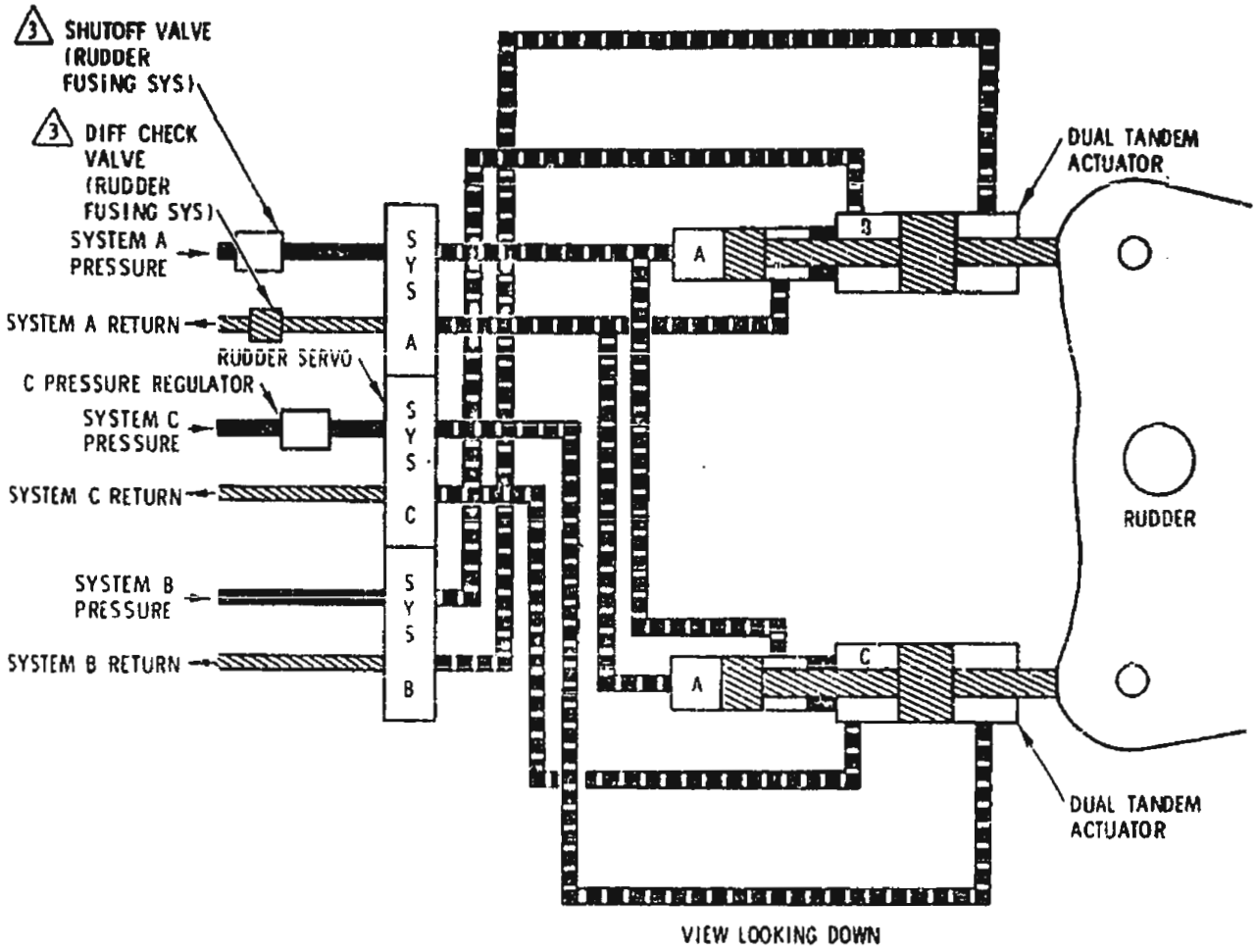


NOTE

1. HYDRAULIC LIMITER SHOWN DEACTIVATED (30° POSITION)
2. SEAL DRAIN LINES OMITTED FOR CLARITY
3. LETTERS INDICATE HYDRAULIC SYSTEM
4. REF. 29-11-74

MI-0006-27-096

Rudder Servo Hydraulic Supply Schematic
Figure 3



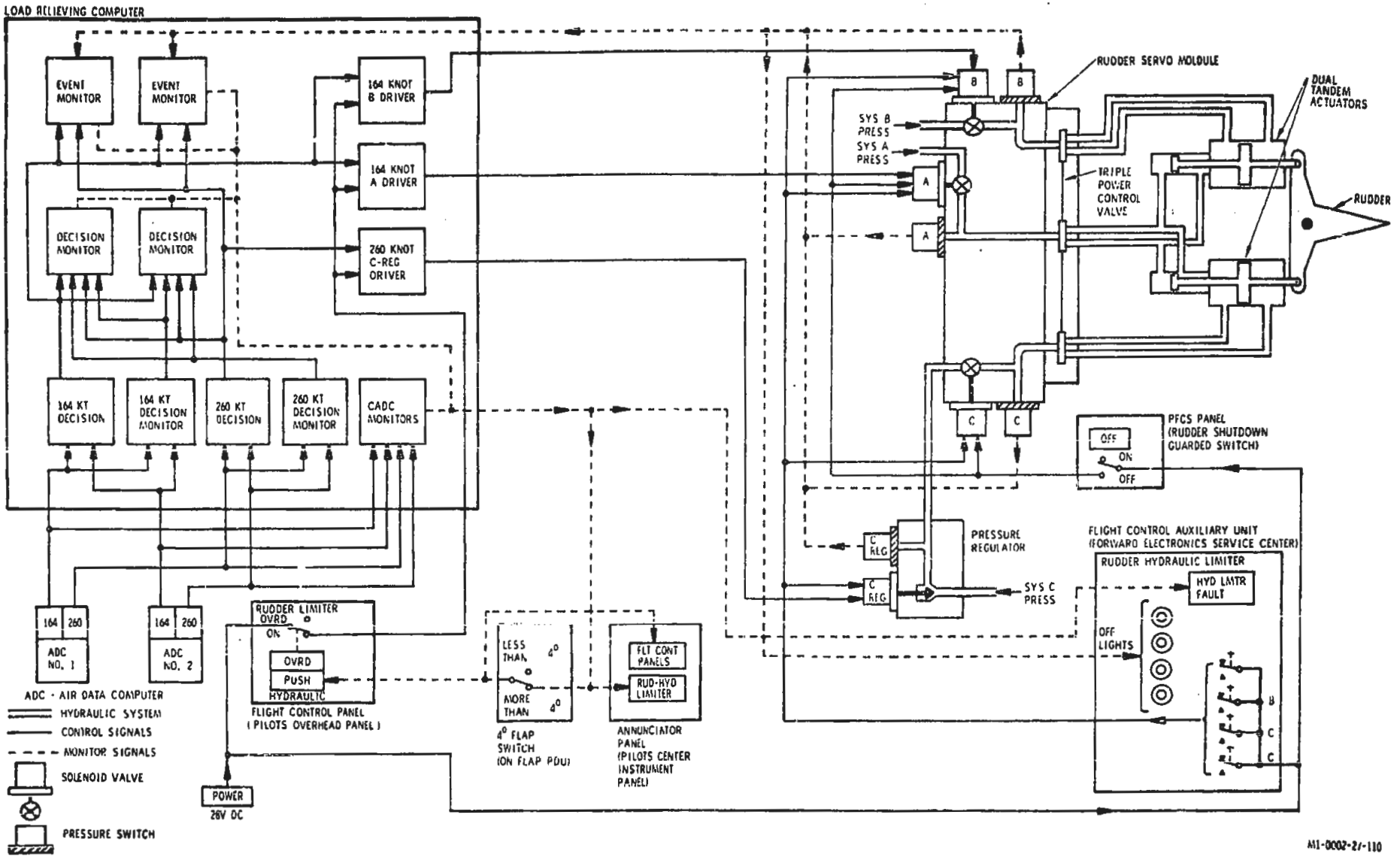
NOTE

1 SEAL DRAIN LINES OMITED FOR CLARITY
2 LETTERS INDICATE HYDRAULIC SYSTEM
3 REF. 29-11-74

PRESSURE LINE
RETURN LINE
CYLINDER LINE

M1-0002-27-664

Rudder Servo Hydraulic Supply Schematic
Figure 3

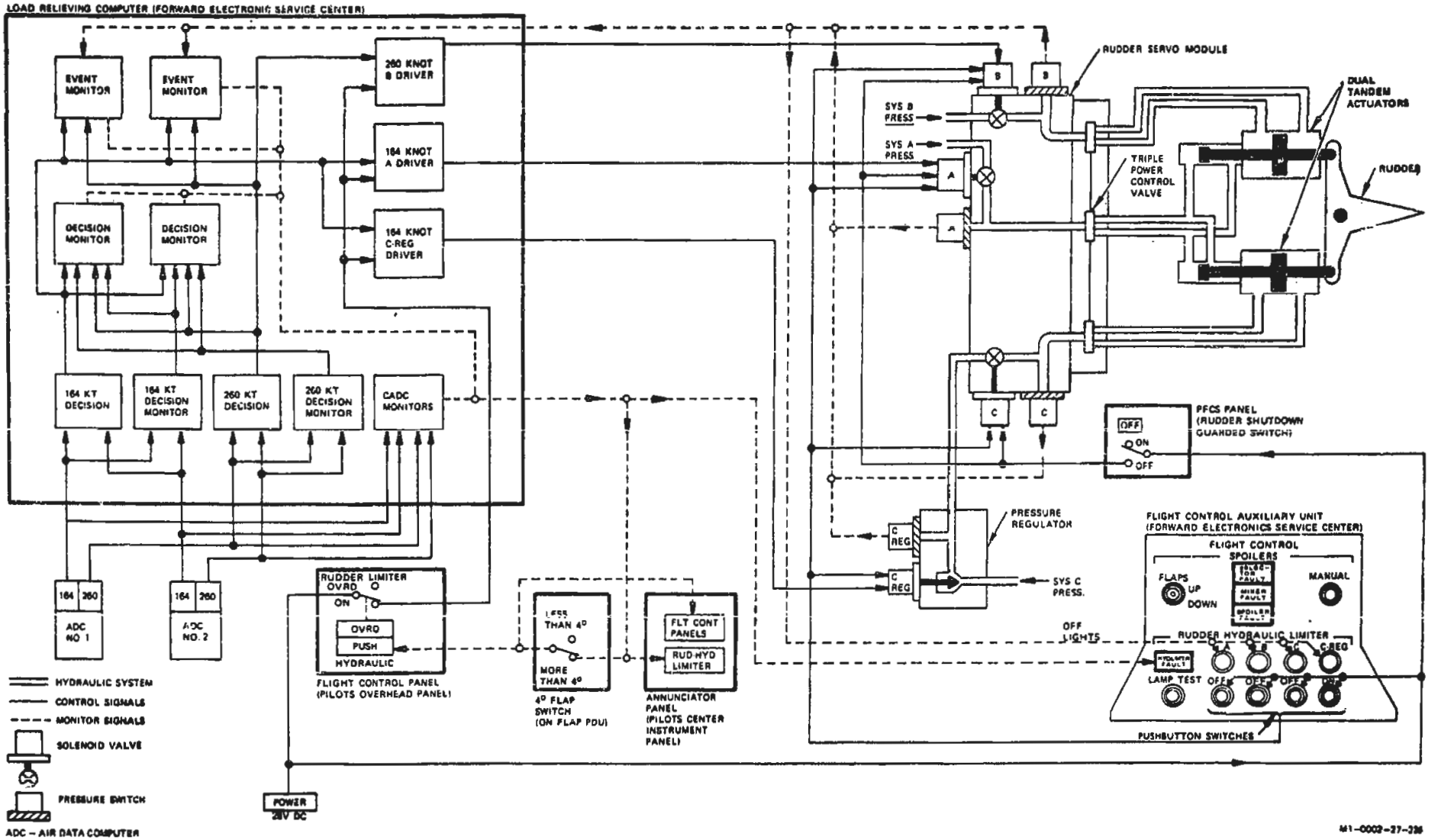


M1-0002-2/-110

R Rudder Hydraulic Limiting System Block Diagram
R Figure 4

EFFECTIVITY: 001-018, 021, 022

001B



R Rudder Hydraulic Limiting System Block Diagram
R Figure 4

EFFECTIVITY: 019, 020, 023-999

0018

knots, the LRS computer turns off system A and B at the rudder servo. At airspeeds above 260 knots system C pressure is reduced to 2000 psi by a rudder pressure regulator in the afterbody.

On aircraft 019, 020, 023-999
at airspeeds up to 164 knots, all three hydraulic systems (A, B, and C) are supplying pressure to the rudder servo. At airspeeds between 164 knots and 260 knots, the LRS Computer turns off system A at the rudder servo and system C pressure is reduced to 2000 psi by a rudder pressure regulator in the afterbody. At airspeeds above 260 knots system B is turned off at the rudder servo.

Hydraulic System pressure is monitored by pressure switches on the rudder servo and provides signals to the LRS computer. If, while in hydraulic limiting mode (airspeed above 164 knots), hydraulic system C is lost, the LRS computer will automatically restore hydraulic system A to rudder servo. If both hydraulic systems A and C are lost, the FCAU will turn on HYDRAULIC PUSH light on pilots overhead RUDDER LIMITER panel.

NOTE: When rudder system A hydraulic fusing check valve is closed, pressure to rudder servo channel A is shut off. Below 164 kts this turns on RUDDER HYD LMTR Annunciator light on pilots Caution and Warning panel.

R (2) On aircraft 001-017,
Mechanical Limiter

At airspeeds below 164 knots, rudder limiter actuators are deenergized. In this condition, limiter arms are retracted and full rudder deflection of 30.5 degrees left and right of neutral is available.

At airspeeds above 164 knots, if flaps are extended less than 4 degrees, the LRS computer energizes rudder limiter actuators. The rudder limiter actuators extend two limiter arms to limit rudder deflection to 8 degrees left and right of neutral. The limiter actuators and arms are mounted within rudder dual-tandem actuator mounting brackets and hinge supports.

Monitoring of rudder control system is accomplished by sensors, flight station displays, and an Auxiliary Unit control panel (Ref. 22-10-12) in forward electronic service center (Ref. Fig. 17).

D. Rudder System Control Panels

The pilots overhead panel contains three flight control panels. The flight control electronics system (FCES) panel contains two YAW SAS switchlights, one switchlight for each yaw SAS electronic channel. Malfunction of an electronic channel will turn on the FAIL legend. Depressing the YAW SAS switchlight will deactivate that channel and turn on the OFF legend (Ref. 22-15-00).

The primary flight control system (PFCS) panel contains a guarded switchlight marked RUDDER. Depressing the switchlight will shut off all three hydraulic systems to rudder servo and turn on the OFF legend.

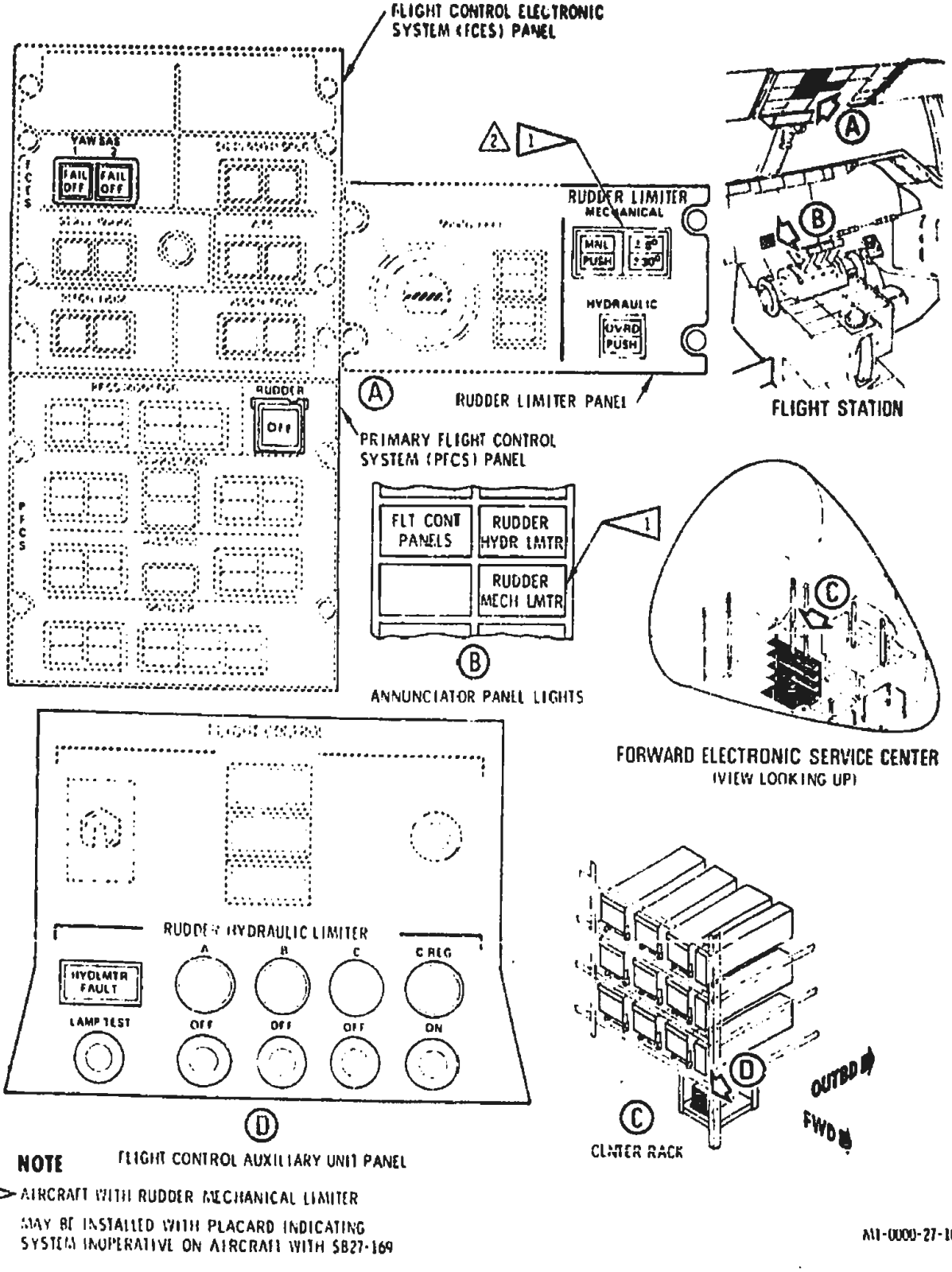
The RUDDER LIMITER panel contains a HYDRAULIC limiter switchlight. If hydraulic limiting system does not respond properly to LRS computer signals and flaps are extended, the HYDRAULIC switchlight PUSH legend will come on. Depressing HYDRAULIC switchlight will turn off PUSH legend, turn on OVRD legend, and remove electrical power supplied to LRS computer for controlling rudder servo. In this condition, rudder servo and pressure regulator solenoids will be deenergized and allow all three hydraulic systems to supply rudder servo at all flight speeds.

CR The RUDDER LIMITER panel also contains two MECHANICAL limiter switchlights on aircraft 001-017.

If mechanical limiting system does not respond properly to LRS computer signals, MECHANICAL switchlight PUSH legend will come on. Depressing MECHANICAL MNL/PUSH switchlight will turn off PUSH legend, turn on MNL legend, disable automatic control of mechanical limiter, and enable the ±8°/±30° switchlight. The ±8°/±30° switchlight allows the pilot to manually select either 8 degrees (rudder limiting) or 30 degrees (normal rudder). The ±8° and the ±30° switchlight legends are active at all times to show rudder limiter arm position.

On pilots annunciator panel,RUDDER HYDR LMTR and RUDDER MECH LMTR annunciator lights warn flight crew of a malfunction in the associated system. The FLT CONT PANELS annunciator light is on any time pilot action is required on the three overhead flight control panels.

The FLIGHT CONTROL AUXILIARY UNIT (FCAU) control panel is used to ground check rudder hydraulic limiter system. The FCAU is mounted below bottom shelf of center rack in forward electronic service center (Ref. 22-10-12).



NOTE

1 AIRCRAFT WITH RUDDER MECHANICAL LIMITER

2 MAY BE INSTALLED WITH PLACARD INDICATING SYSTEM INOPERATIVE ON AIRCRAFT WITH SB27-169

AM-0000-27-1058

R Rudder System Flight Station Control Panels
R Figure 5

R The RUDDER HYDRAULIC LIMITER section of FCAU contains five pushbutton switches, four indicator lights, and an annunciator light. When pushbutton switch A,B, or C is depressed, the corresponding light comes on and remains on until the switch is released. When a light is on, it indicates corresponding servo solenoid shutoff valve has shut off hydraulic supply to rudder servo. The A,B, and C represent hydraulic systems supplying pressure to the rudder servo.

When C-REG pushbutton switch is depressed, the corresponding light will come on and stay on as long as switch is depressed. When light is on, it indicates solenoid shutoff valve on the pressure regulator has actuated and regulator has reduced hydraulic system C pressure supplying rudder servo to 2000 psi.

The HYD LMT FAULT annunciator light on auxiliary unit comes on any time a malfunction occurs in the hydraulic limiter system. The LAMP TEST switch, when depressed, turns on all indicators on the auxiliary control unit panel.

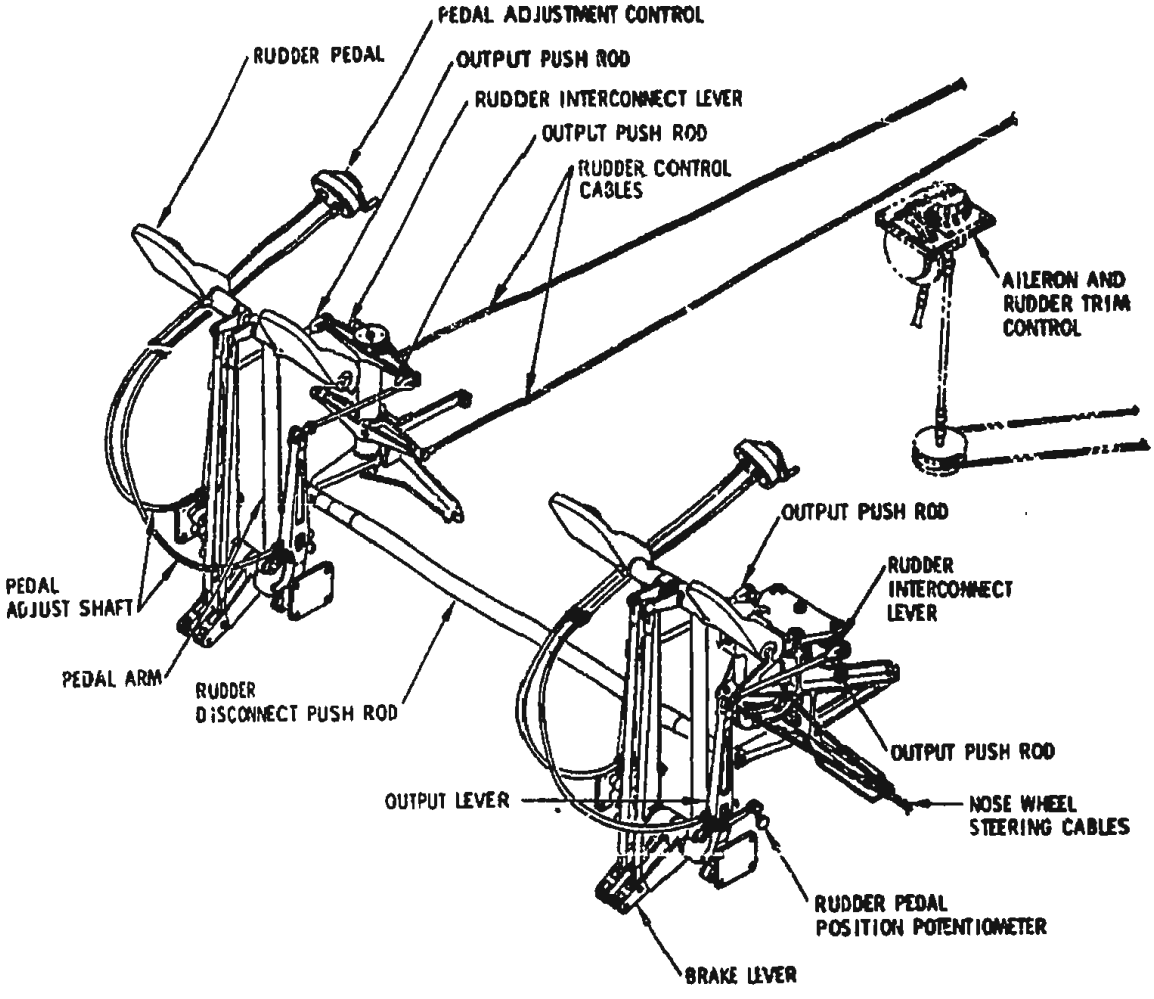
3. Rudder Pedals

A. Description and Operation

The Captain and First Officer are each provided with a pair of rudder pedals to control aircraft about its vertical (yaw) axis. Each pedal is pivoted from the top of a pedal arm. The lower end of the pedal arm rotates on a pedal arm pivot shaft assembly mounted to floor structure (Ref. Fig. 6).

Each pedal is coupled to an output lever through a pedal adjusting worm gear mechanism. The output levers of each pair of pedals are pushrod connected to a center-pivoted interconnect lever which produces the reciprocating pedal motion. The First Officers interconnecting lever assembly includes the rudder cable drive. The First Officers interconnecting lever is coupled to Captains interconnecting lever by a pushrod.

Rudder pedal movement is limited to 3.25 inches forward and 3.31 inches aft by permanent stops on the rudder servo that limits servo input arm rotation. Toe pressure on rudder pedals causes pedals to rotate about their pivot shaft and provides braking inputs to landing gear brakes.



HH 8402
M1-0102-27-117

Rudder Pedals
Figure 6

4. Rudder Pedal Adjust Mechanism

A. Description and Operation

The rudder pedal adjust [illegible] provides Captain and [illegible] the fore and aft position [illegible]

A pedal adjustment crank and indicator is mounted on the rear face of Captain and First Officer rudder pedal trim panel. Two flexible shafts extend from crank assembly to worm and sector gear mechanism on the bottom of each pedal arm assembly.

The worm and sector gear mechanism consists of a sector gear bolted to bottom of pedal arm and a worm gear mounted within bottom of the output lever. Rotation of crank handle rotates worm gears on both output levers and causes both pedals to move forward or aft of output levers. Total pedal adjustment is 9 inches: 4 inches forward of pedal neutral and 5 inches aft. The pedal adjust indicator shows pedal adjustment in inches.

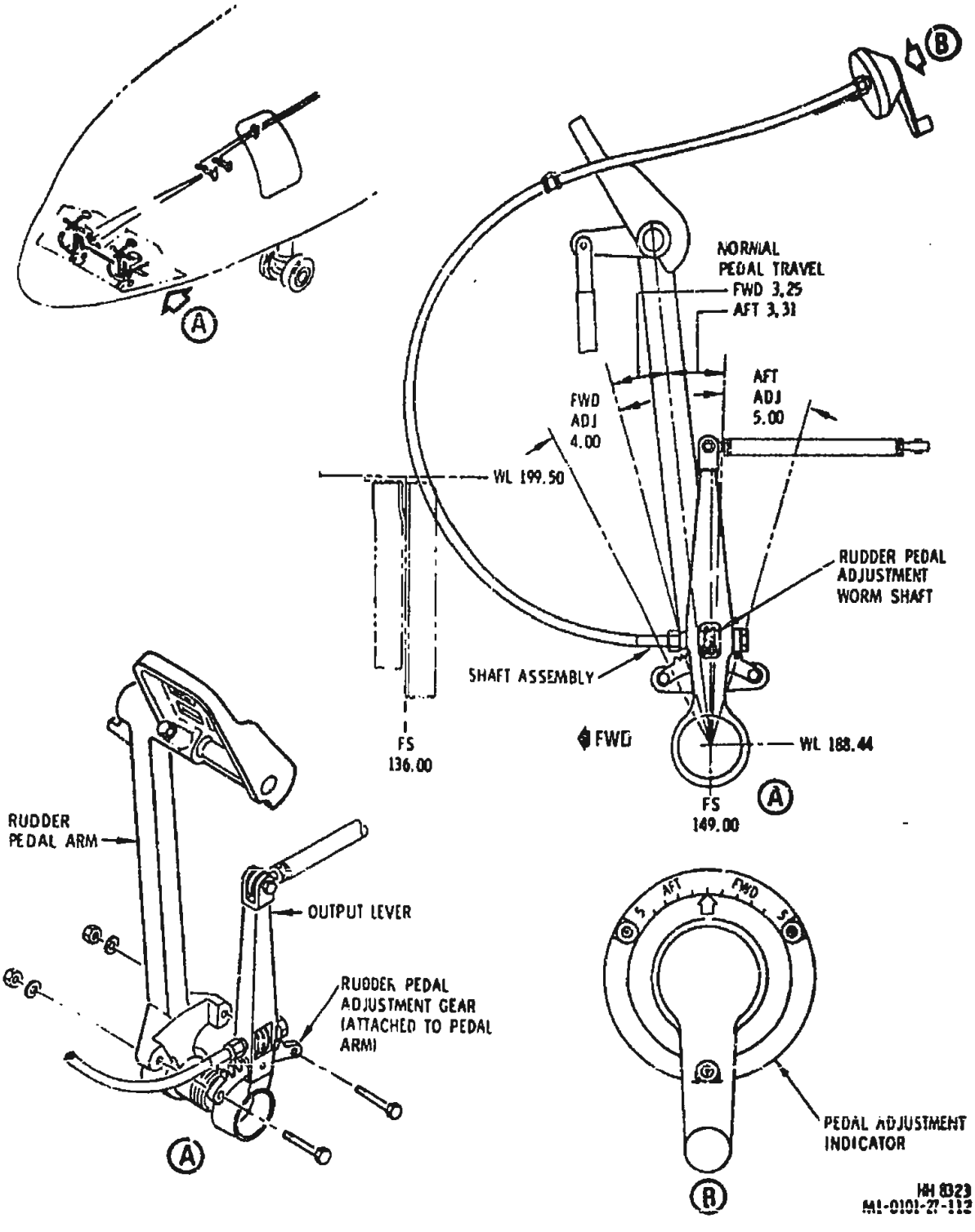
5. Rudder Primary Control Cables

A. Description and Operation

The rudder primary control cables are used to transmit rudder pedal motions to cable quadrant in the vertical stabilizer. The primary cables are fabricated from one-eighth-inch-diameter 7 by 19 cables. In the pressurized fuselage section, cables are made from tinned-carbon steel wire; in afterbody section, cables are made from corrosion-resistant steel wire. Cable friction is reduced by using idler bellcranks instead of pulleys to change cable direction in forward section of cable runs.

Lockclad is used on straight runs of primary rudder control cables to stabilize cable system by reducing cable stretch. Lockclad cable consists of normal flexible cable that has an aluminum tube swaged around it. The swaging operation puts the cable under tension. Thus, normal control system operating loads are lower than prestretched loads so no elastic stretching of cables takes place during control operation. The Lockclad process also results in a control cable with a coefficient of expansion similar to that of airframe structure, and effect of ambient temperature changes on flight controls is considerably reduced.

Cable terminal fittings are swaged over the Lockclad cable combination to produce a completely enclosed cable assembly.



Rudder Pedal Adjust Mechanism
Figure 7

The Lockclad cable assemblies are made in approximately 22-foot lengths and are coupled together by a quick-disconnect shear pin arrangement (Ref. Fig. 8). Standard turnbuckles are also used in cable runs to provide for rigging adjustment. The rudder primary cables in the pressurized fuselage section are straight runs that extend through the cabin floor beams and are supported every 80 inches by fairlead rollers. A rubber labyrinth cable seal is used where cables go through fuselage rear pressure bulkhead.

Corrosion protection of cables, where cables are exposed to lavatory or galley spillage, is accomplished by using clear plastic shrink tubing over Lockclad cable.

The Lockclad cable assembly is a fairly rigid assembly. However, it can be bent for removal and installation, without producing a permanent bend in the cable, as long as the radius of the bend is not less than 48 inches.

For information on fabricating replacement cable assemblies for flight control systems, refer to Chapter 91.

6. Rudder System Feel-spring Assembly

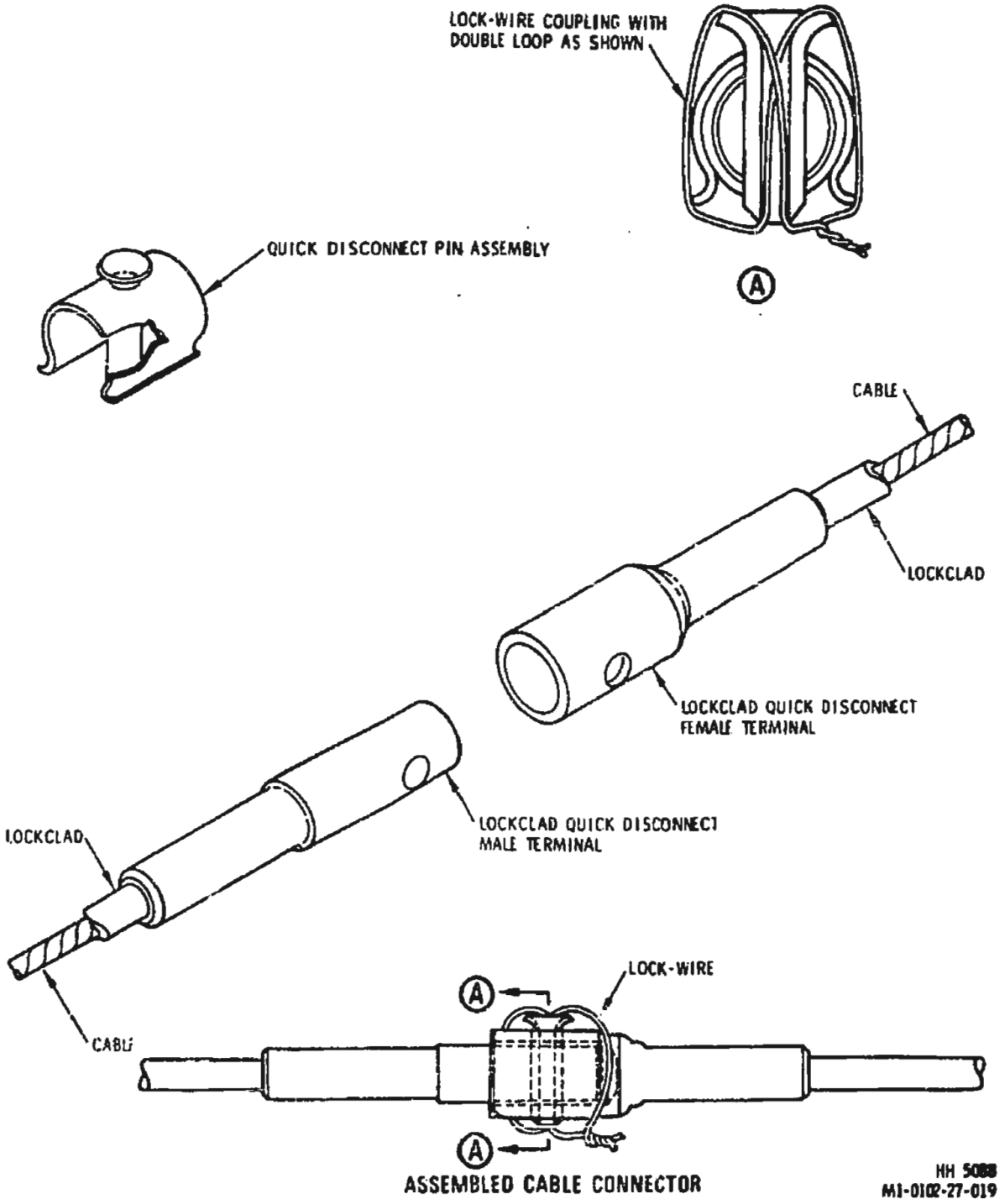
A. Description and Operation

The rudder system feel-spring assembly is installed to provide the pilot with artificial feel and centering in the rudder control system. The feel spring is located just forward and below rudder servo, zone 314. One end of feel spring is connected to output of rudder mechanical trim actuator. The other end is coupled to rudder control bellcrank assembly which is common with pilots rudder control system (Ref. Fig. 9).

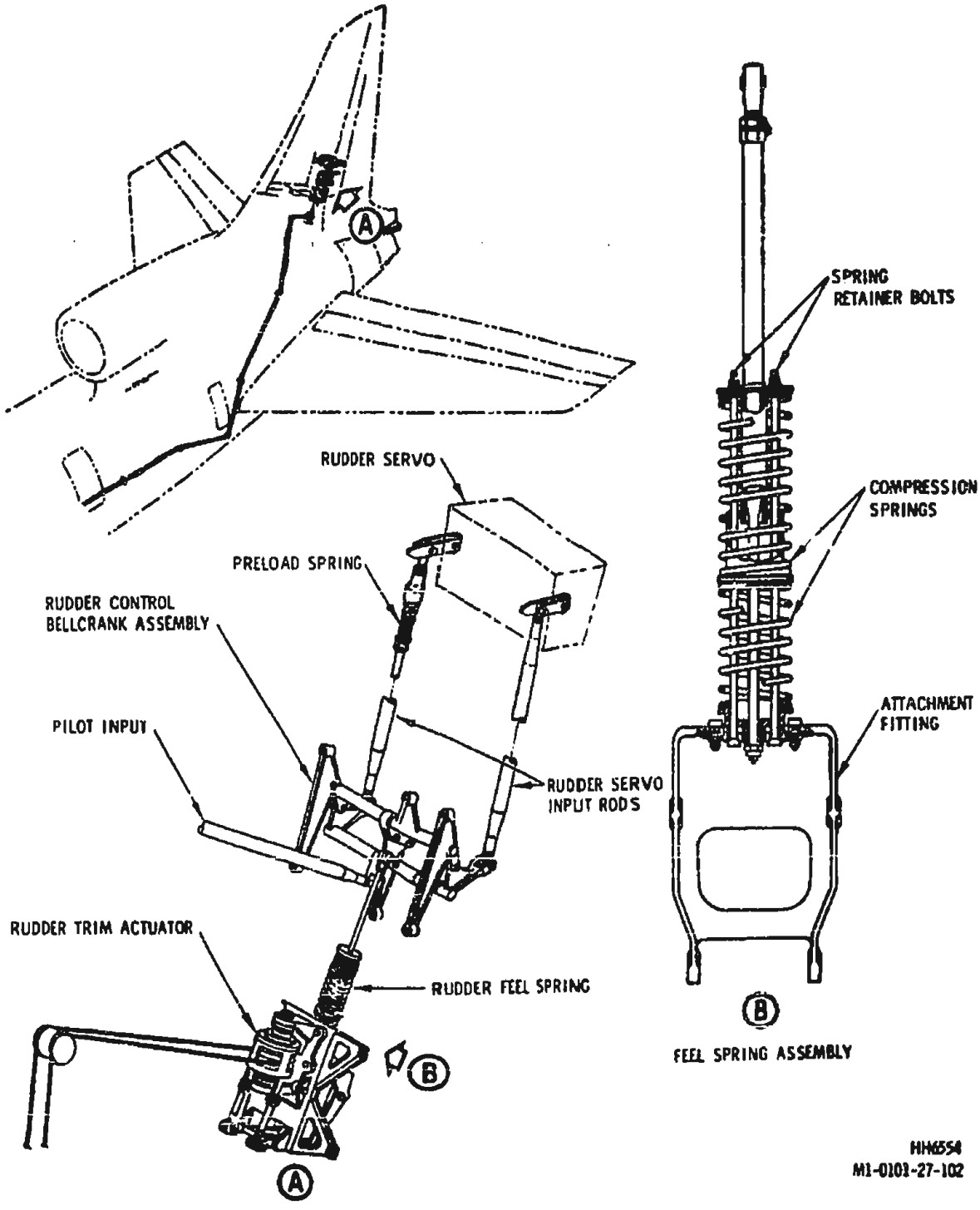
The caged double-acting spring assembly is composed of two springs with the same spring rate. As rudder pedals are moved, the springs in this assembly are compressed. Force from these springs, when compressed, drives back through the
R rudder control system supplying centering force and
R artificial feel. Rotation of rudder trim wheel in flight station results in stroking of mechanical trim actuator. Stroking of trim actuator applies an input into rudder control system through feel spring, and shifts neutral force position of feel spring.

7. Rudder Servo Control Module

A. Description



Lockclad Cable Coupling
Figure 8



Rudder Feel-spring Assembly
Figure 9

The single rudder is controlled by a triple hydromechanical position servo and two dual-tandem actuators. The servo is mounted to the lower rear spar of the vertical stabilizer just below the rudder actuators, zone 324, (Ref. Fig. 1).

The servo system consists of a triple control valve module, two dual-tandem piston actuators, and dual external feedback linkages (Ref. Fig. 10). The servo module is supplied by three hydraulic systems (A, B, and C). The servo consists of three hydraulic manifolds and one linkage manifold. Each hydraulic manifold assembly includes a filter and power control bypass, shutoff, and pressure relief/anticavitation valves.

The dual-tandem actuators are arranged so rear piston on left actuator receives system B pressures; rear piston on right actuator receives system C pressures; and forward piston on both actuators receives system A pressures. The three actuating paths operate in parallel and share the surface load. Any one of the three hydraulic systems can provide adequate rudder control, thus assuring fail-safe operation if one or two hydraulic systems fail.

The servo contains dual input arms to ensure fail safety of the servo input system. Rudder command input motions are transmitted internally to a completely enclosed summing linkage which displaces the three parallel power control valves. Rudder surface movement is fed back to summing linkage by dual feedback rods with a feedback input lever mounted on each side of servo. The servo contains permanent external stops to limit input arm rotation and hydraulically control rudder displacement to 30.5 degrees each side of neutral. The actuators are provided with overtravel and pistons do not bottom in normal operation.

The servo module includes a dual automode module which receive either autopilot inputs, or stability augmentation system (SAS) inputs, or both. A detailed description of servo components follows.

(1) 25-micron Absolute Filter

A 25-micron metallic mesh filter is installed in each hydraulic system to eliminate particle contamination of servo fluid supply. The three filters can be replaced in service and are reusable.

(2) Power Control Valve

The power control valve is a four-way spool selector valve that controls system flow and direction to actuator rudder left and rudder right lines in response

to internal linkage displacement. Valve jam protection is provided for each power control valve by a caged spring in the spool drive connection. The spring allows remaining spools to be displaced independently of a jammed spool.

(3) Bypass and Shutoff Valve (Main Servo Module)

Three bypass and shutoff valves are installed on the main servo module. Each valve provides a means of shutting off hydraulic supply to associated control valve. The two-position bypass and shutoff valve is connected to actuating cylinder lines and is installed in pressure line between filter and control valve. The normal position of bypass and shutoff valve allows passage of system pressure to control valve spool and blocks flow of fluid between actuator cylinder ports.

When associated solenoid shutoff valve is energized, hydraulic pressure is applied to one end of bypass and shutoff valve spool, displacing valve to the shutoff position. The shutoff position shuts off system supply pressure to power control valve and connects cylinder ports to each other and to return, thus shutting down that system. If system supply pressure falls below 450 psig, then bypass and shutoff valve spring automatically drives valve to shutoff position. Energizing system A and B solenoid shutoff valves does not interrupt supply pressure to automode components on servo.

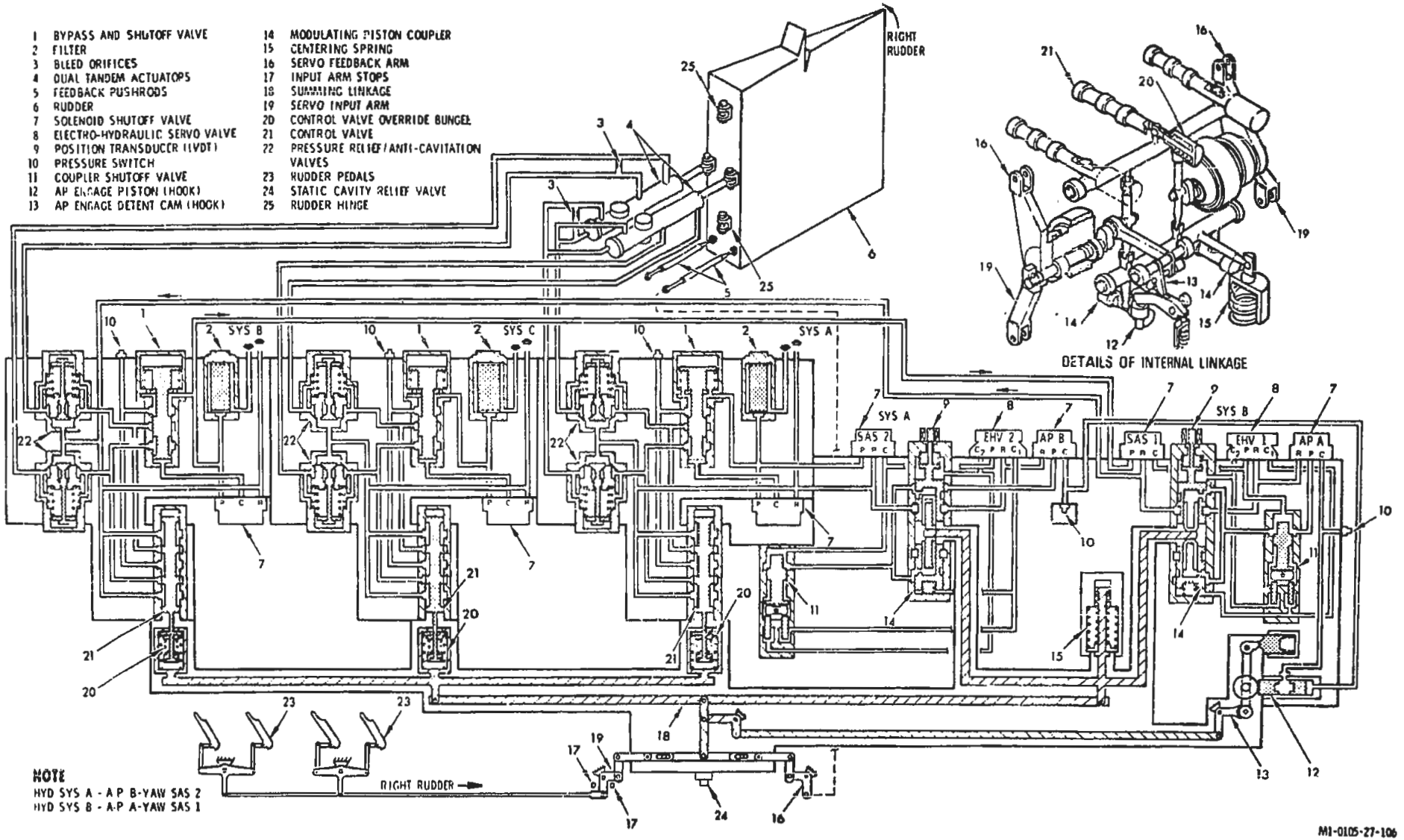
(4) Solenoid Shutoff Valve

Seven solenoid-operated hydraulic shutoff valves are plate mounted to rudder servo. Three shutoff valves control hydraulic flow to the three power control valves. Four shutoff valves control autopilot functions of servo and are covered under Automode Module. The solenoid shutoff valve controls operation of bypass and shutoff valve.

Energizing the solenoid shutoff valve hydraulically positions the bypass and shutoff valve to shutoff position, thus, shutting down that control system. The solenoid shutoff valves are controlled from PFCS MONITOR panel on pilots overhead panel which contains a guarded switchlight marked RUDDER (Ref. Fig. 4). Depressing switchlight energizes all three solenoid valves on rudder servo, which will deactivate servo and allow rudder to return to neutral position.

(5) Pressure Relief and Anticavitation Valve

1 BYPASS AND SHUTOFF VALVE
2 FILTER
3 BLEED ORIFICES
4 DUAL TANDEM ACTUATORS
5 FEEDBACK PUSHRODS
6 RUDDER
7 SOLENOID SHUTOFF VALVE
8 ELECTRO-HYDRAULIC SERVO VALVE
9 POSITION TRANSDUCER (LVDT)
10 PRESSURE SWITCH
11 COUPLER SHUTOFF VALVE
12 AP ENGAGE PISTON (HOOK)
13 AP ENGAGE DETENT CAM (HOOK)
14 MODULATING PISTON COUPLER
15 CENTERING SPRING
16 SERVO FEEDBACK ARM
17 INPUT ARM STOPS
18 SUMMING LINKAGE
19 SERVO INPUT ARM
20 CONTROL VALVE OVERRIDE BUNGEE
21 CONTROL VALVE
22 PRESSURE RELIEF/ANTI-CAVITATION VALVES
23 RUDDER PEDALS
24 STATIC CAVITY RELIEF VALVE
25 RUDDER HINGE



DETAILS OF INTERNAL LINKAGE

Rudder Servo Module Schematic
Figure 10

R
R
001e EFFECTIVITY: ALL

Two pressure relief and anticavitation valves are installed for each hydraulic system. A pressure relief and anticavitation valve is installed between each cylinder port and return port. The relief valve limits excessive cylinder pressure which might occur as a result of abnormal external hinge moments. The relief valve unseats at 3700 psig and relieves excess pressure into the return line.

The anticavitation function of the assembly prevents negative pressure buildup (cavitation) in actuating cylinder of a system that is shut down. Since actuator of shut down system is connected to control surface, actuator will be stroked with movement of surface. Stroking an actuator with fluid supply shut off can draw air into system across actuating cylinder rod seals. The anticavitation valve opens when 2 to 5 psi differential pressure is produced across anticavitation valve assembly and opens affected cylinder port to system return, allowing fluid to flow into the low-pressure side of cylinder.

(6) Pressure Switch

A pressure switch is plumbed into the pressure manifold between shutoff valve and control valve in each of three channels. The switch senses if hydraulic pressure is available to the power control valve. The switch signals are used in the load relieving system (LRS) computer (Ref. 27-51-00) to control hydraulic supply to rudder servo during rudder limiting mode. The switch signals are also used to operate hydraulic system A, B, and C OFF lights on control panel of flight control auxiliary unit (in forward electronic service center).

(7) Static Cavity Relief Valve

One static cavity relief valve is installed in the servo linkage manifold to protect manifold against excessive return pressure buildup. The linkage manifold is common to all three control valves and is filled with fluid before installation.

Fluid pressure in linkage manifold is a function of control valve spool lap leakage and will reflect approximate average of the three systems return pressure. The relief valve cracks at 250 psi with full flow 300 psi. The relief valve is ported overboard.

Occasional fluid discharge from the relief valve may occur due to transient high return pressure spikes and

can be considered normal. However, prolonged or persistent discharge is cause for further investigation.

R On aircraft 001-036 with SB29-079,
R fluid discharged from the relief valve port is directed
R overboard through a drain line to the servo compartment
R drain line bracket assembly (Ref. 51-10-06).

(8) Automode Module

Two automode modules (channels) are part of rudder servo (Ref. Fig. 10). The two automode channels operate in parallel and provide autopilot and stability augmentation system (SAS) inputs into the rudder servo (Ref. 22-15-00). Normally, both channels are active for SAS during all flight modes. For autopilot operation, both channels are active for landing mode. In cruise, only one channel is active for autopilot with second channel in standby.

The SAS and autopilot are dualized to ensure fail-safe operation. Each automode module consists of a solenoid shutoff valve, electrohydraulic servo valve (EHV), modulating piston/coupler, coupler shutoff valve, feedback transducer, and pressure switch. A detailed description of automode components follows.

(a) Solenoid Shutoff Valve

Two shutoff valves (Ref. Fig. 11) are plate mounted on each of the two automode modules. The shutoff valves are identical to shutoff valves used on the main rudder servo. One shutoff valve on each automode module controls hydraulic supply to the automode module components (actuated by SAS engagement). The second shutoff valve on each module controls one of the dual autopilot engaging cam (rudder hook) pistons (actuated by autopilot engagement). The autopilot engaging shutoff valve receives hydraulic pressure through the SAS engagement shutoff valve. The automode module must be active (SAS engaged) before engaging cam (rudder hook) can be engaged.

(b) Electrohydraulic Servo Valve (EHV)

An electrohydraulic servo valve (Ref. Fig. 12) is plate mounted to each automode module. The servo valve receives electrical autopilot and/or SAS input signals which are amplified and converted to hydraulic pressure and flow differentials. These

hydraulic signals are then ported to modulating piston/coupler. Stroking of modulating piston/coupler positions the three rudder power control valves through internal summing linkage.

(c) Modulating Piston/Coupler

The modulating piston/coupler converts hydraulic differentials generated by the electrohydraulic servo valve into mechanical displacement. The output of both modulating piston/couplers are applied to a common linkage to displace the three rudder power control valves. The coupler mechanism hydraulically couples modulating piston to drive arm. Thus, a malfunctioning automode module can be decoupled and allow functioning modulating piston/coupler to provide normal autopilot control. Control of coupling function is controlled by a coupler shutoff valve.

(d) Coupler Shutoff Valve

The coupler shutoff valve automatically disengages modulating piston from its drive arm if modulating piston bottoms or jams. The coupler shutoff valve consists of two pistons, a plunger valve, and a cam. The coupler shutoff valve compares modulating piston cylinder pressures, and if these pressures exceed a preselected value, one of the two pistons displaces the coupler shutoff valve spool. This action depressurizes modulating piston couplers and associated autopilot engage piston.

R (e) Feedback Transformer (LVDT)

R A (LVDT) Linear Variable Differential Transformer
R is coupled to each modulating piston. The
R transformer provides an electrical feedback signal to autopilot computer and completes the servo loop. The feedback signal controls modulating piston stroking rate.

(f) Pressure Switch

A pressure switch senses hydraulic pressure in manifold to autopilot engage piston of each automode channel. The switch signals are used in the autopilot computer engage logic to sense pressurizing of engage piston. The autopilot computer uses engage signals to sequence activation of each automode channel.

B. Operation

(1) Manual Operation

Normal operation of the rudder servo is with all three systems pressurized and active. The servo module is supplied by hydraulic systems A, B, and C. To simplify description of system operation, only system A will be described in detail. However, normally all three servo channels are active, and a command input would displace the three parallel-acting power control valves to control the two dual-tandem actuators in unison. Figure 10 shows the two dual-tandem actuators with all three servo channels and the two autopilot channels active.

Hydraulic system A fluid pressure (3000 psi nominal) is delivered to servo module, filtered by a 25-micron filter, and distributed to various servo components. Fluid is supplied to solenoid shutoff valve and to spring chamber of bypass and shutoff valve. The solenoid shutoff valve is normally deenergized, shutting off flow at pressure port (P) of solenoid valve and connecting solenoid valve cylinder port (C) to return (R). This permits bypass and shutoff valve to shuttle to the ON position as shown, and to port fluid to pressure port of power control valve. The servo is now active and will respond to control valve displacement. System A fluid is also supplied to solenoid shutoff valve of one of the autopilot control modules.

Operation of the manual servo is as follows. Application of left rudder by either Captain or First Officer will, through the cable and linkage system, produce a left rudder input to rudder servo. The command input will displace the three parallel power control valves. Control valve displacement will open left tandem actuator retract ports and right tandem actuator extend ports to system pressure. The left tandem actuator extend ports and right tandem actuator retract ports will be opened to return. Hydraulic flow is proportional to control valve displacement. The actuators will respond and position rudder left.

Rudder movement is fed back to servo through dual feedback arms and compared with input command through internal summing linkage. The feedback nulls the control valves when rudder reaches commanded position and hydraulically locks the rudder in that position. A right yaw input is similar except all motions and

hydraulic portings are reversed, causing rudder to position right.

(2) Stability Augmentation System (SAS) Operation

The electrohydraulic servo valve on each automode module receives electrical rate error signals from the yaw damper computer (Ref. 22-15-00). These error signals are generated by the yaw rate gyro. The servo valves convert these signals into proportional hydraulic flows and pressures. The differential pressure is applied across the modulating pistons and causes them to stroke against centering spring force. Modulating piston movement pivots summing lever around pilots input link and displaces three power control valves. The rudder responds to control valve displacement and provides corrective action to original rate error signal.

As the modulating piston strokes in response to incoming yaw rate error signals, a feedback signal is generated by a position transducer coupled to the modulating piston. The feedback signal controls stroke of modulating piston. When modulating piston reaches commanded position, the feedback signal cancels original error signal to electrohydraulic servo valve and causes servo valve to return to neutral. As aircraft yaw rate is reduced to zero, and yaw damper (rate gyro) error signal is also reduced to zero, the servo valve receives an opposite signal to return modulating piston to neutral.

The modulating piston centering spring mechanically holds automode end of summing lever in neutral when SAS is shut off. The centering spring provides a hard point for pilots manual inputs to react against. When SAS is operating, both pilot manual inputs and SAS inputs can be applied simultaneously to summing lever. Thus, control valve displacement is algebraic sum of pilot manual inputs and SAS inputs.

(3) Autopilot Operation

Autopilot operation can be engaged only if the SAS is engaged. With SAS engaged, automode shutoff valve is energized and electrohydraulic servo valve is receiving SAS correction signals. When autopilot is engaged, autopilot shutoff valve is energized to actuate autopilot engaging cam. The engaging cam mechanically locks pilots input linkage.

The engaging mechanism is designed so in event of autopilot malfunction, the pilot can apply enough force to rudder pedals to force cam roller out of engagement and assume immediate control of rudder.

With autopilot engaged, yaw position error signals and yaw rate (SAS) error signals are electrically summed in yaw computer. The resultant signal is applied to the electrohydraulic servo valve.

In cruise, only one autopilot channel is active, the second channel is in standby. During landing, both channels are active. However, either autopilot channel will provide full autopilot control of yaw system. Yaw position errors from yaw computer are fed to the electrohydraulic servo valve which converts the error signal to proportionate hydraulic flows to the modulating piston. The modulating piston strokes against the centering spring and displaces the summing lever which pivots around the fixed fulcrum produced by the autopilot engage mechanism. Movement of the summing lever displaces the three power control valves which hydraulically position rudder.

As rudder moves out of its trimmed position in response to autopilot commands, output of a rudder surface position transducer increases and eventually balances autopilot command signal with an equal and opposite signal. As the corrective maneuver returns aircraft to desired flight path, initial position error command signal diminishes and position transducer signal (which is now the larger of the two) takes effect as an opposite command signal to the electrohydraulic servo valve and returns rudder to original position.

The position transducer connected to the modulating piston controls the rate at which servo force is applied to rudder. This transducer signal, which is produced by modulating piston stroking, dampens original autopilot command signal. This damped signal is reflected in electrohydraulic servo valve and controls stroke of modulating piston.

8. Solenoid Shutoff Valve

A. Description and Operation

The solenoid shutoff valve is a plate-mounted, two-position, three-way hydraulic valve. The shutoff valve contains a pressure port, a cylinder port, and return port and functions to open the cylinder port to pressure or to return

(Ref. Fig. 11). The valve is mounted to the rudder components with four screws and is hydraulically sealed by a gasket plate face seal.

R On aircraft 001-017, ten shutoff valves are used in the rudder system. Seven are mounted to rudder servo, one for each of the three hydraulic systems on manual servo, and two each on two automode modules. One shutoff valve is mounted to the system C pressure regulator and one each is mounted to the two rudder deflection limiter actuators.

R On aircraft 018-999, eight shutoff valves are used in rudder system. Seven are mounted to rudder servo, one for each of the three hydraulic systems on manual servo, and two each on the two automode modules. One shutoff valve is mounted to the system C pressure regulator and control module.

The shutoff valve consists of a double coil assembly, hydraulic filter, sleeve assembly, and ball check valve assembly. Operation of shutoff valve is controlled by energizing or deenergizing solenoid. With solenoid deenergized, a spring-loaded plunger holds ball on pressure inlet seat against system pressure. In this condition, cylinder port is open to system return so no hydraulic pressure can be applied to cylinder port of shutoff valve.

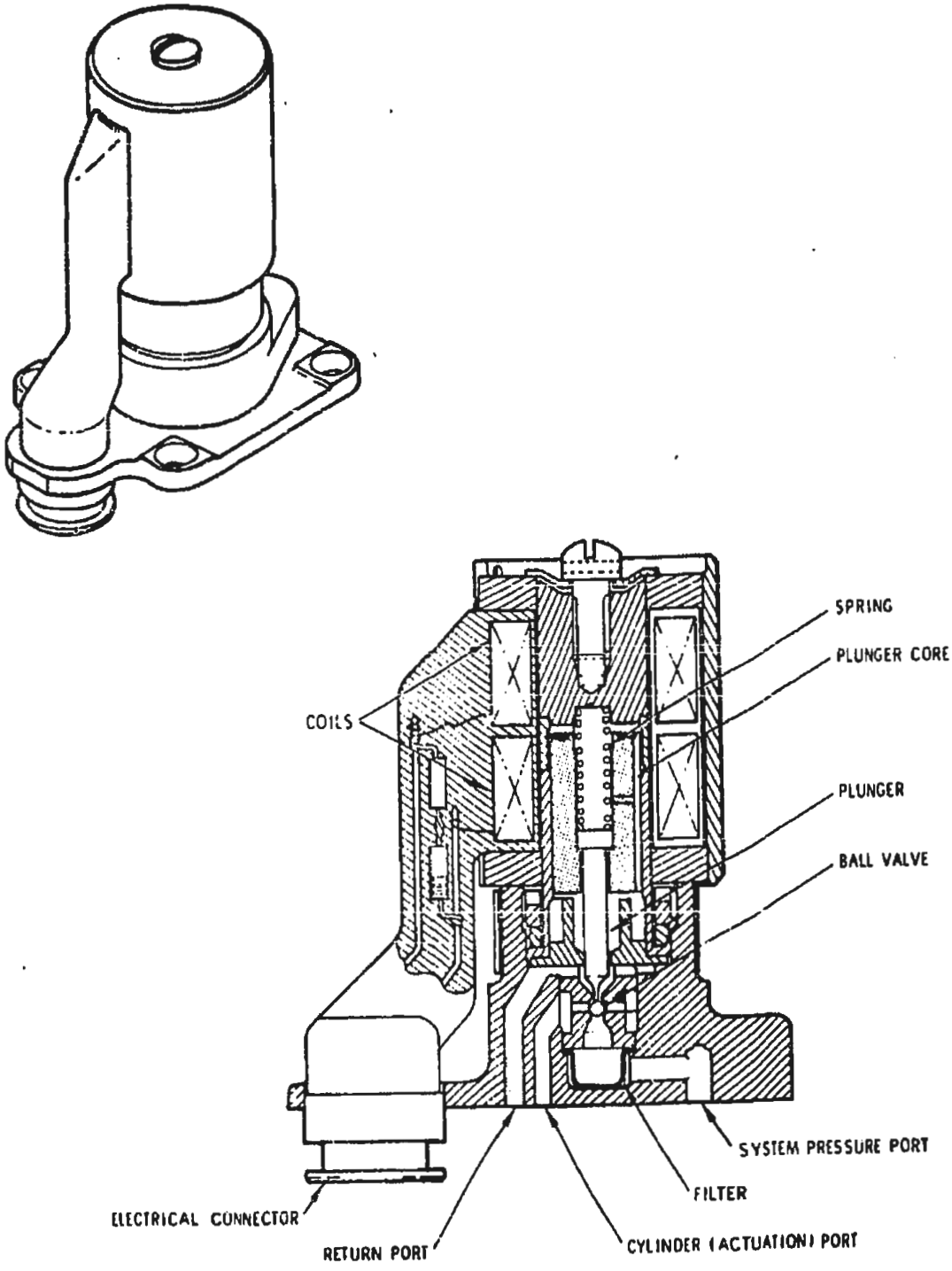
When solenoid is energized by 28V dc, the double coil magnetic force on plunger core and system pressure on ball overcome plunger spring force to raise plunger. System pressure then holds ball against return seat and opens pressure port to cylinder port. Loss of solenoid electrical power will allow spring-loaded plunger to force ball on pressure inlet seat, thus shutting off hydraulic flow to cylinder port of shutoff valve.

o. Electrohydraulic Servo Valve

A. Description

The electrohydraulic servo valve (EHV) is a plate-mounted, four-way proportional valve that controls flow of hydraulic fluid to a modulating piston actuator. Two EHV are mounted on rudder servo automode modules.

The EHV receives electrical yaw rate signals and, if autopilot is engaged, yaw position error signals, and positions modulating piston (Ref. 22-15-00). If autopilot is engaged, autopilot and SAS error signals are electrically



HH 6468
MI-A00-27-062

Solenoid Shutoff Valve
Figure 11

summed in computer and composite signal is directed to the EHV.

The EHV is essentially a signal converter and a two-stage hydraulic amplifier. The valve receives small electrical signals and converts them to large hydraulic output signals which are used to drive the modulating piston. The EHV consists of a torque motor, a jet-pipe first-stage nozzle with mechanical feedback, and a second-stage four-way spool valve is attached to first-stage nozzle through the feedback spring (Ref. Fig. 12). A 25-micron filter, installed in valve pressure manifold, ensures contaminant-free fluid supply to valve. The EHV is attached to rudder servo by four screws, and hydraulically sealed by plate-type gasket face seals.

The torque motor is an electromagnetic device which consists of two pole shoes, two coils connected by ships wiring to output of autopilot yaw system computer, and an armature which is coupled to the first-stage nozzle. The nozzle is held in neutral (hydraulic null) position by a spring.

B. Operation

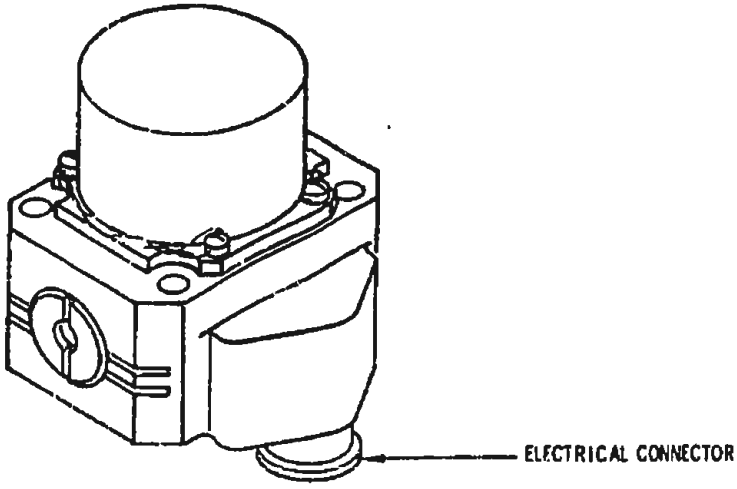
Hydraulic system pressure is supplied to the EHV where fluid is filtered and ported to both pressure ports of second-stage spool valve and to the first-stage nozzle. With a balanced electrical signal applied to the motor, the nozzle is held in neutral position. In this condition, nozzle fluid-jet impinges equally on both second-stage spool receiver jets, thus producing equal hydraulic pressures across the second-stage spool, which keeps the second-stage spool valve in null position.

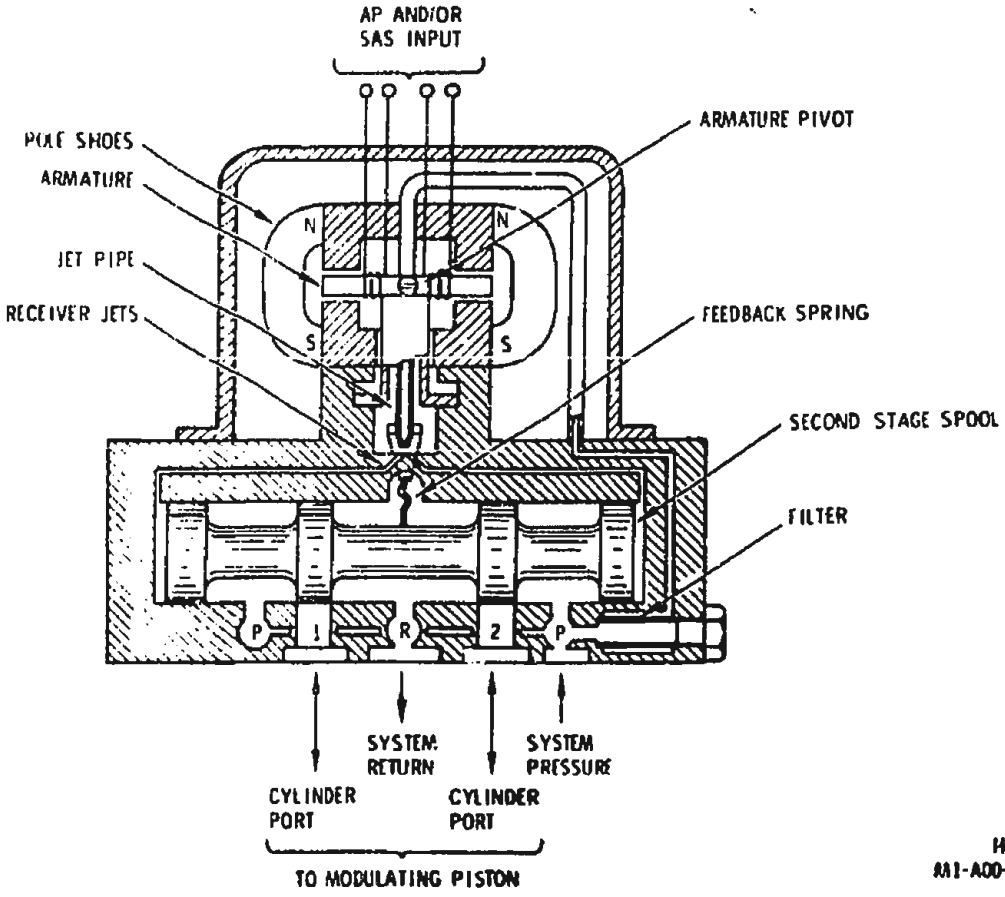
An electrical input command signal would produce an unbalanced magnetic force in the torque motor and cause armature and nozzle to rotate slightly. In this condition, the nozzle fluid-jet impinges unequally on second-stage spool receiver jets and produces a differential pressure across second-stage spool which would displace spool. Displacement of second-stage spool would control hydraulic flow and pressure to modulating piston.

The modulating piston is coupled to a position transducer (LVDT) which senses modulating piston displacement. The LVDT provides the feedback signal to the yaw computer, which completes servo-positioning loop.

10. Rudder Dual-tandem Actuator

A. Description and Operation





MH 5087
M1-A00-27-035

Electrohydraulic Servo Valve
Figure 12

Two dual-tandem actuators are installed between lower two rudder hinge fittings and serve to position rudder in response to rudder servo commands (Ref. Fig. 13). The actuators are trunnion-mounted to hinge fittings. Split trunnion caps are used to facilitate actuator removal.

Hydraulic connections to actuator are made through rigid hydraulic lines welded to a plate fitting. The plate fitting is bolted to top face of upper trunnion and sealed with a plate gasket seal. Internal passages route hydraulic fluid to respective piston chambers. Rotation of actuator on its trunnion causes slight twisting of rigid hydraulic lines. The hydraulic lines are routed to allow line twisting.

Each dual-tandem actuator contains two pistons on a common piston rod. The pistons are designated as a rod end piston and a head end piston. The rod end piston is an equal-area piston; the head end piston is an unequal area piston.

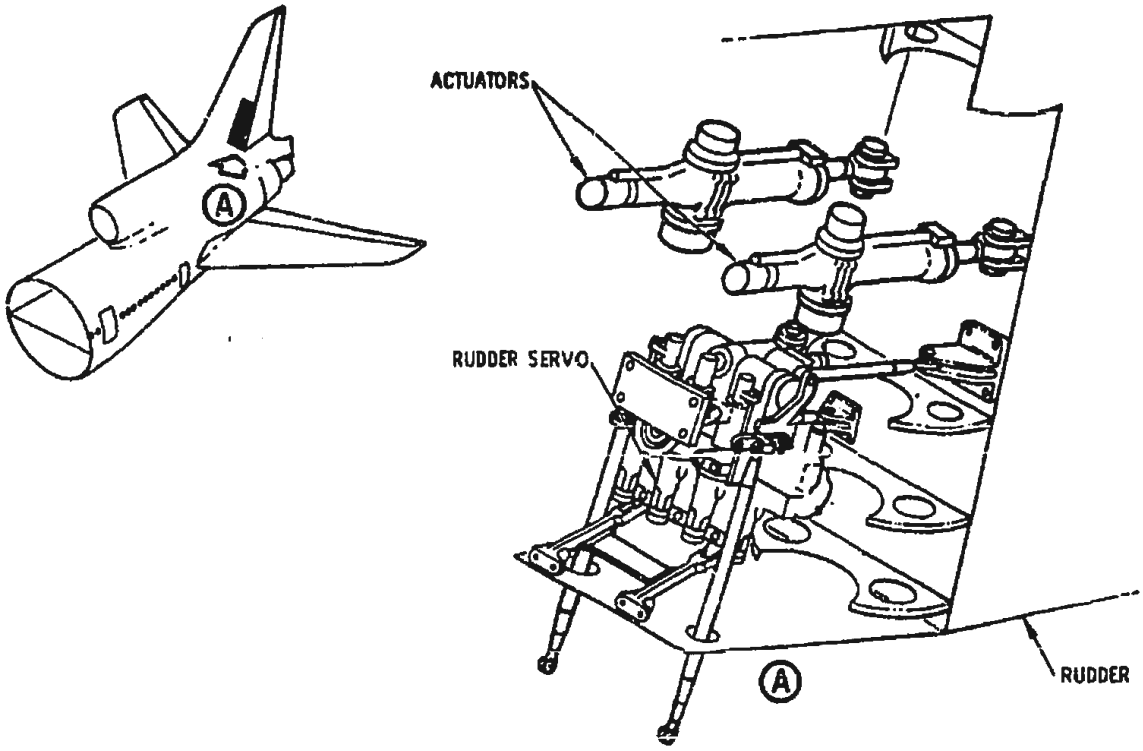
System A supplies the head end piston of both actuators. System B supplies the rod end piston of the left actuator, and system C supplies the rod end piston of the right actuator. The net result is that there are three actuation paths. The three actuation paths operate in parallel and share rudder load. Any system can provide adequate rudder control.

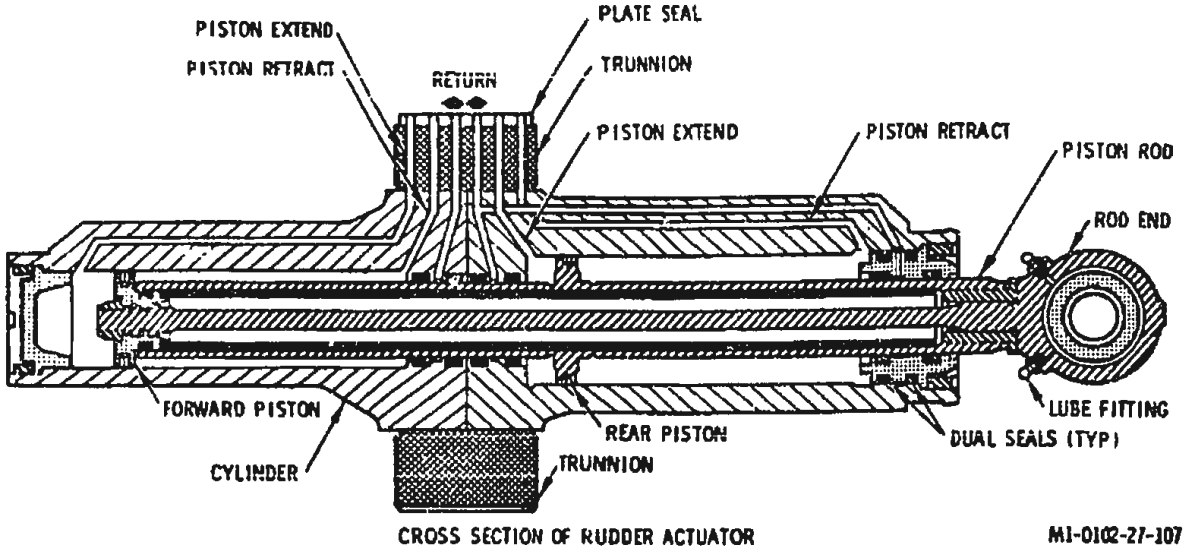
The piston rod gland includes a scraper ring and dual static and dynamic seals. The dual seals reduce external leakage as the cavity between the seals is connected to system return. Thus, the outer seals are exposed to system return pressures only. The bulkhead between rod and head pistons also use the dual dynamic seal configuration, with their cavities connected to their respective system return. The actuator rod end contains a self-aligning bearing. Two lubrication fittings are threaded into the rod end fitting.

11. Rudder Damper

A. Description and Operation

Four hydraulic dampers are installed between rudder and vertical stabilizer to protect rudder against possible rudder flutter. The rudder is pivoted on seven hinges, with No. 1 hinge being the lowest hinge. The dampers are mounted between machined clevis fittings on rudder hinge and hinge bearing fittings of hinges No. 3, 4, and 5, and machined clevis fittings mounted to vertical stabilizer and rudder just above hinge No. 6.





CROSS SECTION OF RUDDER ACTUATOR

M1-0102-27-107

Rudder Dual-tandem Actuator
Figure 13

The damper is a linear, hydraulic piston-type with an integral reservoir. Any rudder flutter oscillations will produce rapid reciprocating piston stroking. Dampening action is produced by controlling fluid flow across damper piston (Ref. Fig. 14).

The hollow damper piston rod contains a spool valve that controls hydraulic flow across piston by controlling spool port openings. The spool valve is load-sensitive (higher the fluid pressure, the larger the spool openings) and responds to damper pressures to produce an essentially lineal (straight) dampening curve. The spool also incorporates two ball relief valves to allow flow across damper piston if spool jams.

The damper reservoir fluid level is determined by viewing the reservoir piston indicator through a sight glass window in cylinder housing. Inscribed indicator marks on housing (FULL and REFILL) show when reservoir should be recharged with hydraulic fluid.

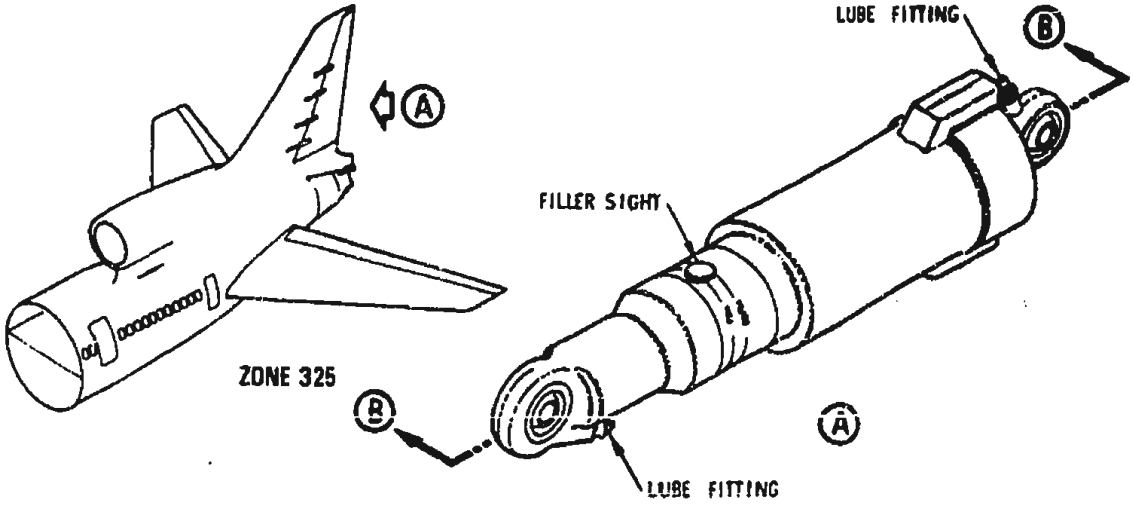
The piston rod end of cylinder contains two ports for filling damper and charging reservoir. One port contains a check valve and is used for charging; other port contains a threaded plug used for bleeding damper during filling procedure. The damper piston rod and cylinder mounting lug contain self-aligning spherical bearings. A lube fitting is provided for both bearings.

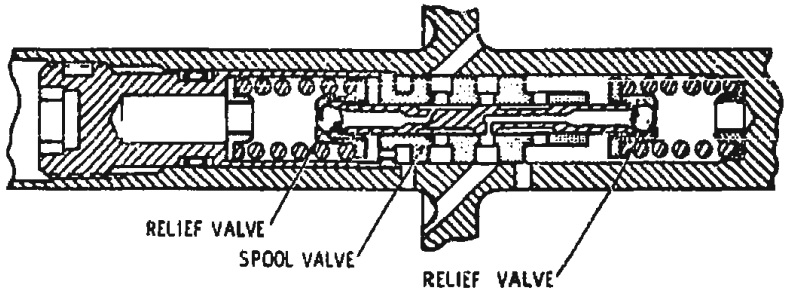
12. Rudder

A. Description and Operation

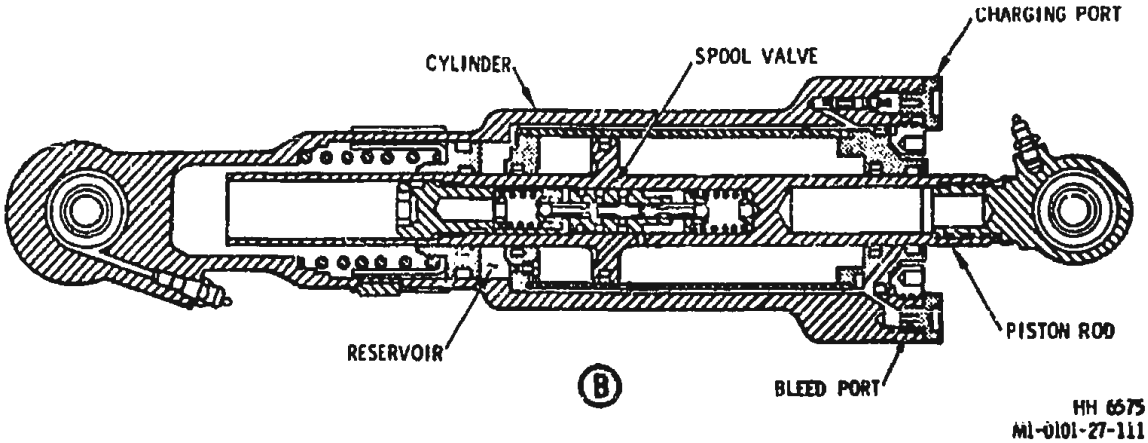
The rudder is a hinged, tabless control surface and, except for trailing edge, is all-metal construction. The rudder consists of a box structure, with front and rear spars, chordwise ribs, clad aluminum alloy skin panels, and a leading edge fairing. The trailing edge is made from multiple layers of fiber glass internally stiffened with bonded beaded doublers.

The rudder is supported by seven replaceable hinge bearings mounted to rudder front spar. Each bearing fitting includes a lubrication fitting. The lower two hinge bearings (No. 1 and 2, with No. 1 being the lowest hinge) are bolted to a heavy machined fitting that includes two rudder actuator pivot fittings. Hinge fittings No. 3, 4, and 5 include machined lugs for attaching three hydraulic dampers. A fourth damper is connected to a fitting mounted above No. 6 hinge.





SPOOL VALVE DETAIL



Rudder Surface Damper
Figure 14

Flutter damping is assisted by a counterbalance weight mounted near the top of the rudder and extending forward of hinge line (Ref. Fig. 15).

The rudder is a balanced surface. Weight and balance information is provided on a data placard located near lower end of front spar at rudder station 62. Access to placard is through access panels 324A and 325C left and right (Ref. 6-40-00). Weight and balance procedures are covered in Structure Repair Manual, Section 51-90-00.

Four additional fittings are mounted to rudder front spar and are used for the following. Two fittings, located below No. 1 hinge, are connected to rudder servo feedback pushrods. Two fittings, located above No. 3 hinge, operate position transducers; the top fitting is connected by a pushrod to two dual-surface position feedback transducers used in the autopilot system; the lower fitting is connected by a pushrod to a single surface-position transducer used for pilots surface-position indicator.

Three threaded fittings are provided on each side of the rudder near the No. 5 hinge to attach hoist fittings for removing and installing the rudder.

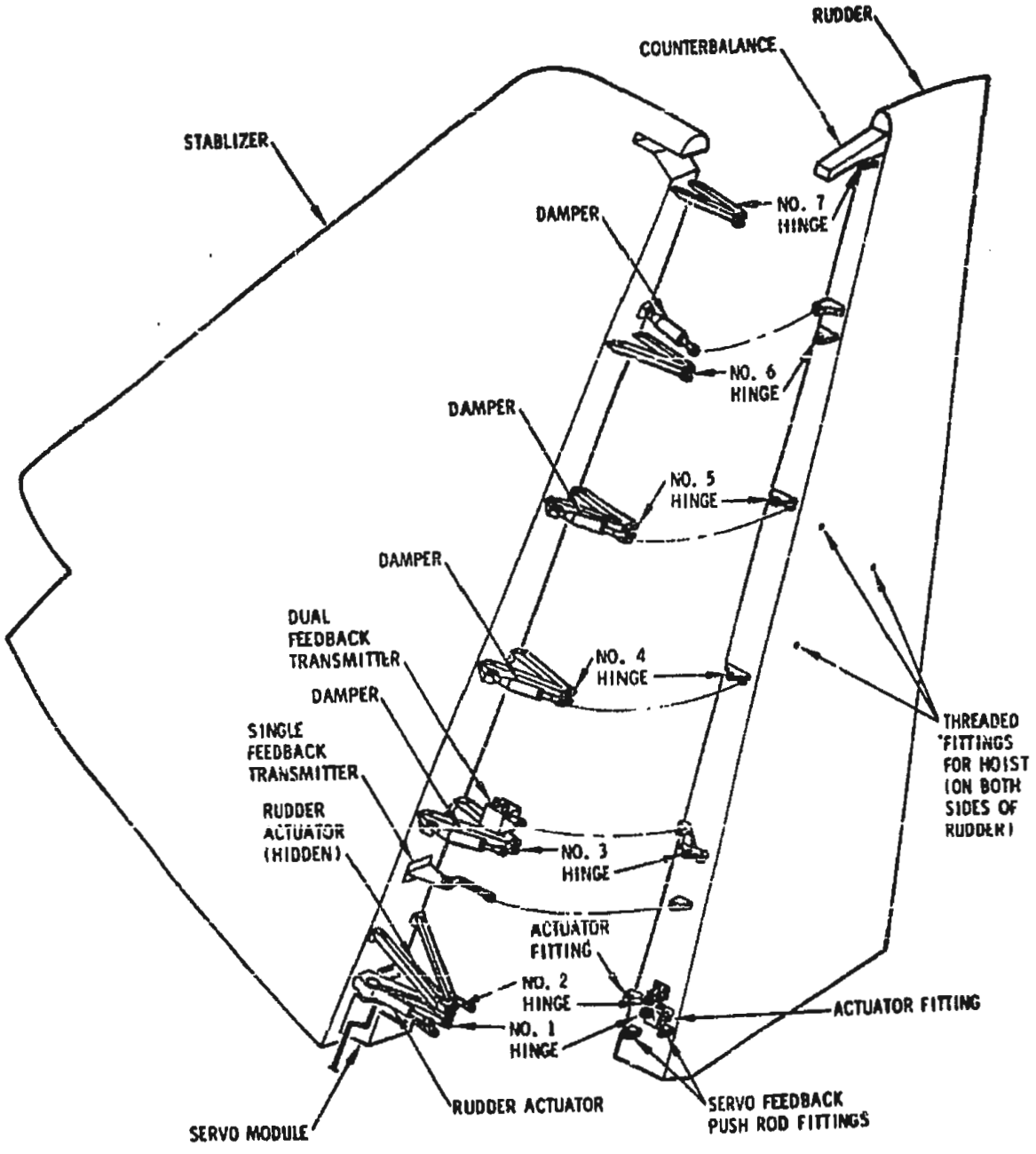
13. Hydraulic Pressure Regulator and Control Module

A. Description and Operation

The pressure regulator and control module is part of the rudder limiting system and is used to reduce available rudder power during cruise. The module is controlled by signals from the load relieving system (LRS) computer (Ref. Fig. 4). Normally, hydraulic systems A, B, and C supply the rudder servo.

On aircraft 001-018, 021, 022,
when aircraft speed exceeds 164 knots, system A and B are shut off at servo by LRS computer. At speeds in excess of 260 knots, the pressure regulator is energized to reduce system C pressure to 2000 psi.

On aircraft 019, 020, 023-999,
when aircraft speed exceeds 164 knots, the LRS computer shuts off System A at rudder servo and energizes system C pressure regulator to reduce System C pressure to 2000 psi. At speeds in excess of 260 knots, system B is shut off at rudder servo. The pressure regulator and control module is connected in series with system C pressure supply to the rudder servo. The module is bolted to the forward right side of the FS 1975 bulkhead approximately 4 feet above the



M1-0101-27-141

Rudder
Figure 15

horizontal stabilizer, zone 314. The module consists of a pressure regulator, solenoid shutoff valve, and a pressure switch (Ref. Fig. 16).

When pressure regulator is deenergized, the solenoid shutoff valve allows system C pressure to left side of pressure regulator. This moves regulator spool to full-open position and allows full pressure from inlet port to outlet port as shown in left view of Figure 16.

When pressure regulator is energized, the solenoid shutoff valve shuts off system pressure to left side of pressure regulator. This allows regulator to function as follows. Outlet pressure on spool end, opposite spring, moves spool against spring. When outlet pressure reaches 2000 psi, hydraulic force overcomes spring force and moves spool to restrict outlet pressure. This regulating action maintains 2000 psi outlet pressure (as shown in right view of Figure 16).

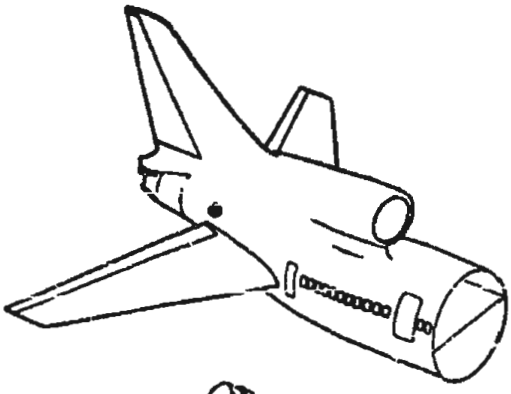
A pressure switch senses outlet pressure status and directs switch signals to load relieving system (LRS) computer (Ref. 27-51-00). The switch actuates by 2400 psi on increasing pressure and by 2100 psi on decreasing pressure.

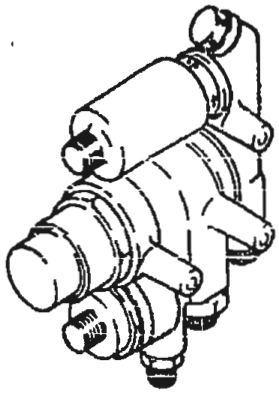
R 14. On aircraft 001-017,
Rudder Deflection-Limiter Actuator

A. Description and Operation

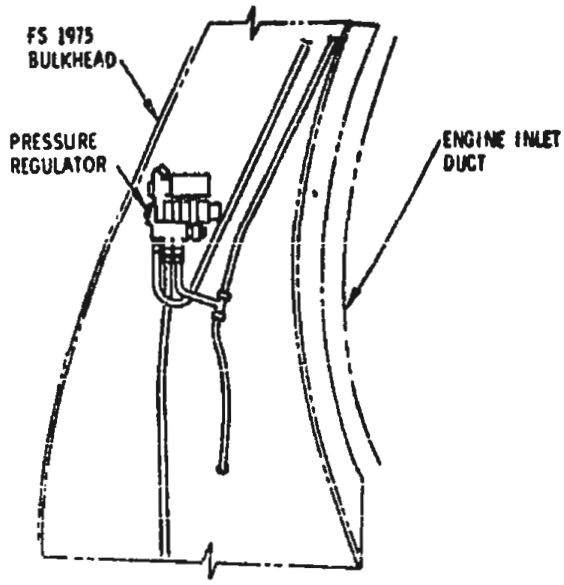
The rudder deflection-limiter actuator is a hydraulic piston actuator that positions two stop arms in response to signals from the load relieving system (LRS) computer (Ref. 27-51-00). The mechanical limiters can also be manually positioned from overhead RUDDER LIMITER panel by releasing (out) MNL/PUSH switchlight which then enables the ±8°/±30° switchlight. The rudder mechanical limiters can then be manually positioned to 8° or 30°. The stop arms, when extended, limit rudder deflection to 8 degrees each side of neutral.

Two actuators (installed side-by-side) and two stop arms are mounted between the two lower rudder hinge supports. The left actuator is supplied by hydraulic system B, the right actuator by hydraulic system A. One actuator is connected to each stop arm, and stop arms are link-connected to each other. Either actuator can hydraulically position both stop arms (Ref. Fig. 18). However, loss of electrical power to either actuator will prevent actuators from positioning to the limited (±8°) position.

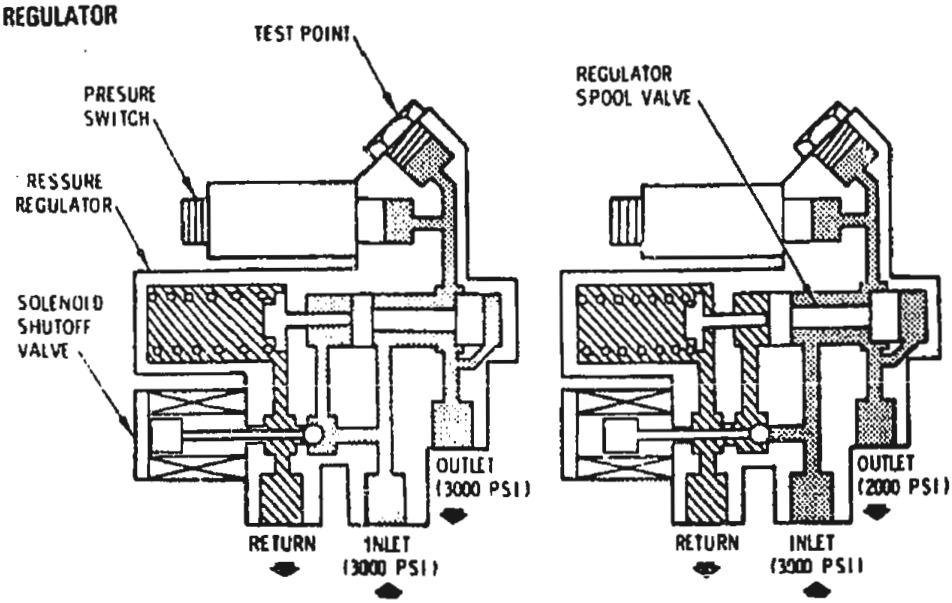




PRESSURE REGULATOR



VIEW LOOKING AFT
(RIGHT SIDE OF FUSELAGE)



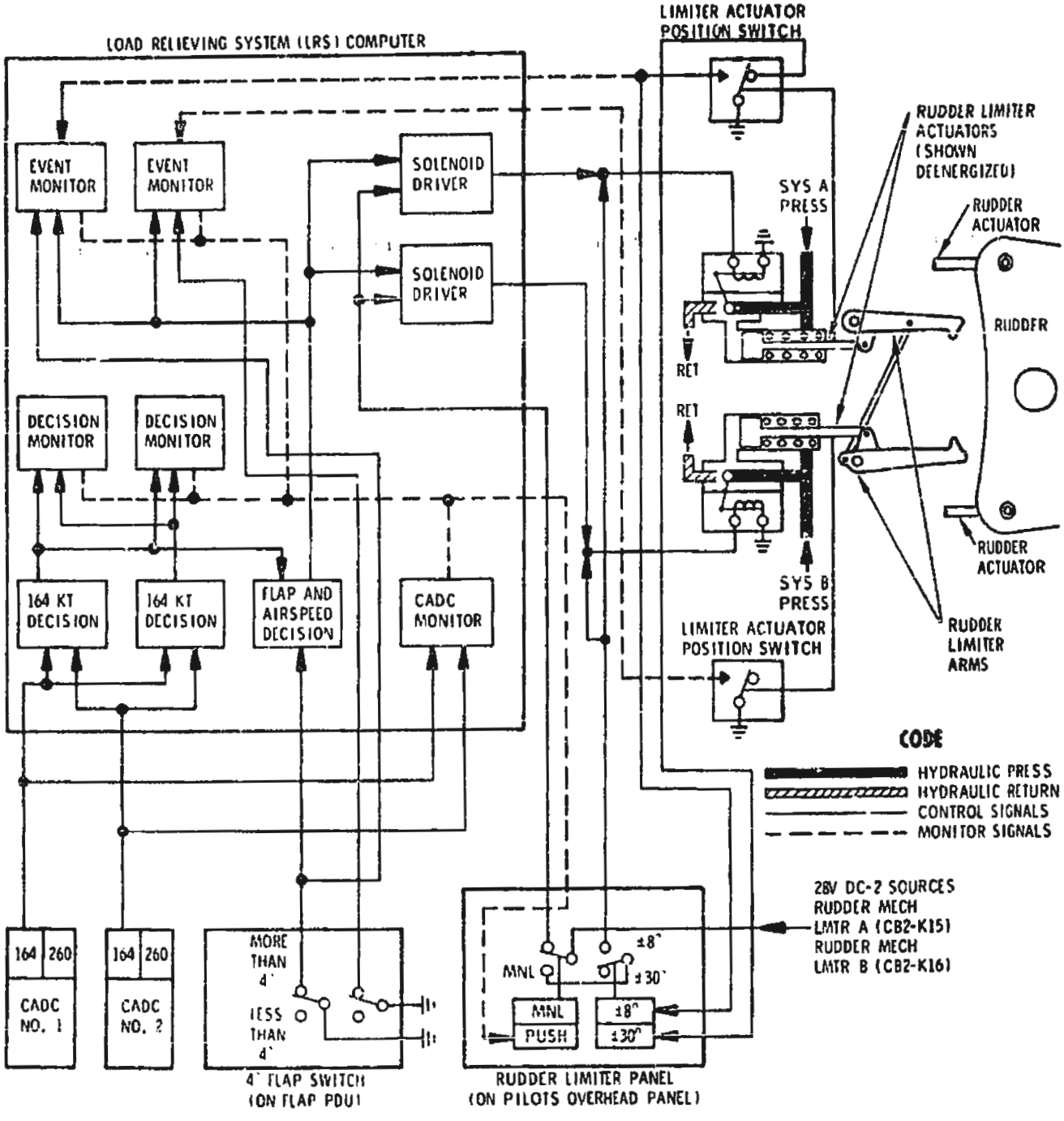
SHOWN IN DE-ENERGIZED OR OPEN POSITION

SHOWN IN ENERGIZED OR REGULATING POSITION

SCHEMATIC OF PRESSURE REGULATOR

HH 6631
MI-0102-27-109

Hydraulic Pressure Regulator and Control Module
Figure 16



M1-0102-27-097

CR
CR

Rudder Mechanical Limiting System Block Diagram
Figure 17

Each actuator assembly consists of a piston, a limit switch, and a plate-mounted solenoid shutoff valve. The shutoff valve actuation port is connected to the piston extend port. The piston retract port is always open to system pressure. In addition, the piston is spring-loaded to the retract position. When the shutoff valve is deenergized (full rudder), the piston is held in retract position by system pressure and spring. Energizing shutoff valve (rudder limiting) ports system pressure to piston extend port and extends piston. The piston extend area is much larger than the piston retract area. With system pressure on both sides of piston, the piston extend force is greater than piston retract force.

Piston extension is limited to 0.7 inch by a machined shoulder on piston rod which contacts cylinder. The piston rod is connected to the piston through a ball joint to allow relative movement between piston and rod.

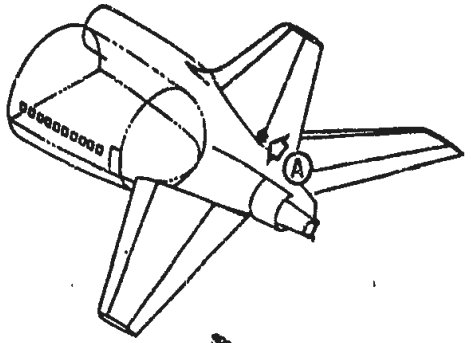
Two double-pole double-throw limit switches are mounted in the piston rod end cap. When the piston is fully extended, extend limit switches are actuated. The switch signals, which are fed to LRS computer, are used for fault detection and position indication. If mechanical limiters do not respond correctly to LRS computer signals, FLT CONT PANELS light and RUDDER MECH LMTR lights on pilots annunciator panel and MECHANICAL PUSH light on RUDDER LIMITER panel will come on.

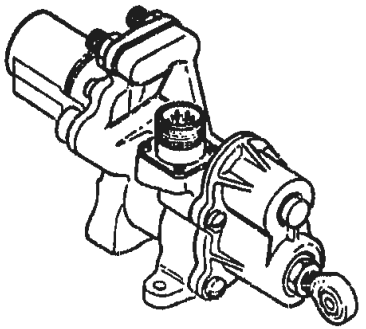
The solenoid shutoff valve (Ref. Fig. 11) is a two-position, hydraulic control valve that is plate-mounted to the limiter actuator. The shutoff valve is electrically controlled from the LRS computer. If aircraft speed is below 164 knots or flaps are extended 4 degrees or more, the shutoff valves are deenergized to allow full rudder deflection. If aircraft speed exceeds 164 knots and flaps are extended less than 4 degrees, the shutoff valves are energized to extend actuator piston and rotate stop arms to the limited position.

15. Visco Jets

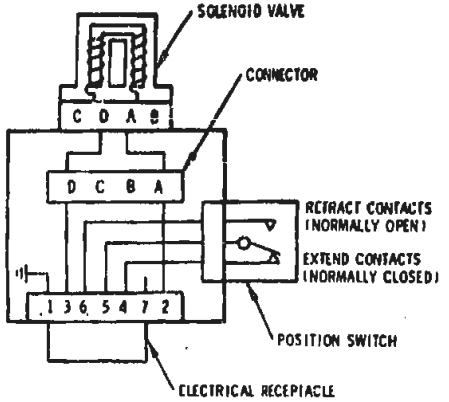
A. Description and Operation

Visco jets or rudder hydraulic fluid by-pass restrictors are located on the tube assembly, (Ref. Fig. 19) zone 320, connecting the dual rudder actuators to rudder servo. The forward section of the tube assembly contains the "A" system jet and aft section contains the "B" system jet. Both jets may be installed through either left or right restrictor access plugs. If hydraulic system "C" were to fail along with an undetected fail condition of surface flutter

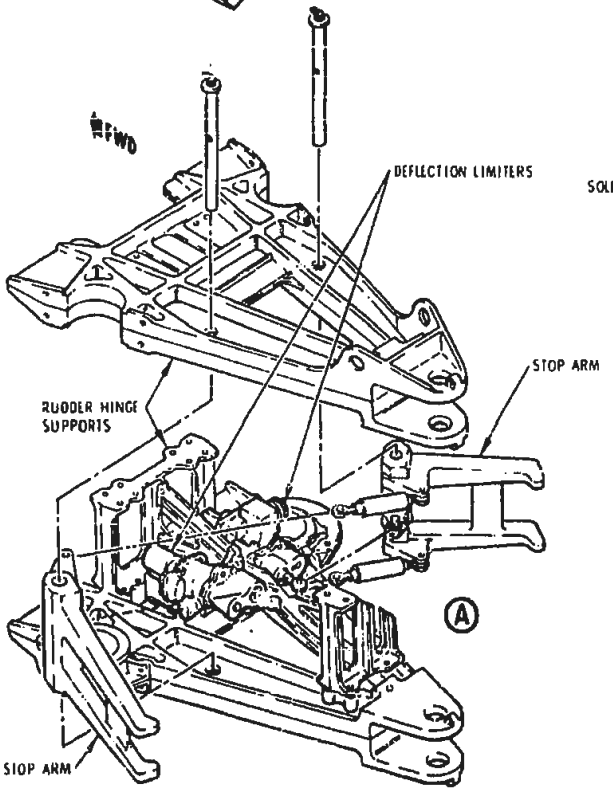




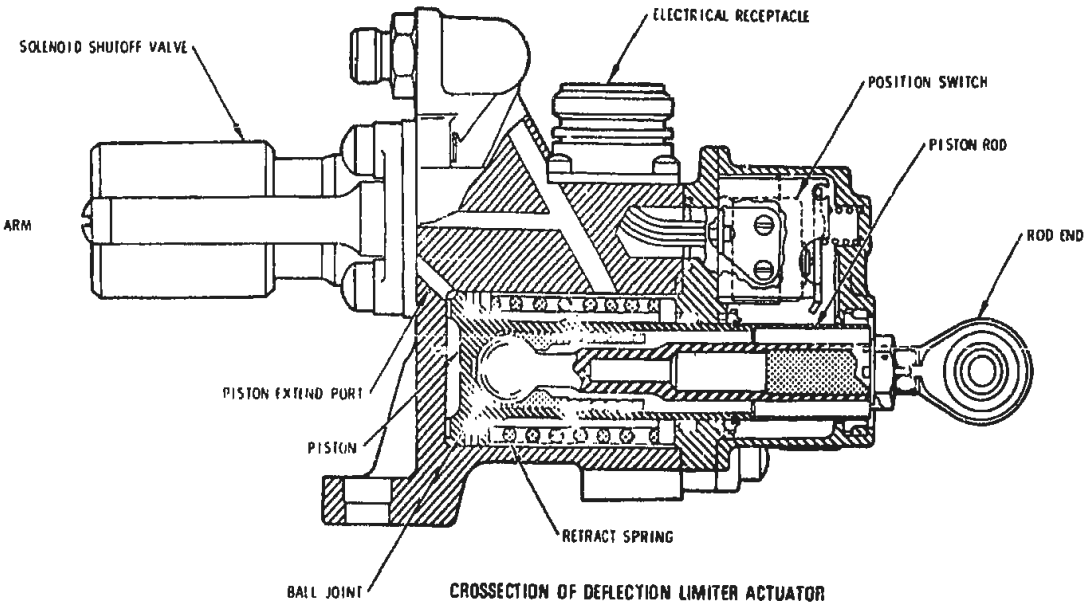
DEFLECTION LIMITER ACTUATOR



WIRING SCHEMATIC



DEFLECTION LIMITER ACTUATORS INSTALLATION

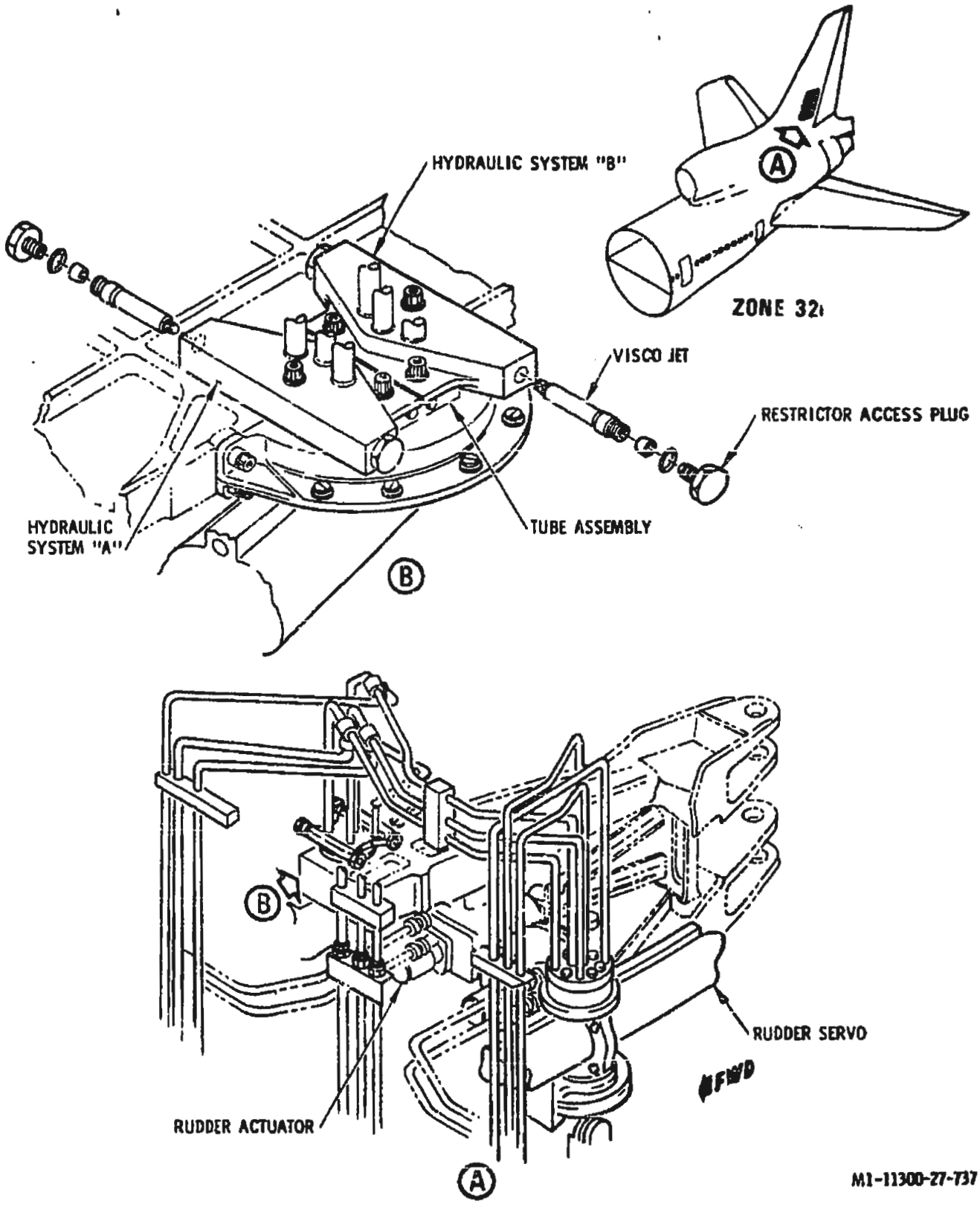


CROSSECTION OF DEFLECTION LIMITER ACTUATOR

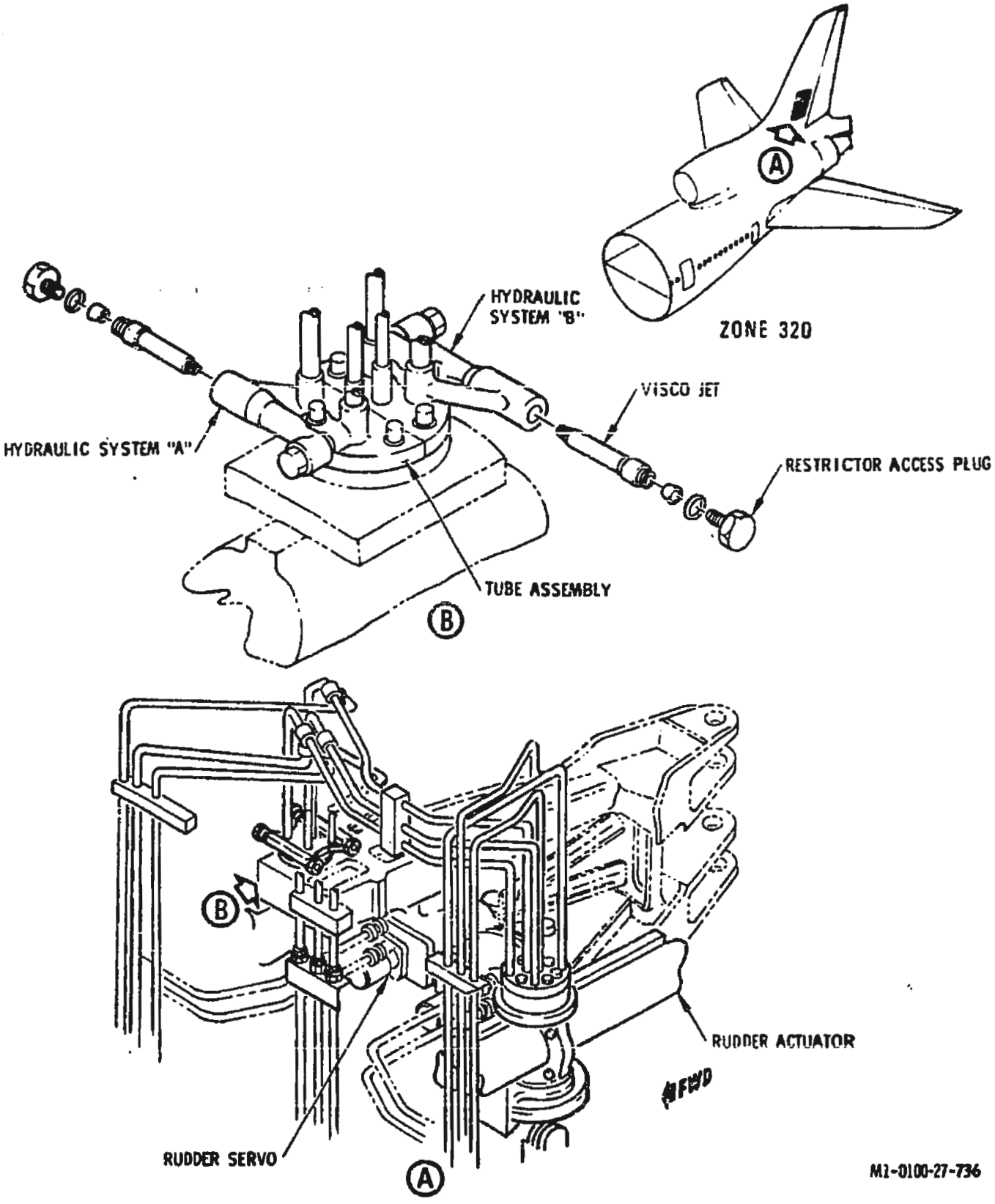
G444
M1-A01-27-116

Rudder Deflection-Limiter Actuator
Figure 18

dampers, a subsequent failure of either hydraulic System "A" or System "B" could cause rudder oscillation. The jets provide a dampening effect to the failed "A" or "B" system, eliminating the oscillation problem.



Visco Jet - Rudder Hydraulic Fluid Bypass Restrictors
Figure 19



Visco Jet - Rudder Hydraulic Fluid Bipass Restrictors
Figure 19

RUDDER CONTROL SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manaul Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

Fault Isolation Diagrams and Schematics List
Table 101

FIGURE	TITLE
101	Rudder Control System Component Location Index
102	Rudder Control System Component Locators
103	RUDDER HYDR LMTR Annunciator Light On
104	RUDDER TRIM EXCESSIVE
105	Rudder Pedal Operation Stiff or Notchy
106	Rudder Pedals Do Not Center
107	YAW Trim Wheel Operation Stiff or Notchy

Fault Isolation Diagrams and Schematics List (Cont)
Table 101

	FIGURE	TITLE
	108	Rudder Pedal Adjustment Crank Operation Stiff or Chatters
	109	RUDDER LIMITER HYDRAULIC PUSH Light On Dimly
	110	RUDDER MECH LMTR and RUDDER HYDR LMTR Annunciator Lights on
	111	RUDDER MECH LMTR Annunciator Light On.
	112	RUDDER HYDR LMTR Annunciator Light on. RUDDER LIMITER Panel HYDRAULIC PUSH Light out.
	SCHEM 1	Rudder Limiting System Electrical Schematic
	SCHEM 2	Rudder Hydraulic Limiter Fault Monitoring Simplified Schematic
R	SCHEM 3	Rudder Servo Simplified Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACTUATOR – DEFLECTION LIMITER	2	VERT STAB/324AL, 324AR	27-21-16
AIR DATA COMPUTER (ADC)	2	FESC/112AB	34-14-01
COMPUTER – LOAD RELIEFING SYS (LRS)	1	FESC/112AB	27-21-00
DRUM – RUDDER TRIM CONTROL CABLE	1	FESC/112AB	27-22-02
FLIGHT CONTROL AUXILIARY UNIT (FCAU)	1	FESC/112AB	27-21-00
MODULE – RUDDER SERVO CONT	1	VERT STAB/324AL, 324AR	27-21-07
NOSEWHEEL STEERING SYSTEM	1	FESC/112AB & 211AB	32-51-04
PRESSURE SWITCH – A & B SYS, RUD SERVO	2	VERT STAB/324AL, 324AR	27-21-25
PRESSURE SWITCH – C SYS, RUD SERVO	1	AFTERBODY/317BB	27-21-19
QUADRANT – AFT CABLE	1	VERT STAB/313FR	27-21-00
RUDDER FUSING SYSTEM	1	ABOVE HORIZ STAB/317BB	29-11-74
RUDDER PEDALS	4	FLT STA	27-21-01
SPRING – RUDDER FEEL	1	VERT STAB/313FR	27-21-06
STOP ARM – DEFLECTION LIMITER	2	VERT STAB/324AL, 324AR	27-21-16
SWITCHBOX – FLAP POWER DRIVE UNIT (PDU)	2	HYD SERV CENT/147AB	27-51-12
TRIM CONTROL – AILERON AND RUDDER	1	FLT STA, CENT CONSOLE	27-12-01
VALVE – SOLENOID SHUTOFF, RUD SERVO	9	VERT STAB/324AL, 324AR	27-21-08

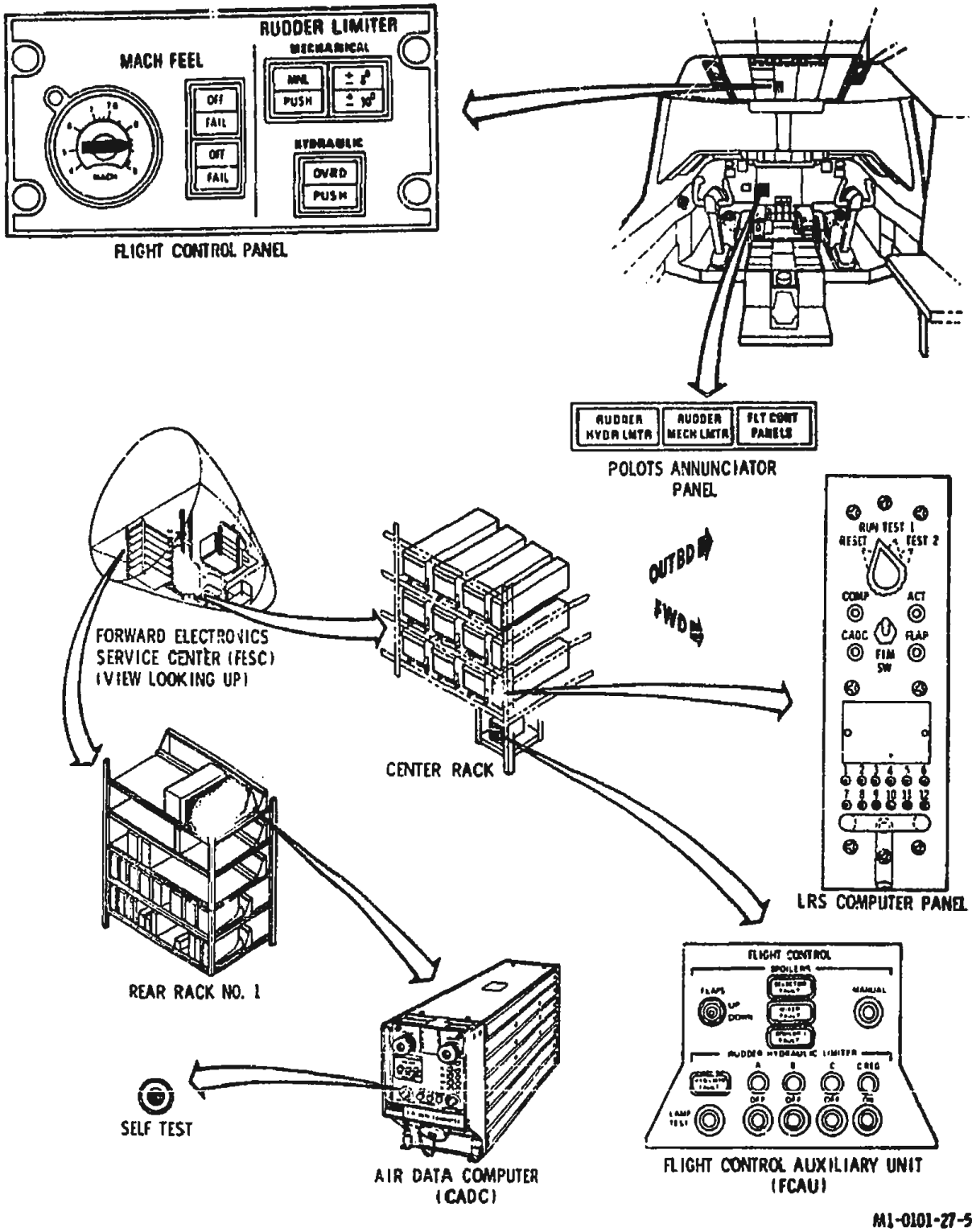
M1-0000-27-865

Rudder Control System Component Location Index
Figure 101

COMPONENT	QTY	AREA/ACCESS	REFERENCE
BELLCRANK – RUDDER CONTROL	1	VERT STAB/324AL, 324AR	27-21-06
COMPUTER – LOAD RELIEVING SYS (LRS)	1	FESC/112AB	27-21-00
ADC	2	FESC/112AB	34-14-01
DRUM – RUDDER TRIM CONTROL CABLE	1	FESC/112AB	27-22-02
FLIGHT CONTROL AUXILIARY UNIT (FCAU)	1	FESC/112AB	27-21-00
MODULE – RUDDER SERVO CONT	1	VERT STAB/324AL, 324AR	27-21-07
NOSEWHEEL STEERING SYSTEM	1	FESC/112AB AND 211AB	32-51-04
PRESSURE SWITCH – A B & SYS, RUD SERVO	2	VERT STAB/324AL, 324AR	27-21-25
PRESSURE SWITCH – C SYS, RUD SERVO	1	AFTERBODY/317BB	27-21-19
QUADRANT – AFT CABLE	1	VERT STAB/313FR	27-21-00
RUDDER FUSING SYSTEM	1	ABOVE HORIZ STAB/317BB	29-11-74
RUDDER PEDALS	4	FLT STA	27-21-01
SPRING – RUDDER FEEL	1	VERT STAB/313FR	27-21-06
SWITCHBOX – FLAP POWER DRIVE UNIT (PDU)	2	HYD, SERV CENT/147AB	27-51-12
TRIM CONTROL – AILERON AND RUDDER	1	FLT STA/P17	27-12-01
VALVE – SOLENOID SHUTOFF	9	VERT STAB/324AL, 324AR	27-21-08

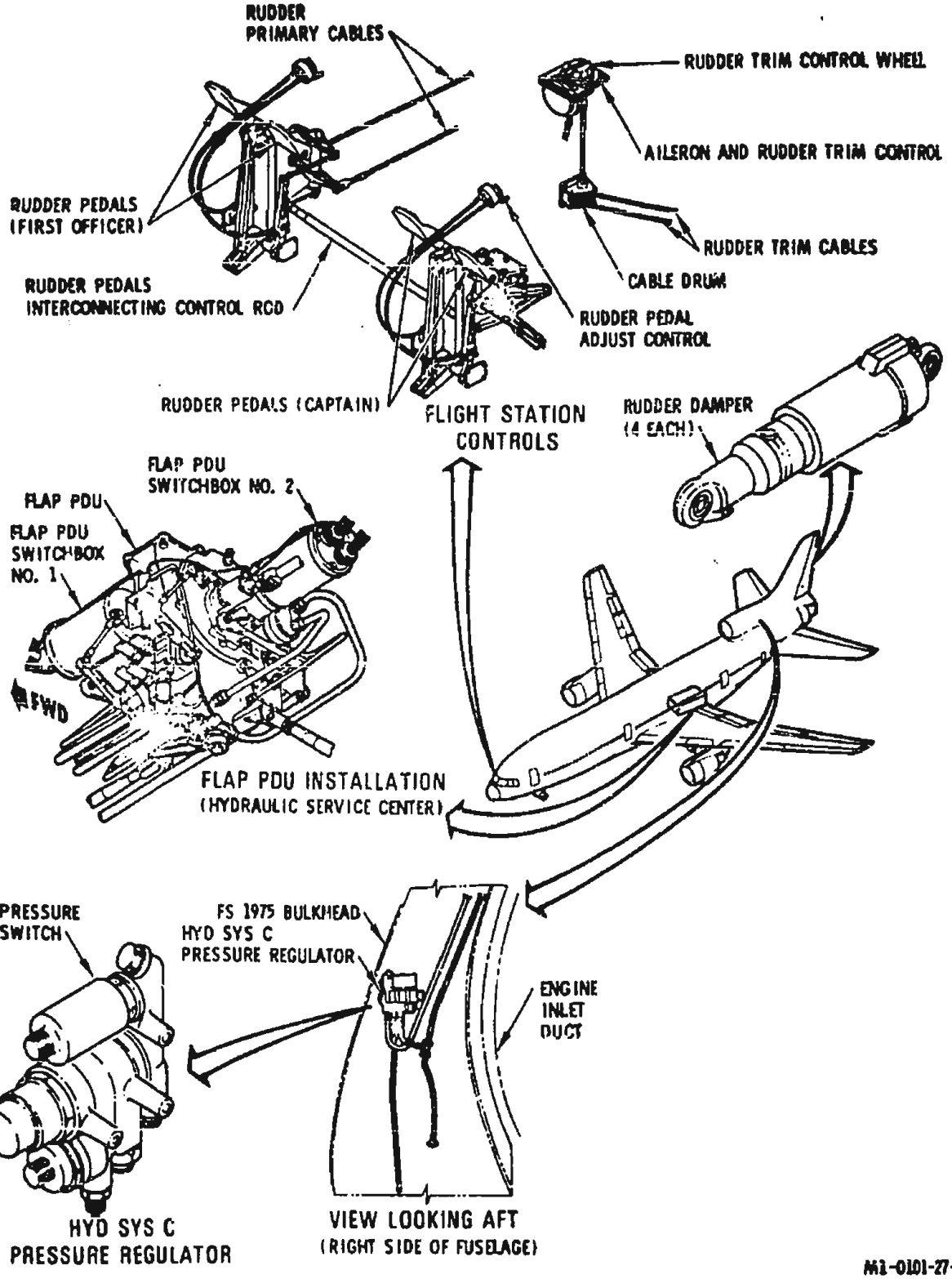
M1-0000-27-884

Rudder Control System Component Location Index
Figure 101

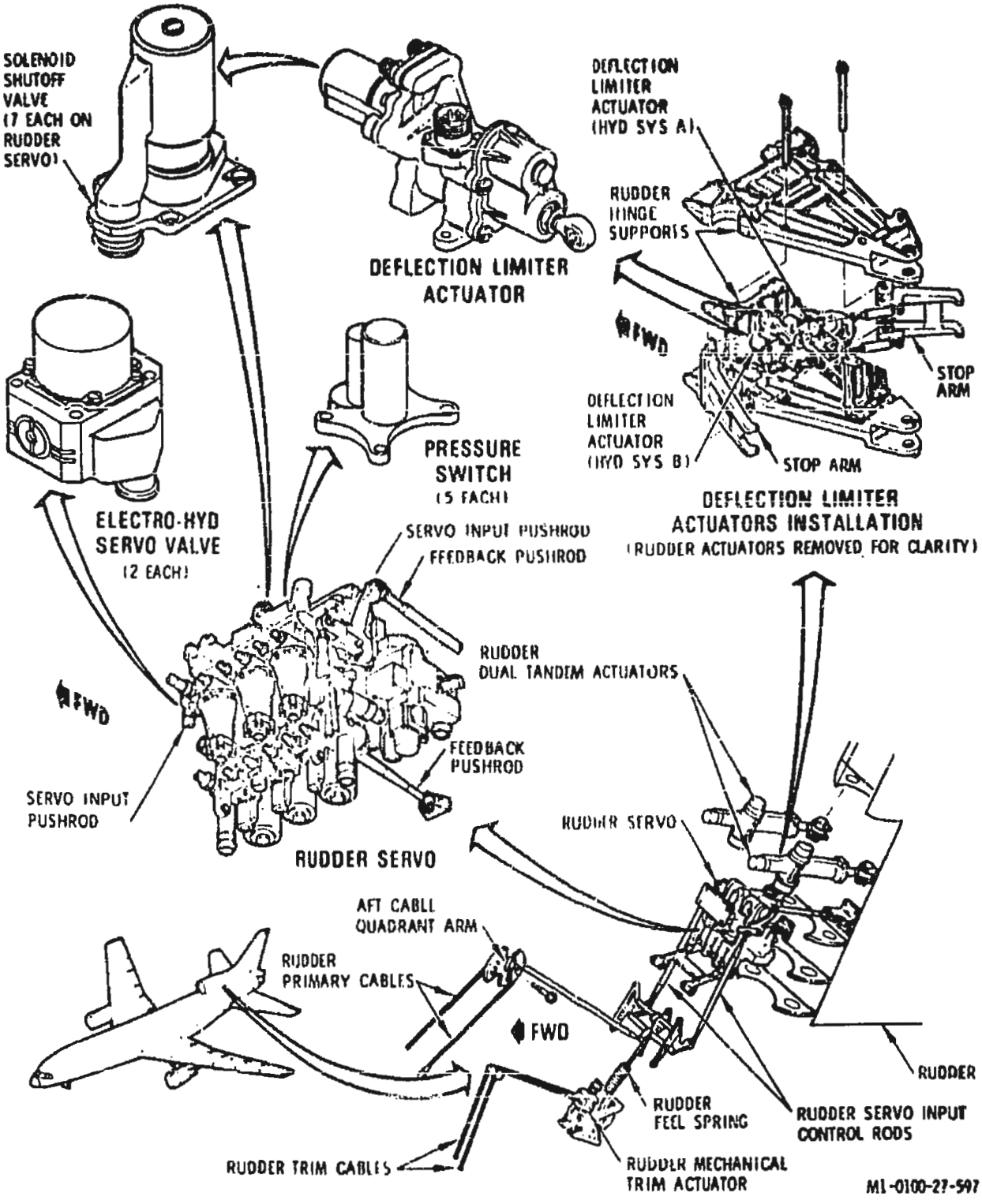


M1-0101-27-595

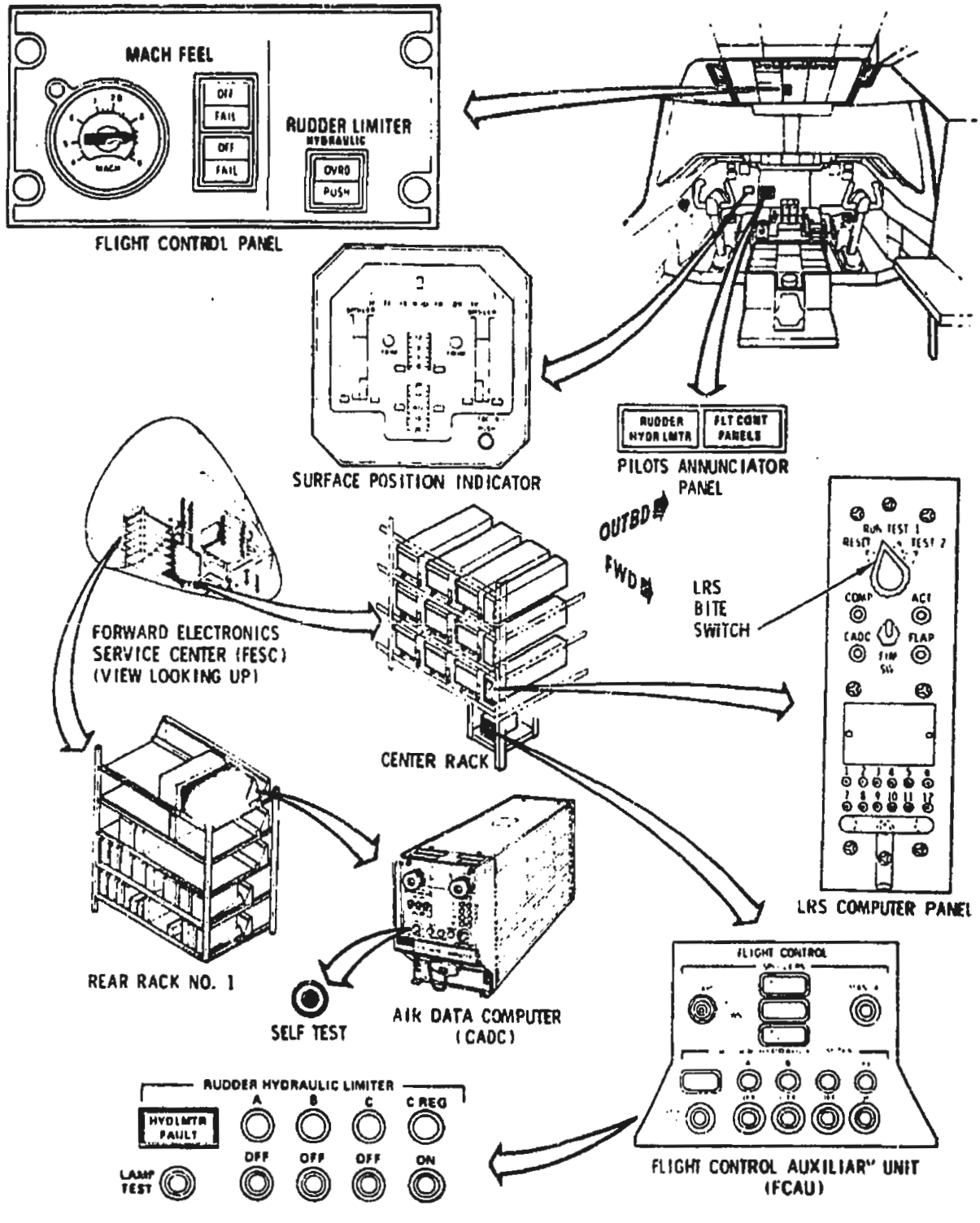
Rudder Control System Component Locators
Figure 102 (Sheet 1)



Rudder Control System Component Locators
Figure 102 (Sheet 2)

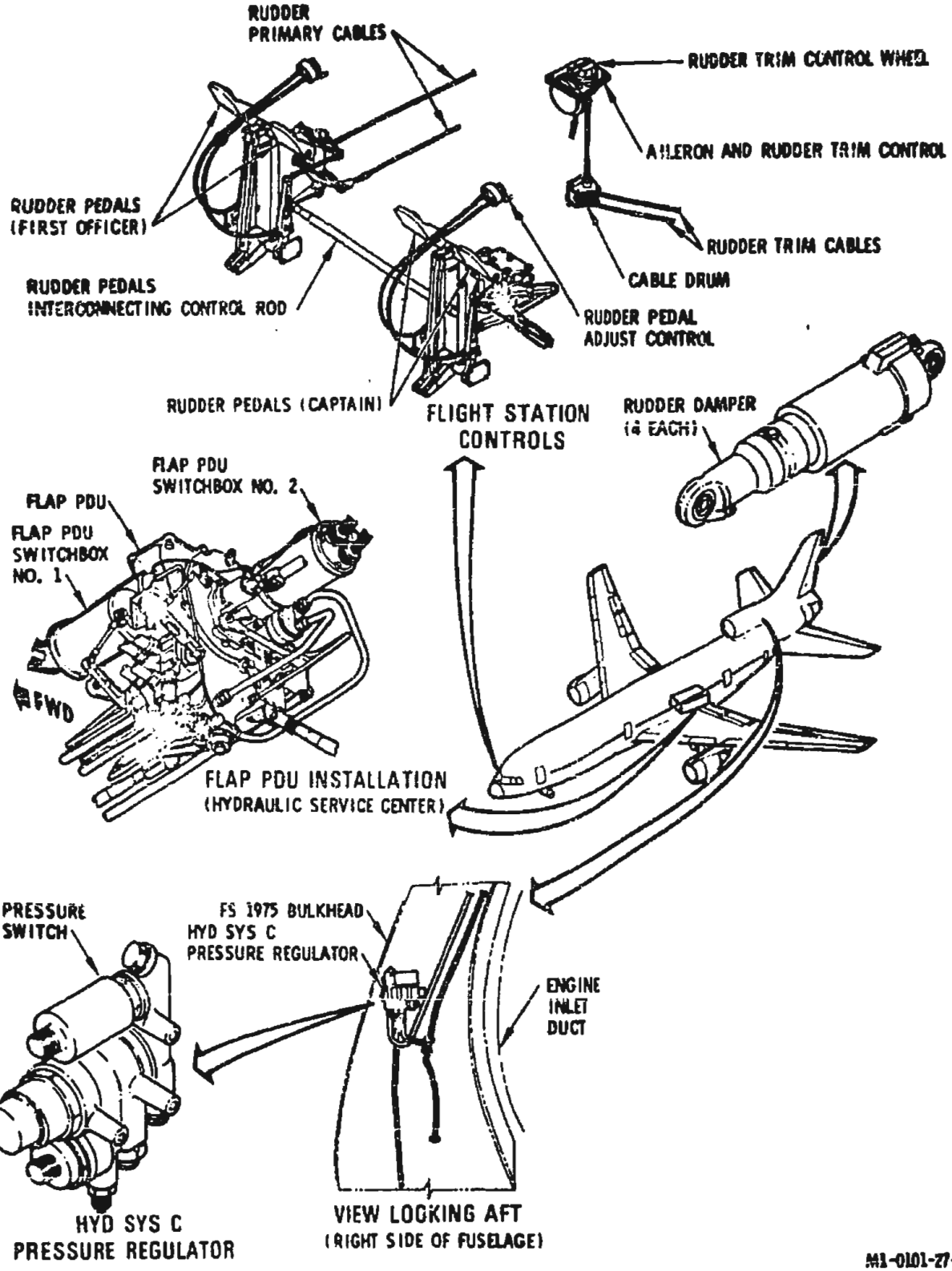


Rudder Control System Component Locators
Figure 102 (Sheet 3)

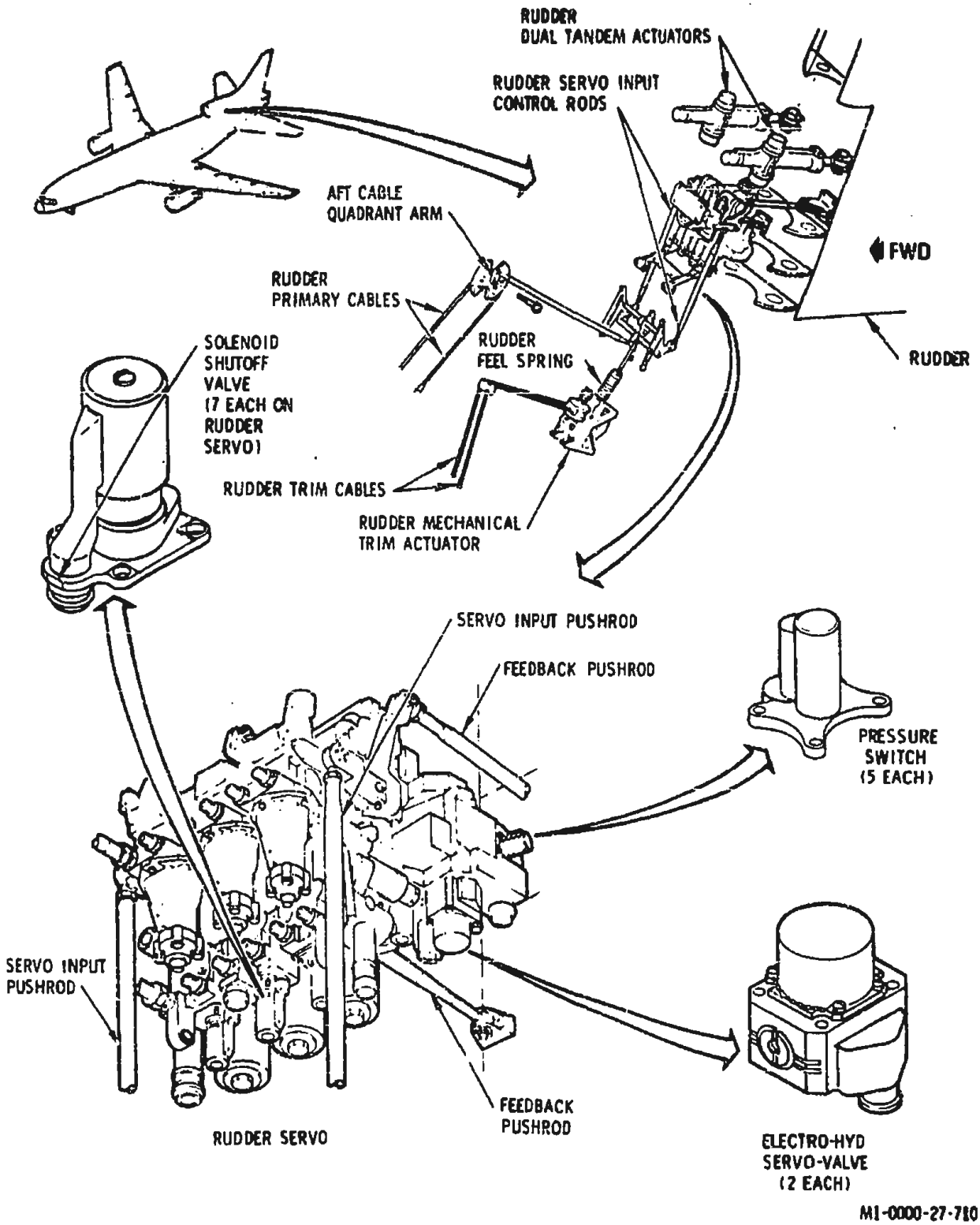


M1-0000-27-709

Rudder Control System Component Locators
Figure 102 (Sheet 1)



Rudder Control System Component Locators
Figure 102 (Sheet 2)

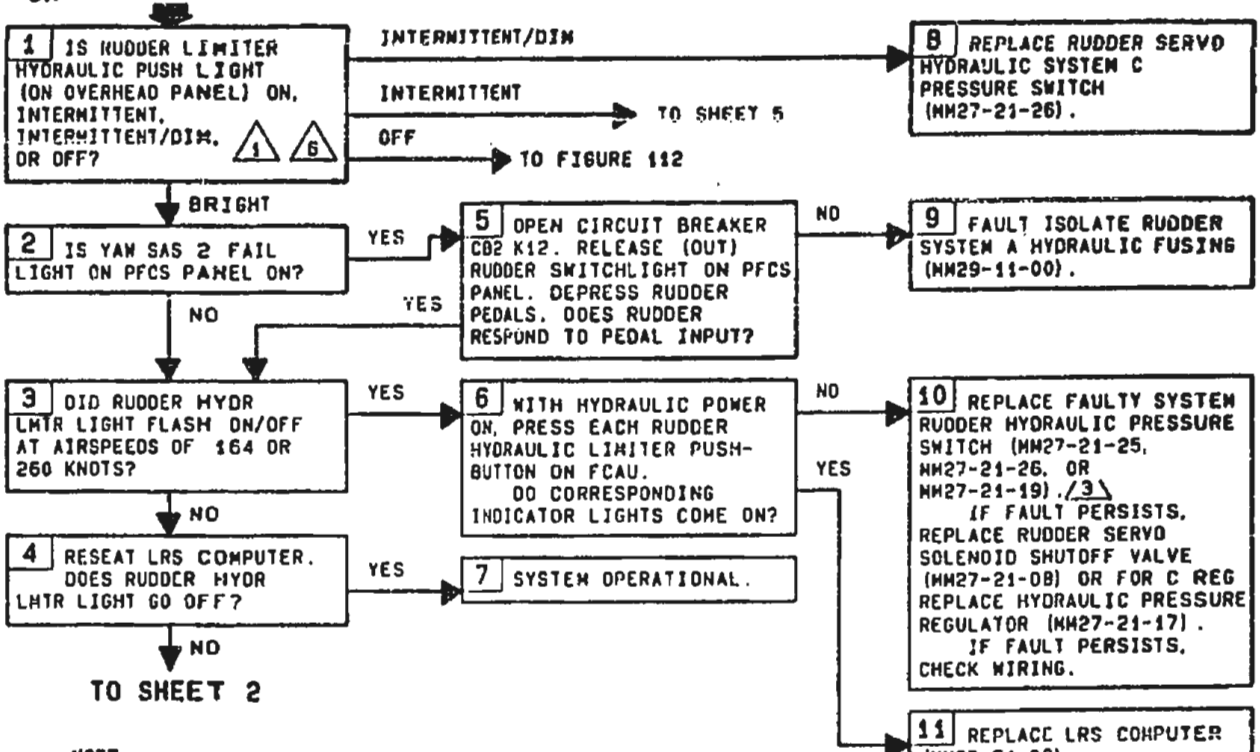


Rudder Control System Component Locators
Figure 102 (Sheet 3)

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER SYS A, B, AND C (MM29-11-00)
CB'S: 187, 2H12, 2H20, 2K12, 2K13, 2K14, 2K15, 2K16, 3GG, 3G3

WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEM

RUDDER HYDR LMTR LIGHT (ON PILOTS ANNUNCIATOR PANEL) ON


1 IS RUDDER LIMITER HYDRAULIC PUSH LIGHT (ON OVERHEAD PANEL) ON, INTERMITTENT, INTERMITTENT/DIM, OR OFF? 1 6
INTERMITTENT/DIM
INTERMITTENT
TO SHEET 5
OFF
TO FIGURE 112
8 REPLACE RUDDER SERVO HYDRAULIC SYSTEM C PRESSURE SWITCH (MM27-21-26).
BRIGHT
2 IS YAW SAS 2 FAIL LIGHT ON PFCS PANEL ON?
YES
5 OPEN CIRCUIT BREAKER CB2 K12. RELEASE (OUT) RUDDER SWITCHLIGHT ON PFCS PANEL. DEPRESS RUDDER PEDALS. DOES RUDDER RESPOND TO PEDAL INPUT?
NO
9 FAULT ISOLATE RUDDER SYSTEM A HYDRAULIC FUSING (MM29-11-00).
NO
YES
3 DID RUDDER HYDR LMTR LIGHT FLASH ON/OFF AT AIRSPEEDS OF 164 OR 260 KNOTS?
YES
6 WITH HYDRAULIC POWER ON, PRESS EACH RUDDER HYDRAULIC LIMITER PUSH-BUTTON ON FCAU. DO CORRESPONDING INDICATOR LIGHTS COME ON?
NO
10 REPLACE FAULTY SYSTEM RUDDER HYDRAULIC PRESSURE SWITCH (MM27-21-25, MM27-21-26, OR MM27-21-19). 3
IF FAULT PERSISTS, REPLACE RUDDER SERVO SOLENOID SHUTOFF VALVE (MM27-21-08) OR FOR C REG REPLACE HYDRAULIC PRESSURE REGULATOR (MM27-21-17).
IF FAULT PERSISTS, CHECK WIRING.
NO
4 RESEAT LRS COMPUTER. DOES RUDDER HYDR LMTR LIGHT GO OFF?
YES
7 SYSTEM OPERATIONAL.
YES
11 REPLACE LRS COMPUTER (MM27-51-06).
IF FAULT PERSISTS, TROUBLESHOOT AIR DATA COMPUTER (MM34-14-00).
IF FAULT PERSISTS, CHECK WIRING.
NO
TO SHEET 2

NOTE

1 WITH FLAPS EXTENDED 4° OR MORE, THE PUSH LIGHT ON THE HYDRAULIC SWITCHLIGHT (ON RUDDER LIMITER PANEL) WILL BE ON FOR ALL FAULTS. IF PUSH LIGHT IS ON WITH FLAPS FULL UP, THE FOLLOWING CAN BE THE CAUSE:
1 LOSS OF HYDRO SYS A AND C.
2 FAULTY RUDDER SERVO C SYS PRESS. SWITCH
3 FAULTY FCAU

2 IF AC PUMPS AND B-A PTU ARE USED TO PRESSURIZE SYSTEM A, PRESSURIZE ONLY SYSTEM ON RUDDER SERVO AS FOLLOWS: UNLATCH RUDDER SWITCHLIGHT ON PFCS PANEL. OPERATE RUDDER TO VERIFY RUDDER IS INOPERATIVE. OPEN CIRCUIT BREAKER RUDDER SERVO A (2K12) TO TURN ON SYSTEM A.

3 TO CONFIRM FAULTY PRESSURE SWITCH, PULL CIRCUIT BREAKER CB1-B7. REMOVE LRS AND CHECK PRESSURE SWITCH RESISTANCE AT LRS COMPUTER JACK PINS PER CHART BELOW. (CHART SHOWS PRESSURE SWITCH GROUND CONDITION.) (VERIFY THAT POSITIVE METER LEAD IS ON JACK PIN AND NEGATIVE LEAD TO GROUND)

4 ON -119 COMPUTER, ACTUATE FIM SWITCH ON LRS TO ENABLE FIM BALLS.

5 RESET LRS COMPUTER AFTER REPLACING ANY COMPONENT.

6 DURING LANDING GEAR OPERATION OCCASIONAL FLASHING IS CONSIDERED NORMAL.

M1-0002-27-1156

CR
CR

RUDDER HYDR LMTR Annunciator Light On
Figure 103 (Sheet 1)

FROM SHEET 1

PREREQUISITES
(REFER TO SHEET 1)

1 IN FESC, CHECK FLIGHT CONTROL AUXILIARY UNIT (FCAU) FOR NORMAL INDICATIONS OF RUDDER HYDRAULIC LIMITER LIGHTS.
ARE ALL FOUR LIGHTS OUT?

NO → 2 CHECK FAULTY RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH FOR CORRECT GROUND SIGNAL TO LRS COMPUTER (REF. SCHEM 1 ELECTRICAL SCHEMATIC).
IS PRESSURE SWITCH SIGNAL OK? ⚠3

YES → 4 REPLACE LRS COMPUTER (MM 27-51-06).
IF LIGHT STILL ON, CHECK WIRING BETWEEN FAULTY CHANNEL PRESSURE SWITCH AND LRS COMPUTER. REPAIR AS REQUIRED.

C.REG FAULTY → 5 REPLACE C SYSTEM PRESSURE REGULATOR (MM27-21-17).

YES → TO SHEET 3

SYS A, B OR C FAULTY → 3

WARNING

VERIFY THAT CONTROL SURFACES ARE CLEAR BEFOR TURNING ON HYDRO SYSTEMS.
VERIFY THAT FAULTY RUDDER SERVO HYDRAULIC SYSTEM (A, B, C) IS RECEIVING HYDRAULIC POWER, WITH ONLY FAULTY HYDRAULIC SYSTEM ON, ACTUATE RUDDER PEDALS. ⚠2
DOES RUDDER RESPOND TO PEDALS?

NO → 6 REPLACE FAULTY RUDDER SERVO HYDRAULIC SYSTEM SOLENOID SHUTOFF VALVE (MM 27-21-08).
IF SYSTEM A IS FAULTY, CHECK RUDDER FUSING SYSTEM (MM 29-11-74,501).

YES → 7 REPLACE FAULTY RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH (MM 27-21-25 OR MM 27-21-36). ⚠3

NOTE

⚠1 IF AC PUMPS AND B A PTU ARE USED TO PRESSURIZE SYSTEM A PRESSURIZE ONLY SYSTEM A ON RUDDER SERVO AS FOLLOWS. RELEASE (CUT) RUDDER SWITCHLIGHT ON PFCS PANEL. OPERATE RUDDER TO VERIFY RUDDER IS INOPERATIVE. OPEN CIRCUIT BREAKER RUDDER SERVO A (CB2-K12) TO TURN ON SYSTEM A.

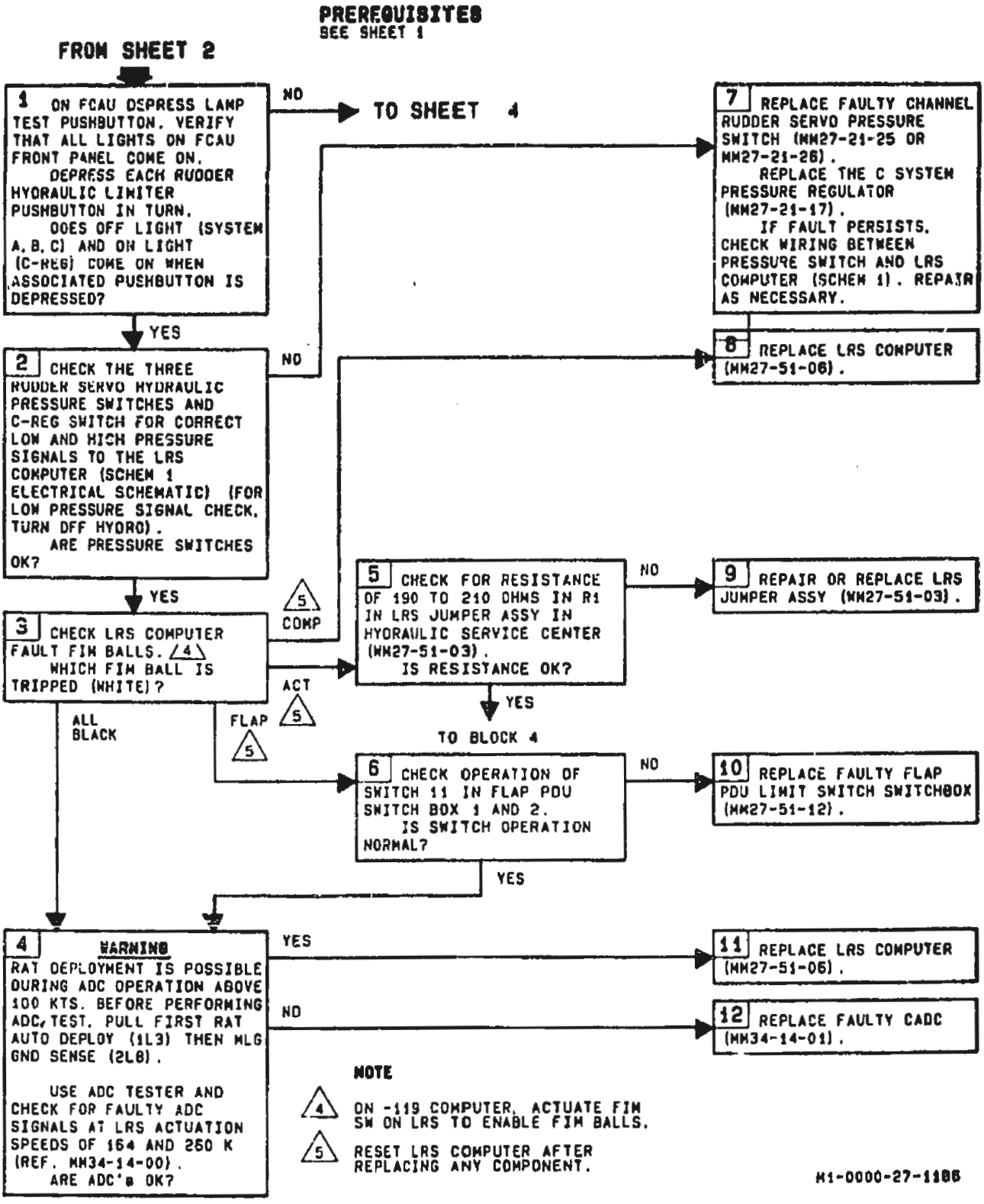
⚠2 TO CONFIRM FAULTY PRESSURE SWITCH PULL CIRCUIT BREAKER CB1-B7, REMOVE LRS AND CHECK PRESSURE SWITCH RESISTANCE AT LRS COMPUTER JACK PINS PER CHART BELOW. (CHART SHOWS PRESSURE SWITCH GROUND CONDITION) (VERIFY THAT POSITIVE METER LEAD IS ON JACK PIN AND NEGATIVE LEAD TO GROUND)

	SYS A	SYS B	SYS C	C-REG
HYDRO PWR OFF	J16B-23 < 6 Ω J16A-23 OPEN	J16A-24 < 6 Ω J16B-24 OPEN	J16A-25 < 6 Ω J16B-25 OPEN	J16A-26 OPEN J16B-26 OPEN
HYDRO PWR ON	J16B-23 OPEN J16A-23 20 Ω	J16A-24 OPEN J16B-24 < 6Ω	J16A-25 OPEN J16B-25 20 Ω	J16A-26 < 5 Ω J16B-26 < 6 Ω

M1-0002-27-11

CR
CR

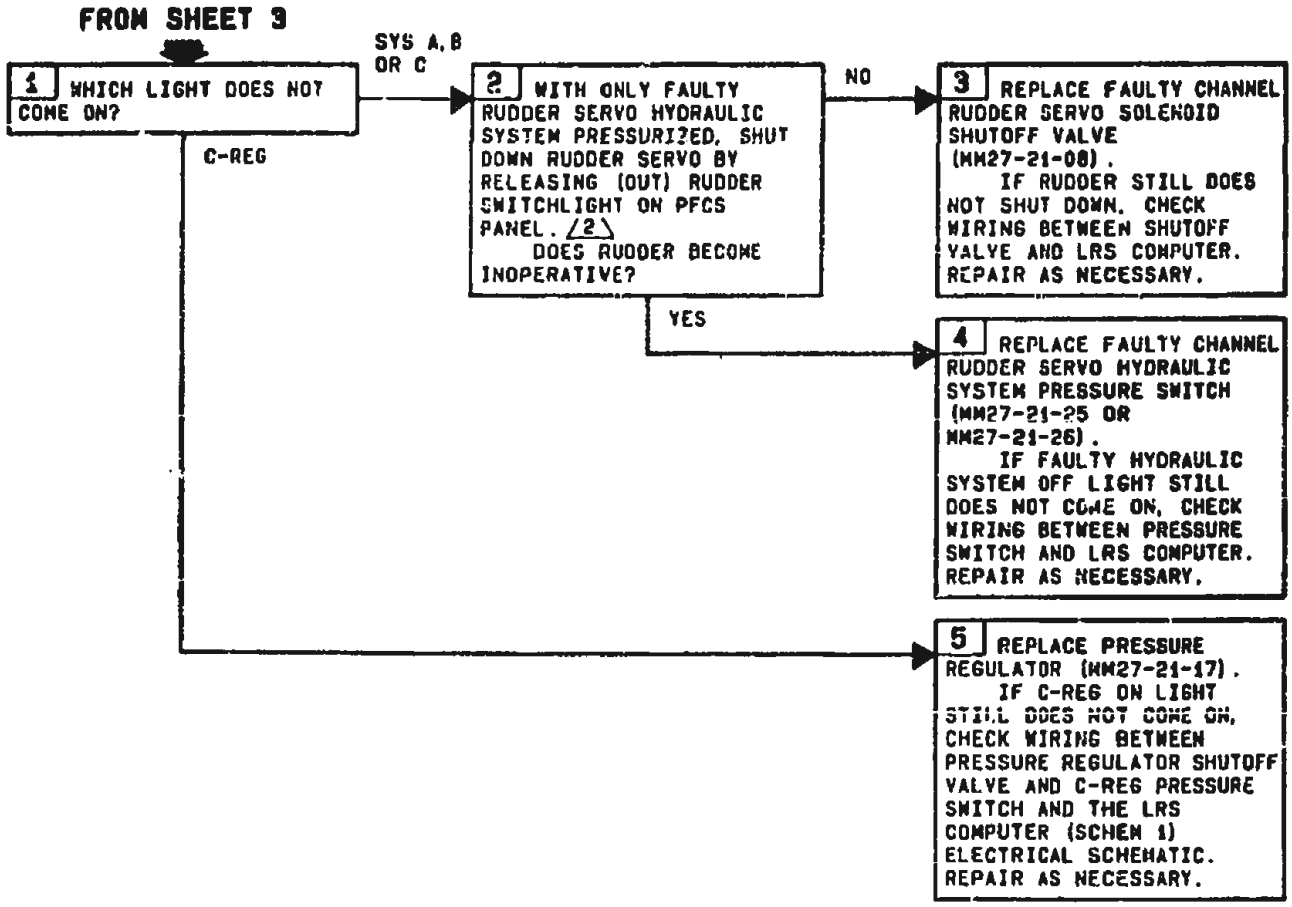
RUDDER HYDR LMTR Annunciator Light On
Figure 103 (Sheet 2)


PREREQUISITES
SEE SHEET 1
FROM SHEET 2
1 ON FCAU DSPRESS LAMP TEST PUSHBUTTON. VERIFY THAT ALL LIGHTS ON FCAU FRONT PANEL COME ON.
DEPRESS EACH RUDDER HYDRAULIC LIMITER PUSHBUTTON IN TURN.
DOES OFF LIGHT (SYSTEM A, B, C) AND ON LIGHT (C-REG) COME ON WHEN ASSOCIATED PUSHBUTTON IS DEPRESSED?
NO
TO SHEET 4
YES
2 CHECK THE THREE RUDDER SERVO HYDRAULIC PRESSURE SWITCHES AND C-REG SWITCH FOR CORRECT LOW AND HIGH PRESSURE SIGNALS TO THE LRS COMPUTER (SCHEM 1 ELECTRICAL SCHEMATIC) (FOR LOW PRESSURE SIGNAL CHECK, TURN OFF HYDRO).
ARE PRESSURE SWITCHES OK?
NO
YES
3 CHECK LRS COMPUTER FAULT FIM BALLS. 4
WHICH FIM BALL IS TRIPPED (WHITE)?
5 COMP
ACT 5
FLAP 5
ALL BLACK
5 CHECK FOR RESISTANCE OF 190 TO 210 OHMS IN R1 IN LRS JUMPER ASSY IN HYDRAULIC SERVICE CENTER (MM27-51-03).
IS RESISTANCE OK?
NO
YES
TO BLOCK 4
6 CHECK OPERATION OF SWITCH 11 IN FLAP PDU SWITCH BOX 1 AND 2.
IS SWITCH OPERATION NORMAL?
NO
YES
4 WARNING
RAT DEPLOYMENT IS POSSIBLE DURING ADC OPERATION ABOVE 100 KTS. BEFORE PERFORMING ADC, TEST, PULL FIRST RAT AUTO DEPLOY (1L3) THEN MLG GND SENSE (2L8).
USE ADC TESTER AND CHECK FOR FAULTY ADC SIGNALS AT LRS ACTUATION SPEEDS OF 164 AND 260 K (REF. MM34-14-00).
ARE ADC's OK?
YES
NO
7 REPLACE FAULTY CHANNEL RUDDER SERVO PRESSURE SWITCH (MM27-21-25 OR MM27-21-26).
REPLACE THE C SYSTEM PRESSURE REGULATOR (MM27-21-17).
IF FAULT PERSISTS, CHECK WIRING BETWEEN PRESSURE SWITCH AND LRS COMPUTER (SCHEM 1). REPAIR AS NECESSARY.
8 REPLACE LRS COMPUTER (MM27-51-06).
9 REPAIR OR REPLACE LRS JUMPER ASSY (MM27-51-03).
10 REPLACE FAULTY FLAP PDU LIMIT SWITCH SWITCHBOX (MM27-51-12).
11 REPLACE LRS COMPUTER (MM27-51-06).
12 REPLACE FAULTY CADC (MM34-14-01).
NOTE
4 ON -119 COMPUTER, ACTUATE FIM SW ON LRS TO ENABLE FIM BALLS.
5 RESET LRS COMPUTER AFTER REPLACING ANY COMPONENT.
M1-0000-27-1186

CR
CR

RUDDER HYDR LMTR Annunciator Light On
Figure 103 (Sheet 3)

PREREQUISITES
SEE SHEET 1


FROM SHEET 3
1 WHICH LIGHT DOES NOT COME ON?
SYS A, B OR C
C-REG
2 WITH ONLY FAULTY RUDDER SERVO HYDRAULIC SYSTEM PRESSURIZED, SHUT DOWN RUDDER SERVO BY RELEASING (OUT) RUDDER SWITCHLIGHT ON PFCS PANEL. /2\
DOES RUDDER BECOME INOPERATIVE?
NO
YES
3 REPLACE FAULTY CHANNEL RUDDER SERVO SOLENOID SHUTOFF VALVE (MM27-21-08).
IF RUDDER STILL DOES NOT SHUT DOWN, CHECK WIRING BETWEEN SHUTOFF VALVE AND LRS COMPUTER. REPAIR AS NECESSARY.
4 REPLACE FAULTY CHANNEL RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH (MM27-21-25 OR MM27-21-26).
IF FAULTY HYDRAULIC SYSTEM OFF LIGHT STILL DOES NOT COME ON, CHECK WIRING BETWEEN PRESSURE SWITCH AND LRS COMPUTER. REPAIR AS NECESSARY.
5 REPLACE PRESSURE REGULATOR (MM27-21-17).
IF C-REG ON LIGHT STILL DOES NOT COME ON, CHECK WIRING BETWEEN PRESSURE REGULATOR SHUTOFF VALVE AND C-REG PRESSURE SWITCH AND THE LRS COMPUTER (SCHEM 1) ELECTRICAL SCHEMATIC. REPAIR AS NECESSARY.

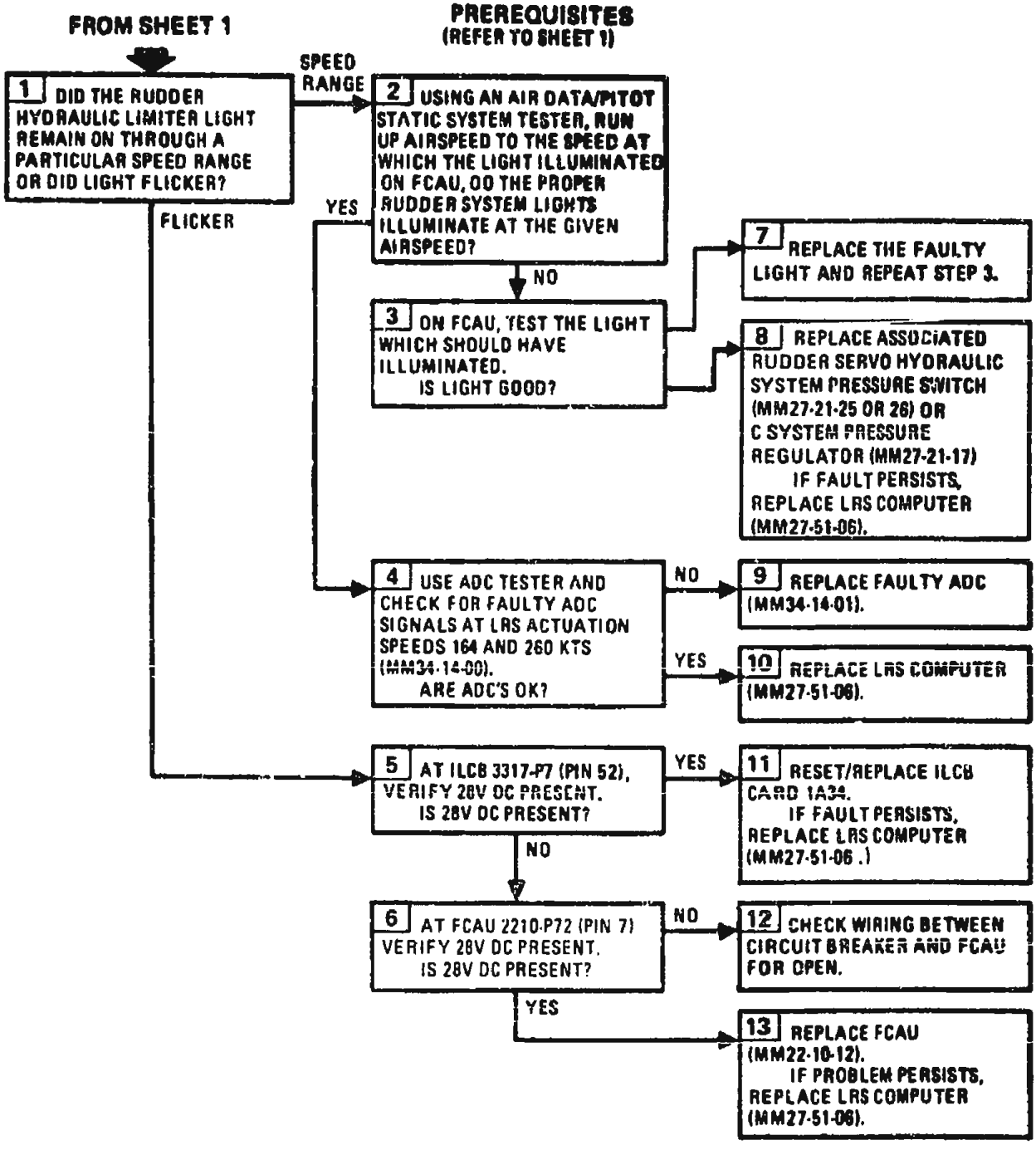
NOTE

/2\ IF AC PUMPS AND B-A PTU ARE USED TO PRESSURIZE SYSTEM A, PRESSURIZE ONLY SYSTEM A ON RUDDER SERVO AS FOLLOWS: RELEASE (OUT) RUDDER SWITCHLIGHT ON PFCS PANEL. OPERATE RUDDER TO VERIFY RUDDER IS INOPERATIVE. OPEN CIRCUIT BREAKER RUDDER SERVO A (2-K12) TO TURN ON SYSTEM A.

M1-0000-27-1187

CR
CR

RUDDER HYDR LMTR Annunciator Light On
Figure 103 (Sheet 4)


FROM SHEET 1
PREREQUISITES
(REFER TO SHEET 1)
1 DID THE RUDDER HYDRAULIC LIMITER LIGHT REMAIN ON THROUGH A PARTICULAR SPEED RANGE OR DID LIGHT FLICKER?
SPEED RANGE
FLICKER
2 USING AN AIR DATA/PITOT STATIC SYSTEM TESTER, RUN UP AIRSPEED TO THE SPEED AT WHICH THE LIGHT ILLUMINATED ON FCAU, DO THE PROPER RUDDER SYSTEM LIGHTS ILLUMINATE AT THE GIVEN AIRSPEED?
YES
NO
3 ON FCAU, TEST THE LIGHT WHICH SHOULD HAVE ILLUMINATED.
IS LIGHT GOOD?
7 REPLACE THE FAULTY LIGHT AND REPEAT STEP 3.
8 REPLACE ASSOCIATED RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH (MM27-21-25 OR 26) OR C SYSTEM PRESSURE REGULATOR (MM27-21-17)
IF FAULT PERSISTS, REPLACE LRS COMPUTER (MM27-51-06).
4 USE ADC TESTER AND CHECK FOR FAULTY ADC SIGNALS AT LRS ACTUATION SPEEDS 164 AND 260 KTS (MM34-14-00).
ARE ADC'S OK?
NO
YES
9 REPLACE FAULTY ADC (MM34-14-01).
10 REPLACE LRS COMPUTER (MM27-51-06).
5 AT ILCB 3317-P7 (PIN 52), VERIFY 28V DC PRESENT.
IS 28V DC PRESENT?
YES
NO
11 RESET/REPLACE ILCB CARD 1A34.
IF FAULT PERSISTS, REPLACE LRS COMPUTER (MM27-51-06.)
6 AT FCAU 2210-P72 (PIN 7) VERIFY 28V DC PRESENT.
IS 28V DC PRESENT?
NO
YES
12 CHECK WIRING BETWEEN CIRCUIT BREAKER AND FCAU FOR OPEN.
13 REPLACE FCAU (MM22-10-12).
IF PROBLEM PERSISTS, REPLACE LRS COMPUTER (MM27-51-06).

M1-0001-27-1188

CR RUDDER HYDR LMTR Annunciator Light On
CR Figure 103 (Sheet 5)

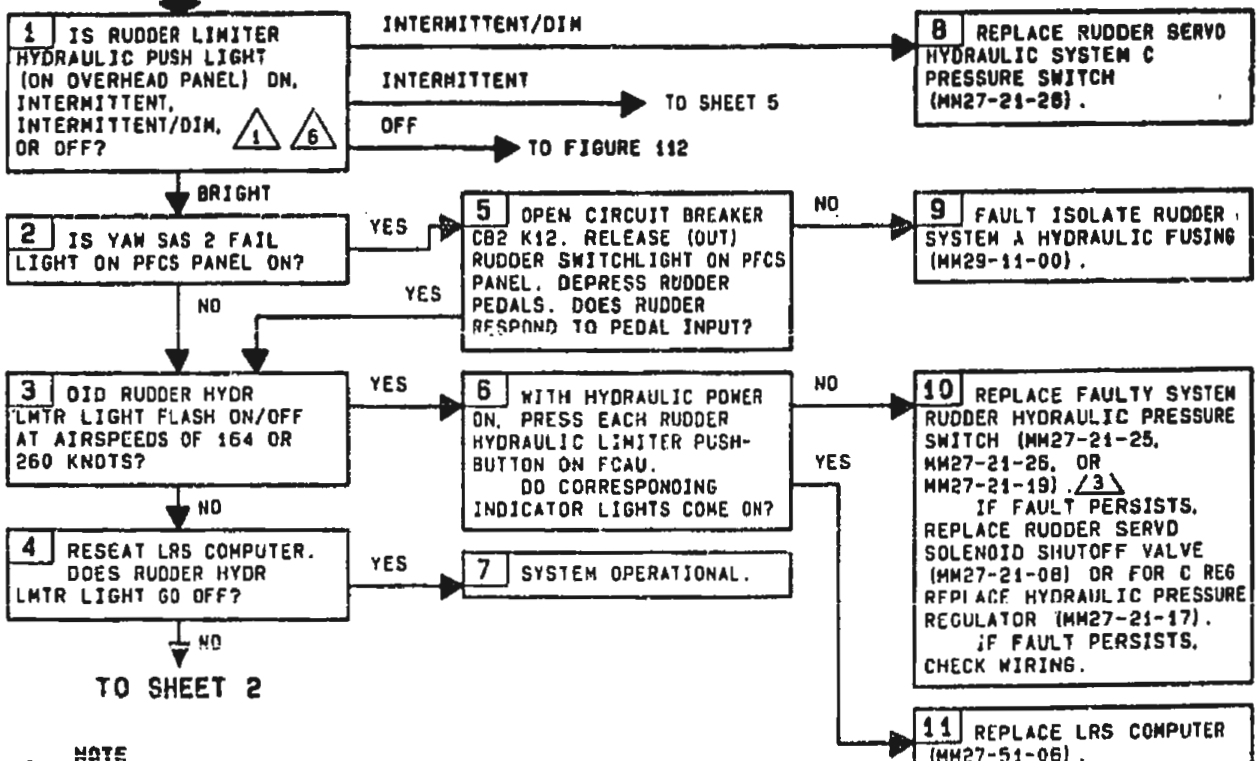
EFFECTIVITY: 001-017

001B

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER SYS A, B, AND C (MM29-11-00)
CB'S: 187, 2K12, 2H20, 2K12, 2K13, 2K14, 2K15, 2K16, 388, 389

WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEM

RUDDER HYDR LMTR LIGHT (ON PILOTS ANNUNCIATOR PANEL) ON


1 IS RUDDER LIMITER HYDRAULIC PUSH LIGHT (ON OVERHEAD PANEL) ON, INTERMITTENT, INTERMITTENT/DIM, OR OFF? 1 6
INTERMITTENT/DIM
INTERMITTENT
TO SHEET 5
OFF
TO FIGURE 112
8 REPLACE RUDDER SERVO HYDRAULIC SYSTEM C PRESSURE SWITCH (MM27-21-26).
BRIGHT
2 IS YAW SAS 2 FAIL LIGHT ON PFCS PANEL ON?
YES
5 OPEN CIRCUIT BREAKER CB2 K12. RELEASE (OUT) RUDDER SWITCHLIGHT ON PFCS PANEL. DEPRESS RUDDER PEDALS. DOES RUDDER RESPOND TO PEDAL INPUT?
NO
9 FAULT ISOLATE RUDDER SYSTEM A HYDRAULIC FUSING (MM29-11-00).
NO
YES
3 DID RUDDER HYDR LMTR LIGHT FLASH ON/OFF AT AIRSPEEDS OF 164 OR 260 KNOTS?
YES
6 WITH HYDRAULIC POWER ON, PRESS EACH RUDDER HYDRAULIC LIMITER PUSH-BUTTON ON FCAU. DO CORRESPONDING INDICATOR LIGHTS COME ON?
NO
10 REPLACE FAULTY SYSTEM RUDDER HYDRAULIC PRESSURE SWITCH (MM27-21-25, MM27-21-26, OR MM27-21-19). 3
IF FAULT PERSISTS, REPLACE RUDDER SERVO SOLENOID SHUTOFF VALVE (MM27-21-08) OR FOR C REG REPLACE HYDRAULIC PRESSURE REGULATOR (MM27-21-17).
IF FAULT PERSISTS, CHECK WIRING.
NO
4 RESEAT LRS COMPUTER. DOES RUDDER HYDR LMTR LIGHT GO OFF?
YES
7 SYSTEM OPERATIONAL.
NO
TO SHEET 2
YES
11 REPLACE LRS COMPUTER (MM27-51-06).
IF FAULT PERSISTS, TROUBLESHOOT AIR DATA COMPUTER (MM34-14-00).
IF FAULT PERSISTS, CHECK WIRING.

NOTE

1. WITH FLAPS EXTENDED 4° OR MORE, THE PUSH LIGHT ON THE HYDRAULIC SWITCHLIGHT (ON RUDDER LIMITER PANEL) WILL BE ON FOR ALL FAULTS. IF PUSH LIGHT IS ON WITH FLAPS FULL UP, THE FOLLOWING CAN BE THE CAUSE:
   1 LOSS OF HYDRO SYS A AND C.
   2 FAULTY RUDDER SERVO C SYS PRESS. SWITCH
   3 FAULTY FCAU
2. IF AC PUMPS AND B-A PTU ARE USED TO PRESSURIZE SYSTEM A, PRESSURIZE ONLY SYSTEM ON RUDDER SERVO AS FOLLOWS: UNLATCH RUDDER SWITCHLIGHT ON PFCS PANEL. OPERATE RUDDER TO VERIFY RUDDER IS INOPERATIVE. OPEN CIRCUIT BREAKER RUDDER SERVO A (2K12) TO TURN ON SYSTEM A.
3. TO CONFIRM FAULTY PRESSURE SWITCH, PULL CIRCUIT BREAKER CB1-B7. REMOVE LRS AND CHECK PRESSURE SWITCH RESISTANCE AT LRS COMPUTER JACK PINS PER CHART BELOW. (CHART SHOWS PRESSURE SWITCH GROUND CONDITION.) (VERIFY THAT POSITIVE METER LEAD IS ON JACK PIN AND NEGATIVE LEAD TO GROUND)
4. ON -119 COMPUTER, ACTUATE FIM SWITCH ON LRS TO ENABLE FIM BALLS.
5. RESET LRS COMPUTER AFTER REPLACING ANY COMPONENT.
6. DURING LANDING GEAR OPERATION OCCASIONAL FLASHING IS CONSIDERED NORMAL.

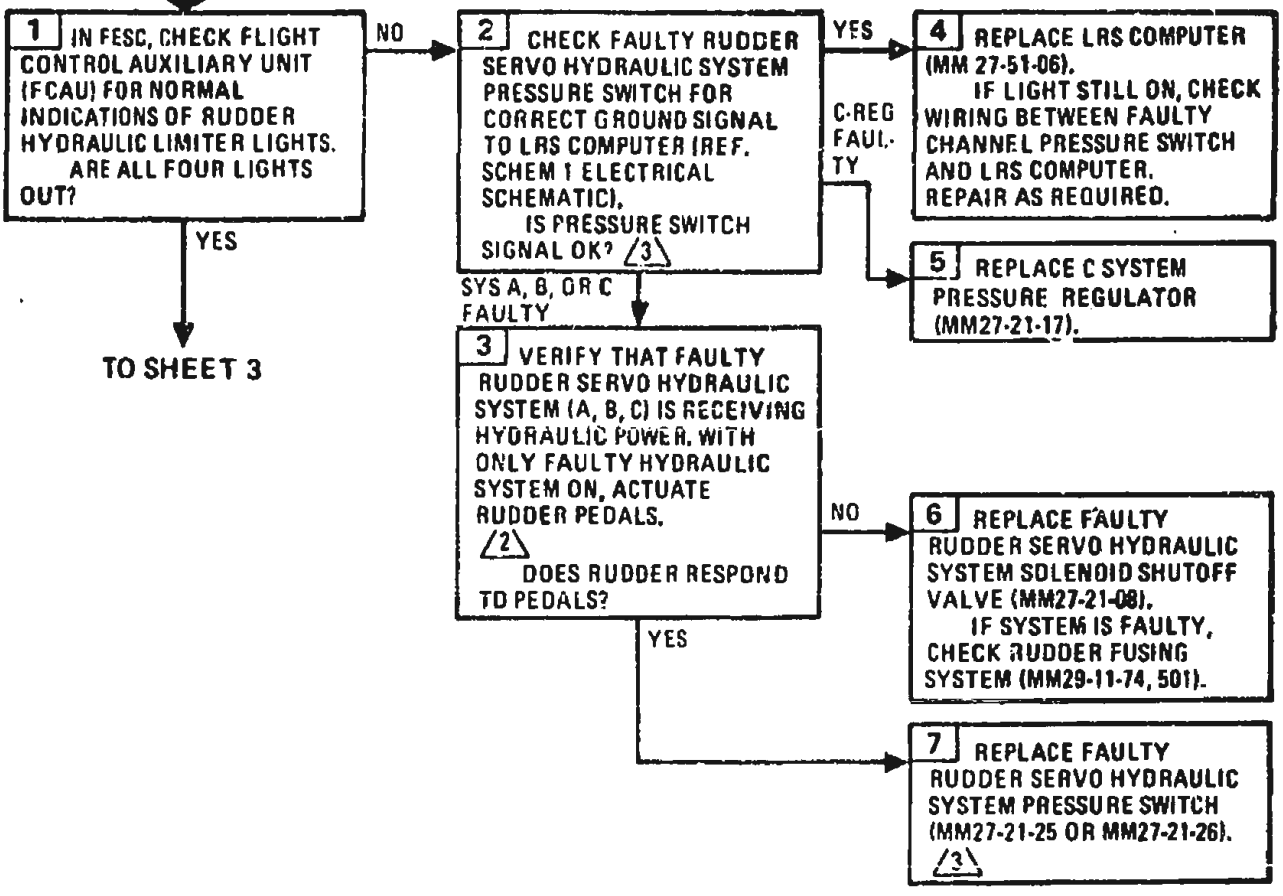
M1-0001-27-1180

CR
CR

RUDDER HYDR LMTR Annunciator Light On
Figure 103 (Sheet 1)

PREREQUISITES
(REFER TO SHEET 1)

FROM SHEET 1


1 IN FESC, CHECK FLIGHT CONTROL AUXILIARY UNIT (FCAU) FOR NORMAL INDICATIONS OF RUDDER HYDRAULIC LIMITER LIGHTS. ARE ALL FOUR LIGHTS OUT?
NO
YES
TO SHEET 3
2 CHECK FAULTY RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH FOR CORRECT GROUND SIGNAL TO LRS COMPUTER (REF. SCHEM 1 ELECTRICAL SCHEMATIC). IS PRESSURE SWITCH SIGNAL OK? /3\
YES
C-REG FAULTY
SYS A, B, OR C FAULTY
4 REPLACE LRS COMPUTER (MM 27-51-06). IF LIGHT STILL ON, CHECK WIRING BETWEEN FAULTY CHANNEL PRESSURE SWITCH AND LRS COMPUTER. REPAIR AS REQUIRED.
5 REPLACE C SYSTEM PRESSURE REGULATOR (MM27-21-17).
3 VERIFY THAT FAULTY RUDDER SERVO HYDRAULIC SYSTEM (A, B, C) IS RECEIVING HYDRAULIC POWER. WITH ONLY FAULTY HYDRAULIC SYSTEM ON, ACTUATE RUDDER PEDALS. /2\ DOES RUDDER RESPOND TO PEDALS?
NO
YES
6 REPLACE FAULTY RUDDER SERVO HYDRAULIC SYSTEM SOLENOID SHUTOFF VALVE (MM27-21-08). IF SYSTEM IS FAULTY, CHECK RUDDER FUSING SYSTEM (MM29-11-74, 501).
7 REPLACE FAULTY RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH (MM27-21-25 OR MM27-21-26). /3\

NOTE

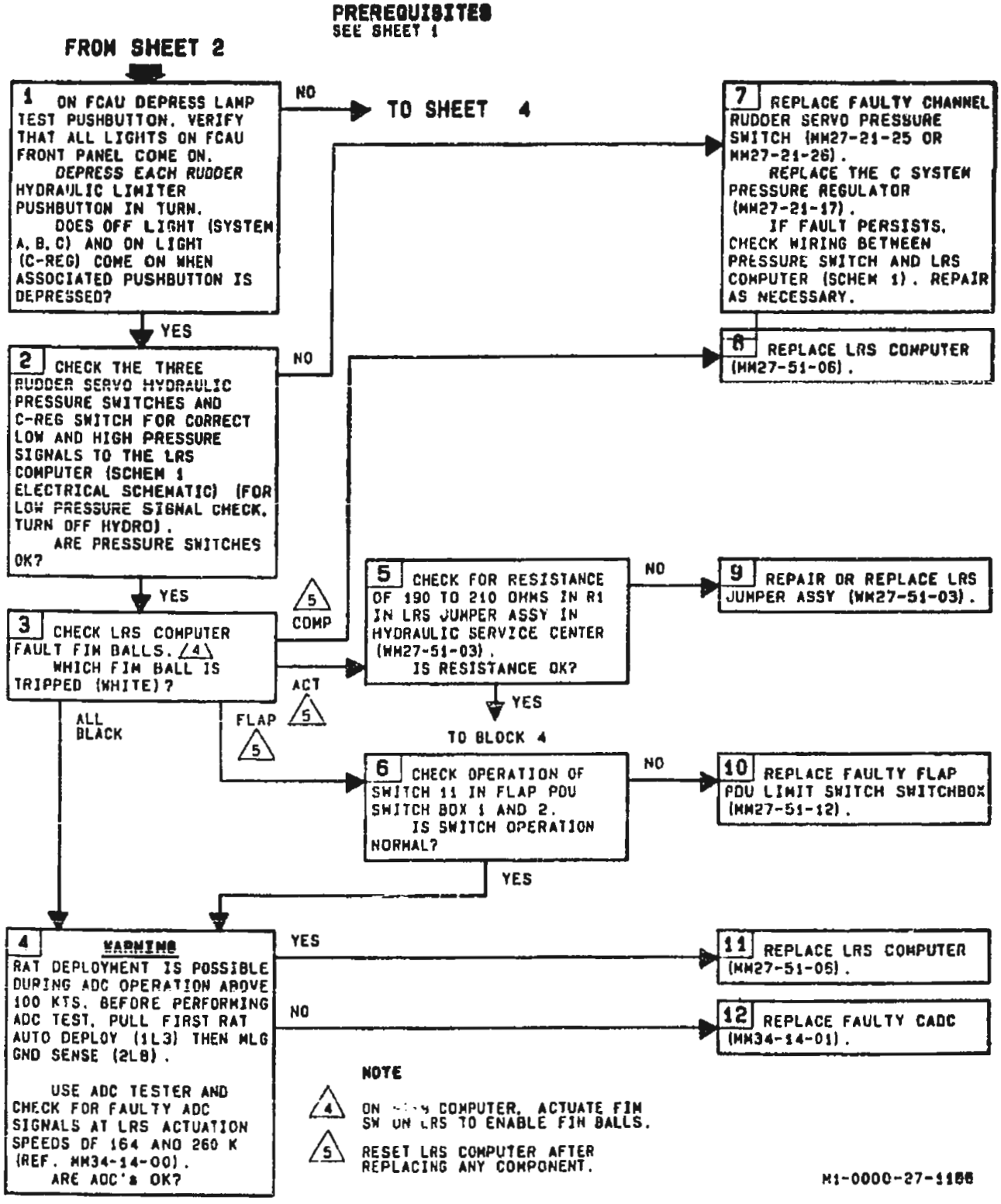
/2\ IF AC PUMPS AND B-A PTU ARE USED TO PRESSURIZE SYSTEM A, PRESSURIZE ONLY SYSTEM A ON RUDDER SERVO AS FOLLOWS: RELEASE (OUT) RUDDER SWITCHLIGHT ON PFCS PANEL. OPERATE RUDDER TO VERIFY RUDDER IS INOPERATIVE. OPEN CIRCUIT BREAKER RUDDER SERVO A (2-K12) TO TURN ON SYSTEM A.

/3\ TO CONFIRM FAULTY PRESSURE SWITCH, PULL CIRCUIT BREAKER CB1-B7, REMOVE LRS AND CHECK PRESSURE SWITCH RESISTANCE AT LRS COMPUTER JACK PINS PER CHART BELOW. (CHART SHOWS PRESSURE SWITCH GROUND CONDITION.) (VERIFY THAT POSITIVE METER LEAD IS ON JACK PIN AND NEGATIVE LEAD TO GROUND)

	SYS A	SYS B	SYS C	C-REG
HYDRO PWR OFF	J16B-23 $<6\Omega$ J16A-23 OPEN	J16A-26 OPEN J16B-26 OPEN	J16A-25 $<6\Omega$ J16B-25 OPEN	J16A-24 $<6\Omega$ J16B-24 OPEN
HYDRO PWR ON	J16B-23 OPEN J16A-23 20Ω	J16A-26 $<6\Omega$ J16B-26 $<6\Omega$	J16A-25 OPEN J16B-25 20Ω	J16A-24 OPEN J16B-24 $<6\Omega$

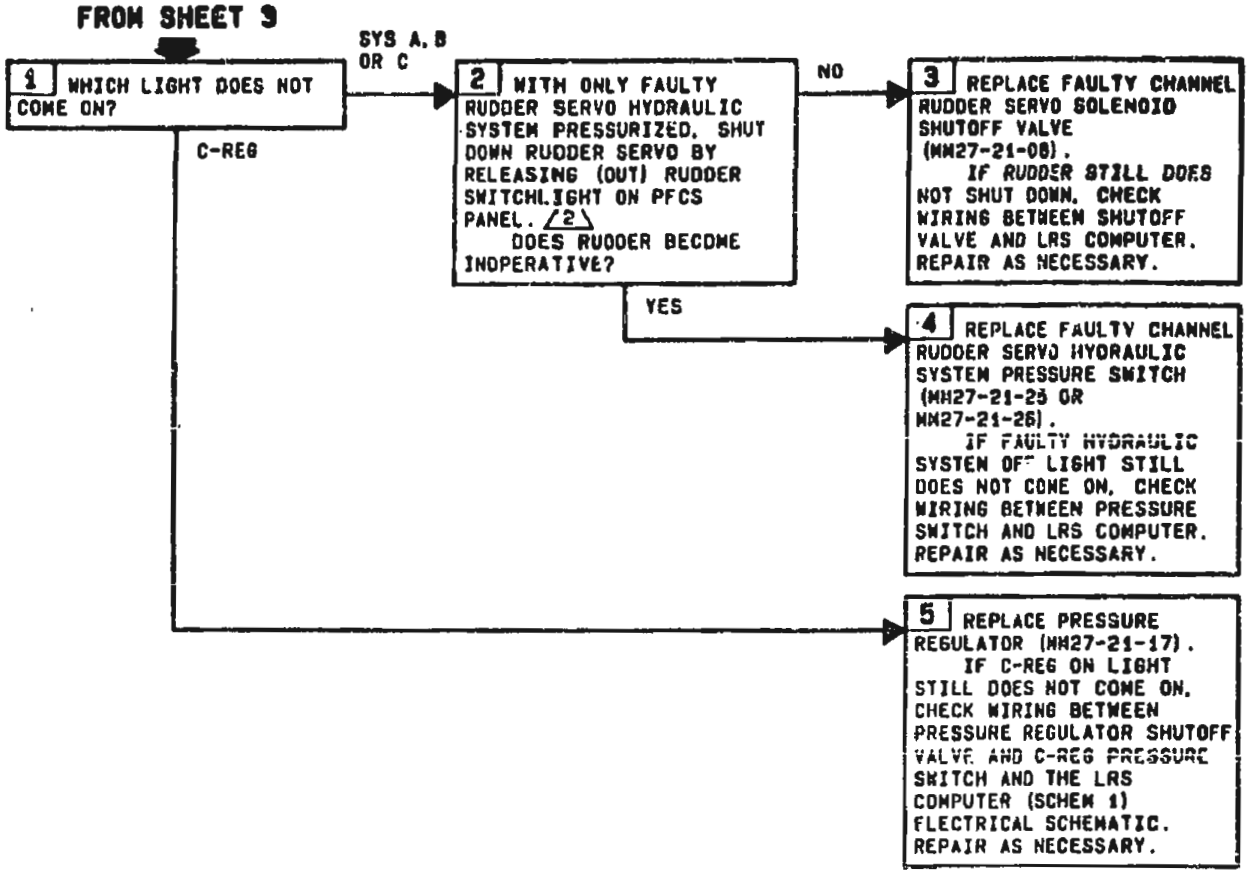
M1-0001-27-1158

CR RUDDER HYDR LMTR Annunciator Light On
CR Figure 103 (Sheet 2)


PREREQUISITES
SEE SHEET 1
FROM SHEET 2
1 ON FCAU DEPRESS LAMP TEST PUSHBUTTON. VERIFY THAT ALL LIGHTS ON FCAU FRONT PANEL COME ON.
DEPRESS EACH RUDDER HYDRAULIC LIMITER PUSHBUTTON IN TURN.
DOES OFF LIGHT (SYSTEM A, B, C) AND ON LIGHT (C-REG) COME ON WHEN ASSOCIATED PUSHBUTTON IS DEPRESSED?
NO
TO SHEET 4
YES
2 CHECK THE THREE RUDDER SERVO HYDRAULIC PRESSURE SWITCHES AND C-REG SWITCH FOR CORRECT LOW AND HIGH PRESSURE SIGNALS TO THE LRS COMPUTER (SCHEM 1 ELECTRICAL SCHEMATIC) (FOR LOW PRESSURE SIGNAL CHECK, TURN OFF HYDRO).
ARE PRESSURE SWITCHES OK?
NO
YES
3 CHECK LRS COMPUTER FAULT FIN BALLS. 4
WHICH FIN BALL IS TRIPPED (WHITE)?
5 COMP
ACT 5
FLAP 5
ALL BLACK
5 CHECK FOR RESISTANCE OF 190 TO 210 OHMS IN R1 IN LRS JUMPER ASSY IN HYDRAULIC SERVICE CENTER (WM27-51-03).
IS RESISTANCE OK?
NO
YES
TO BLOCK 4
6 CHECK OPERATION OF SWITCH 11 IN FLAP PDU SWITCH BOX 1 AND 2.
IS SWITCH OPERATION NORMAL?
NO
YES
4 WARNING
RAT DEPLOYMENT IS POSSIBLE DURING ADC OPERATION ABOVE 100 KTS. BEFORE PERFORMING ADC TEST, PULL FIRST RAT AUTO DEPLOY (1L3) THEN MLG GND SENSE (2L8).
USE ADC TESTER AND CHECK FOR FAULTY ADC SIGNALS AT LRS ACTUATION SPEEDS OF 164 AND 260 K (REF. MM34-14-00).
ARE ADC's OK?
YES
NO
7 REPLACE FAULTY CHANNEL RUDDER SERVO PRESSURE SWITCH (MM27-21-25 OR MM27-21-26).
REPLACE THE C SYSTEM PRESSURE REGULATOR (MM27-21-17).
IF FAULT PERSISTS, CHECK WIRING BETWEEN PRESSURE SWITCH AND LRS COMPUTER (SCHEM 1). REPAIR AS NECESSARY.
8 REPLACE LRS COMPUTER (MM27-51-06).
9 REPAIR OR REPLACE LRS JUMPER ASSY (MM27-51-03).
10 REPLACE FAULTY FLAP PDU LIMIT SWITCH SWITCHBOX (MM27-51-12).
11 REPLACE LRS COMPUTER (MM27-51-06).
12 REPLACE FAULTY CADC (MM34-14-01).
NOTE
4 ON NEW COMPUTER, ACTUATE FIN SW ON LRS TO ENABLE FIN BALLS.
5 RESET LRS COMPUTER AFTER REPLACING ANY COMPONENT.
M1-0000-27-1186

CR RUDDER HYDR LMTR Annunciator Light On
CR Figure 103 (Sheet 3)

PREREQUISITES
SEE SHEET 1


FROM SHEET 3
1 WHICH LIGHT DOES NOT COME ON?
SYS A, B OR C
C-REG
2 WITH ONLY FAULTY RUDDER SERVO HYDRAULIC SYSTEM PRESSURIZED, SHUT DOWN RUDDER SERVO BY RELEASING (OUT) RUDDER SWITCHLIGHT ON PFCS PANEL. (2) DOES RUDDER BECOME INOPERATIVE?
NO
YES
3 REPLACE FAULTY CHANNEL RUDDER SERVO SOLENOID SHUTOFF VALVE (MM27-21-08). IF RUDDER STILL DOES NOT SHUT DOWN, CHECK WIRING BETWEEN SHUTOFF VALVE AND LRS COMPUTER. REPAIR AS NECESSARY.
4 REPLACE FAULTY CHANNEL RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH (MM27-21-25 OR MM27-21-26). IF FAULTY HYDRAULIC SYSTEM OFF LIGHT STILL DOES NOT COME ON, CHECK WIRING BETWEEN PRESSURE SWITCH AND LRS COMPUTER. REPAIR AS NECESSARY.
5 REPLACE PRESSURE REGULATOR (MM27-21-17). IF C-REG ON LIGHT STILL DOES NOT COME ON, CHECK WIRING BETWEEN PRESSURE REGULATOR SHUTOFF VALVE AND C-REG PRESSURE SWITCH AND THE LRS COMPUTER (SCHEM 1) ELECTRICAL SCHEMATIC. REPAIR AS NECESSARY.

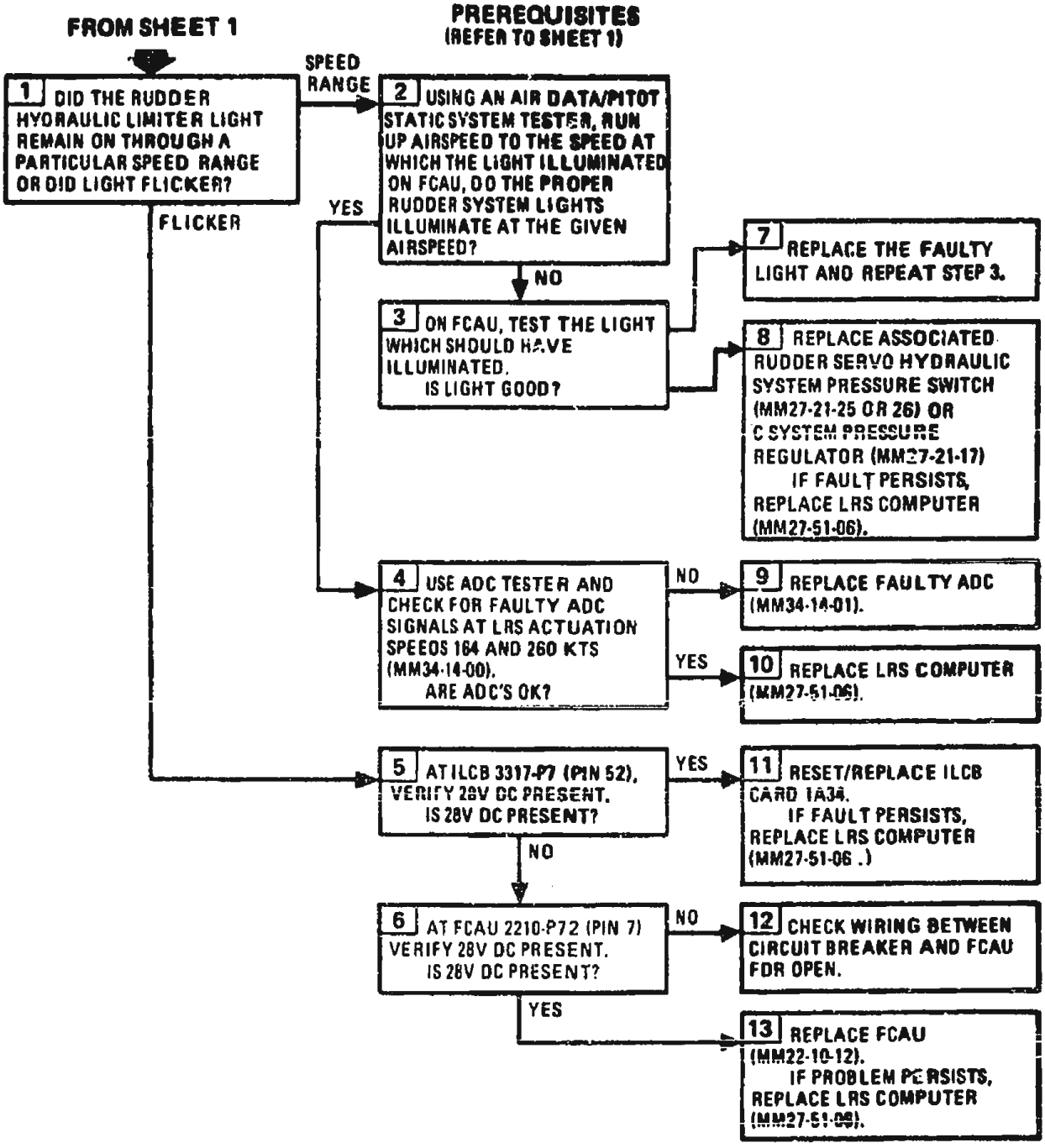
NOTE

(2) IF AC PUMPS AND B-A PTU ARE USED TO PRESSURIZE SYSTEM A, PRESSURIZE ONLY SYSTEM A ON RUDDER SERVO AS FOLLOWS: RELEASE (OUT) RUDDER SWITCHLIGHT ON PFCS PANEL. OPERATE RUDDER TO VERIFY RUDDER IS INOPERATIVE. OPEN CIRCUIT BREAKER RUDDER SERVO A (2-K12) TO TURN ON SYSTEM A.

M1-0000-27-1187

CR
CR

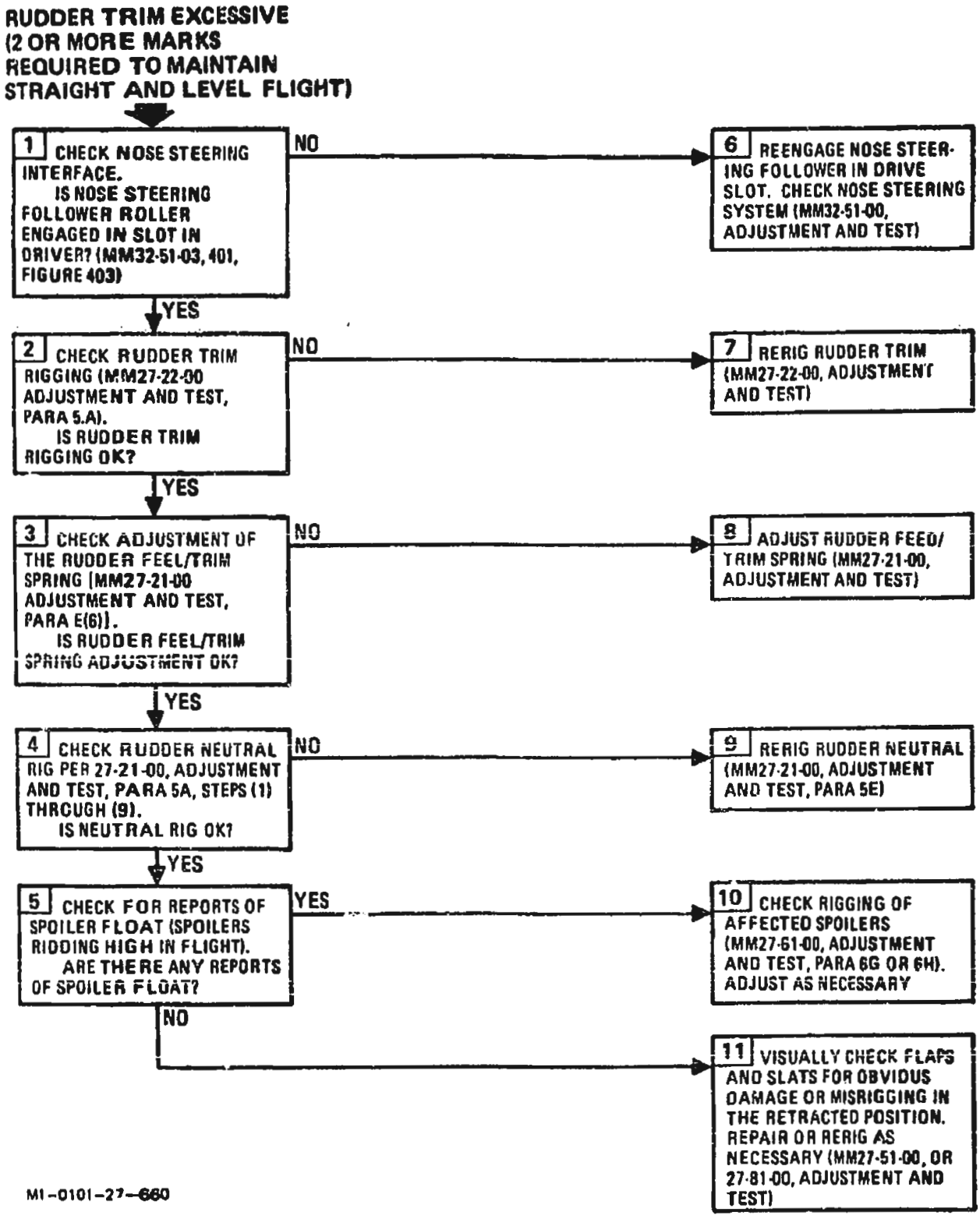
RUDDER HYDR LMTR Annunciator Light On
Figure 103 (Sheet 4)


FROM SHEET 1
PREREQUISITES
(REFER TO SHEET 1)
1 DID THE RUDDER HYDRAULIC LIMITER LIGHT REMAIN ON THROUGH A PARTICULAR SPEED RANGE OR DID LIGHT FLICKER?
SPEED RANGE
FLICKER
2 USING AN AIR DATA/PITOT STATIC SYSTEM TESTER, RUN UP AIRSPEED TO THE SPEED AT WHICH THE LIGHT ILLUMINATED ON FCAU, DO THE PROPER RUDDER SYSTEM LIGHTS ILLUMINATE AT THE GIVEN AIRSPEED?
YES
NO
3 ON FCAU, TEST THE LIGHT WHICH SHOULD HAVE ILLUMINATED.
IS LIGHT GOOD?
7 REPLACE THE FAULTY LIGHT AND REPEAT STEP 3.
8 REPLACE ASSOCIATED RUDDER SERVO HYDRAULIC SYSTEM PRESSURE SWITCH (MM27-21-25 OR 26) OR C SYSTEM PRESSURE REGULATOR (MM27-21-17)
IF FAULT PERSISTS, REPLACE LRS COMPUTER (MM27-51-06).
4 USE ADC TESTER AND CHECK FOR FAULTY ADC SIGNALS AT LRS ACTUATION SPEEDS 164 AND 260 KTS (MM34-14-00).
ARE ADC'S OK?
NO
9 REPLACE FAULTY ADC (MM34-14-01).
YES
10 REPLACE LRS COMPUTER (MM27-51-06).
5 AT ILCB 3317-P7 (PIN 52), VERIFY 28V DC PRESENT.
IS 28V DC PRESENT?
YES
11 RESET/REPLACE ILCB CARD 1A34.
IF FAULT PERSISTS, REPLACE LRS COMPUTER (MM27-51-06 .)
NO
6 AT FCAU 2210-P72 (PIN 7) VERIFY 28V DC PRESENT.
IS 28V DC PRESENT?
NO
12 CHECK WIRING BETWEEN CIRCUIT BREAKER AND FCAU FOR OPEN.
YES
13 REPLACE FCAU (MM22-10-12).
IF PROBLEM PERSISTS, REPLACE LRS COMPUTER (MM27-51-06).

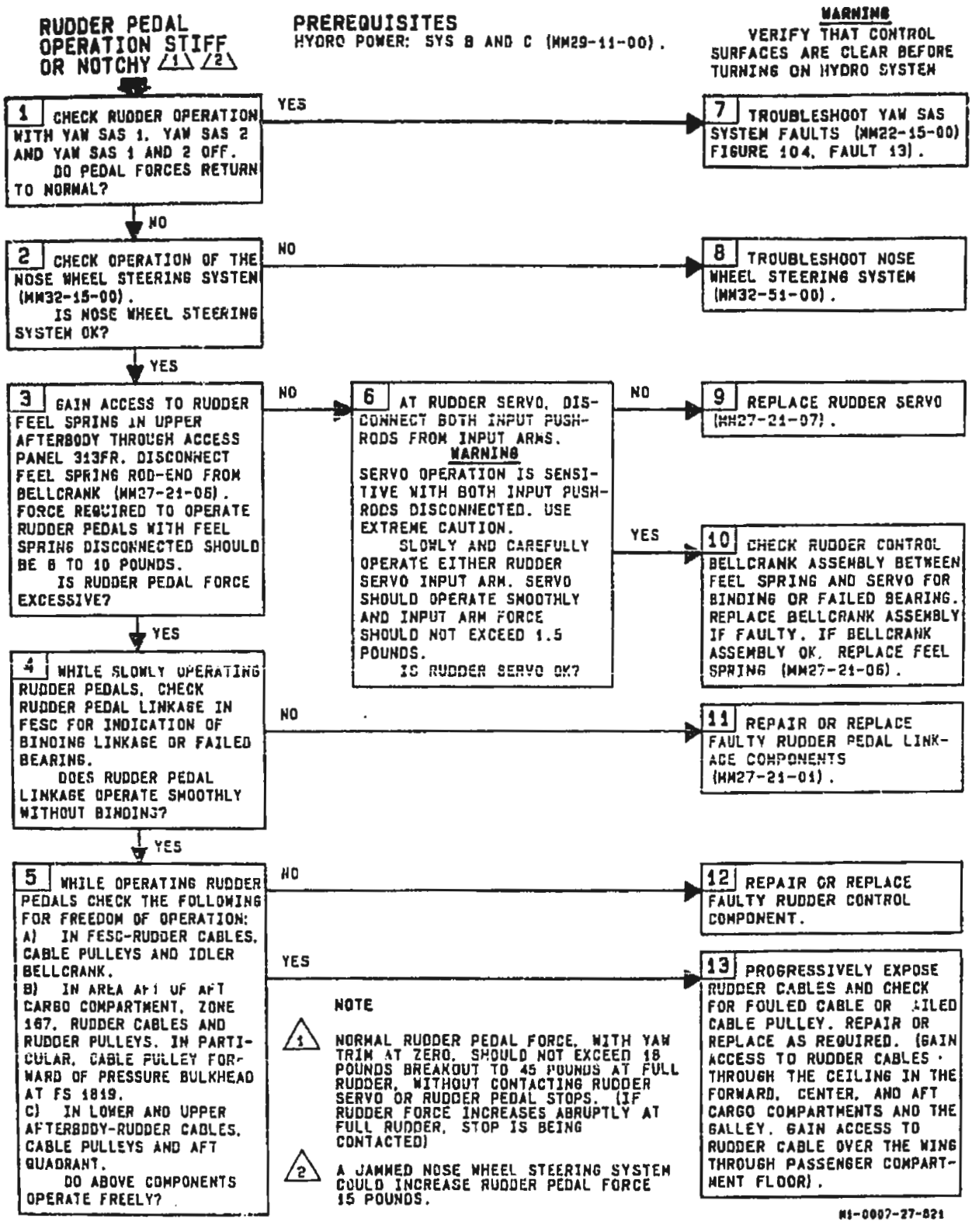
M1-0001-27-1188

CR
CR

RUDDER HYDR LMTR Annunciator Light On
Figure 103 (Sheet 5)


RUDDER TRIM EXCESSIVE (2 OR MORE MARKS REQUIRED TO MAINTAIN STRAIGHT AND LEVEL FLIGHT)
1 CHECK NOSE STEERING INTERFACE. IS NOSE STEERING FOLLOWER ROLLER ENGAGED IN SLOT IN DRIVER? (MM32-51-03, 401, FIGURE 403)
NO
6 REENGAGE NOSE STEERING FOLLOWER IN DRIVE SLOT. CHECK NOSE STEERING SYSTEM (MM32-51-00, ADJUSTMENT AND TEST)
YES
2 CHECK RUDDER TRIM RIGGING (MM27-22-00 ADJUSTMENT AND TEST, PARA 5.A). IS RUDDER TRIM RIGGING OK?
NO
7 RERIG RUDDER TRIM (MM27-22-00, ADJUSTMENT AND TEST)
YES
3 CHECK ADJUSTMENT OF THE RUDDER FEEL/TRIM SPRING (MM27-21-00 ADJUSTMENT AND TEST, PARA E(6)). IS RUDDER FEEL/TRIM SPRING ADJUSTMENT OK?
NO
8 ADJUST RUDDER FEED/ TRIM SPRING (MM27-21-00, ADJUSTMENT AND TEST)
YES
4 CHECK RUDDER NEUTRAL RIG PER 27-21-00, ADJUSTMENT AND TEST, PARA 5A, STEPS (1) THROUGH (9). IS NEUTRAL RIG OK?
NO
9 RERIG RUDDER NEUTRAL (MM27-21-00, ADJUSTMENT AND TEST, PARA 5E)
YES
5 CHECK FOR REPORTS OF SPOILER FLOAT (SPOILERS RIDDING HIGH IN FLIGHT). ARE THERE ANY REPORTS OF SPOILER FLOAT?
YES
10 CHECK RIGGING OF AFFECTED SPOILERS (MM27-61-00, ADJUSTMENT AND TEST, PARA 6G OR 6H). ADJUST AS NECESSARY
NO
11 VISUALLY CHECK FLAPS AND SLATS FOR OBVIOUS DAMAGE OR MISRIGGING IN THE RETRACTED POSITION. REPAIR OR RERIG AS NECESSARY (MM27-51-00, OR 27-81-00, ADJUSTMENT AND TEST)
MI-0101-27-660

Rudder Trim Excessive
Figure 104

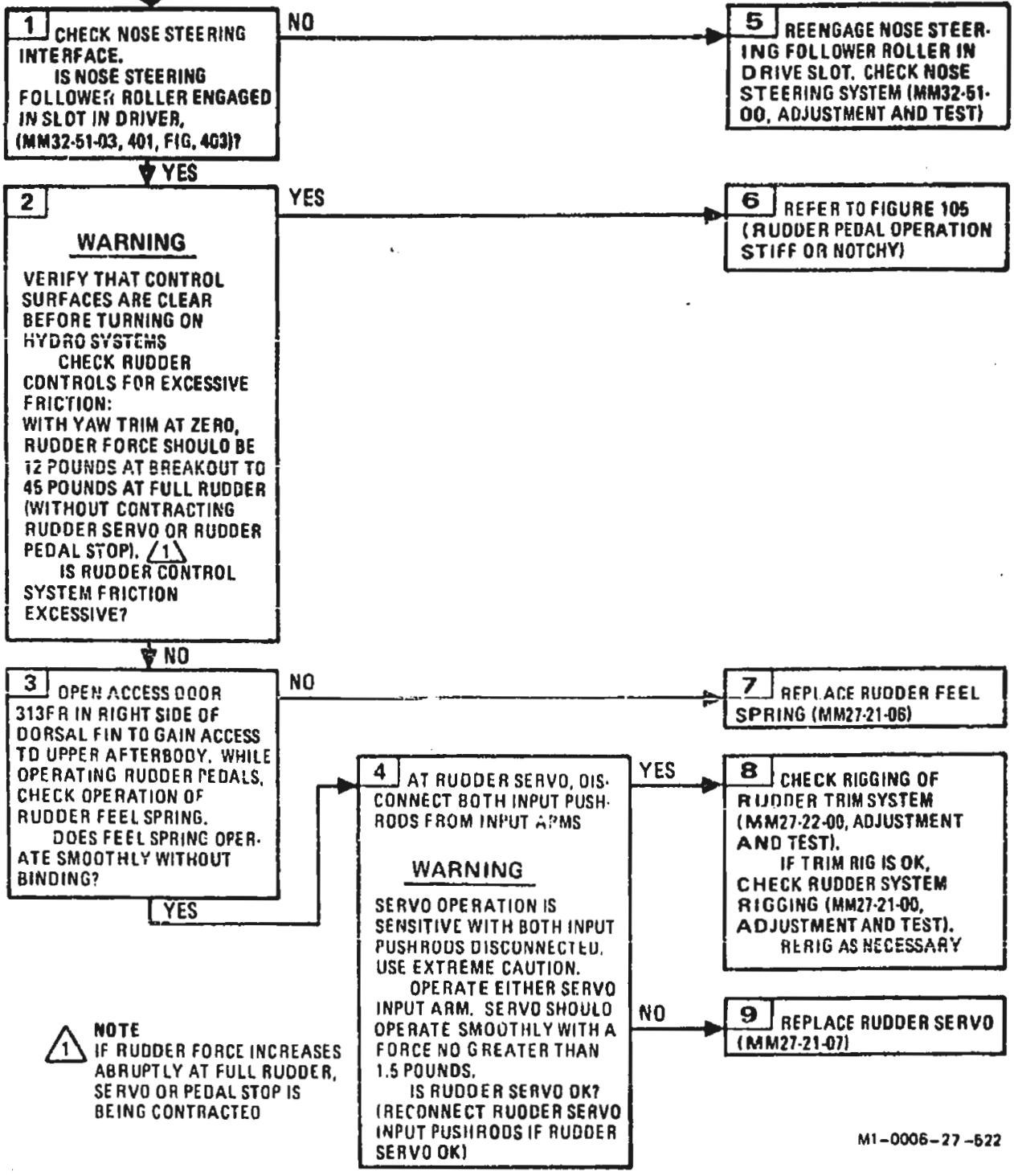

RUDDER PEDAL OPERATION STIFF OR NOTCHY /1\ /2\
PREREQUISITES
HYDRO POWER: SYS B AND C (MM29-11-00).
WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEM
1 CHECK RUDDER OPERATION WITH YAW SAS 1, YAW SAS 2 AND YAW SAS 1 AND 2 OFF.
DO PEDAL FORCES RETURN TO NORMAL?
YES
7 TROUBLESHOOT YAW SAS SYSTEM FAULTS (MM22-15-00) FIGURE 104, FAULT 13).
NO
2 CHECK OPERATION OF THE NOSE WHEEL STEERING SYSTEM (MM32-15-00).
IS NOSE WHEEL STEERING SYSTEM OK?
NO
8 TROUBLESHOOT NOSE WHEEL STEERING SYSTEM (MM32-51-00).
YES
3 GAIN ACCESS TO RUDDER FEEL SPRING IN UPPER AFTERBODY THROUGH ACCESS PANEL 313FR. DISCONNECT FEEL SPRING ROD-END FROM BELLCRANK (MM27-21-06). FORCE REQUIRED TO OPERATE RUDDER PEDALS WITH FEEL SPRING DISCONNECTED SHOULD BE 8 TO 10 POUNDS.
IS RUDDER PEDAL FORCE EXCESSIVE?
NO
6 AT RUDDER SERVO, DISCONNECT BOTH INPUT PUSH-RODS FROM INPUT ARMS.
WARNING
SERVO OPERATION IS SENSITIVE WITH BOTH INPUT PUSH-RODS DISCONNECTED. USE EXTREME CAUTION.
SLOWLY AND CAREFULLY OPERATE EITHER RUDDER SERVO INPUT ARM. SERVO SHOULD OPERATE SMOOTHLY AND INPUT ARM FORCE SHOULD NOT EXCEED 1.5 POUNDS.
IS RUDDER SERVO OK?
NO
9 REPLACE RUDDER SERVO (MM27-21-07).
YES
10 CHECK RUDDER CONTROL BELLCRANK ASSEMBLY BETWEEN FEEL SPRING AND SERVO FOR BINDING OR FAILED BEARING. REPLACE BELLCRANK ASSEMBLY IF FAULTY. IF BELLCRANK ASSEMBLY OK, REPLACE FEEL SPRING (MM27-21-06).
YES
4 WHILE SLOWLY OPERATING RUDDER PEDALS, CHECK RUDDER PEDAL LINKAGE IN FESC FOR INDICATION OF BINDING LINKAGE OR FAILED BEARING.
DOES RUDDER PEDAL LINKAGE OPERATE SMOOTHLY WITHOUT BINDING?
NO
11 REPAIR OR REPLACE FAULTY RUDDER PEDAL LINKAGE COMPONENTS (MM27-21-01).
YES
5 WHILE OPERATING RUDDER PEDALS CHECK THE FOLLOWING FOR FREEDOM OF OPERATION:
A) IN FESC-RUDDER CABLES, CABLE PULLEYS AND IDLER BELLCRANK.
B) IN AREA AFT OF AFT CARGO COMPARTMENT, ZONE 167, RUDDER CABLES AND RUDDER PULLEYS. IN PARTICULAR, CABLE PULLEY FORWARD OF PRESSURE BULKHEAD AT FS 1819.
C) IN LOWER AND UPPER AFTERBODY-RUDDER CABLES, CABLE PULLEYS AND AFT QUADRANT.
DO ABOVE COMPONENTS OPERATE FREELY?
NO
12 REPAIR OR REPLACE FAULTY RUDDER CONTROL COMPONENT.
YES
13 PROGRESSIVELY EXPOSE RUDDER CABLES AND CHECK FOR FOULED CABLE OR PULLEY. REPAIR OR REPLACE AS REQUIRED. (GAIN ACCESS TO RUDDER CABLES THROUGH THE CEILING IN THE FORWARD, CENTER, AND AFT CARGO COMPARTMENTS AND THE GALLEY. GAIN ACCESS TO RUDDER CABLE OVER THE WING THROUGH PASSENGER COMPARTMENT FLOOR).
NOTE
/1\ NORMAL RUDDER PEDAL FORCE, WITH YAW TRIM AT ZERO, SHOULD NOT EXCEED 18 POUNDS BREAKOUT TO 45 POUNDS AT FULL RUDDER, WITHOUT CONTACTING RUDDER SERVO OR RUDDER PEDAL STOPS. (IF RUDDER FORCE INCREASES ABRUPTLY AT FULL RUDDER, STOP IS BEING CONTACTED)
/2\ A JAMMED NOSE WHEEL STEERING SYSTEM COULD INCREASE RUDDER PEDAL FORCE 15 POUNDS.
MS-0007-27-021

R R Rudder Pedal Operation Stiff or Notchy
Figure 105

RUDDER PEDALS DO NOT CENTER

PREREQUISITES

HYDRALIC POWER: SYS B AND C (MM 29-11-00)


1 CHECK NOSE STEERING INTERFACE.
IS NOSE STEERING FOLLOWER ROLLER ENGAGED IN SLOT IN DRIVER, (MM32-51-03, 401, FIG. 403)?
NO
5 REENGAGE NOSE STEERING FOLLOWER ROLLER IN DRIVE SLOT. CHECK NOSE STEERING SYSTEM (MM32-51-00, ADJUSTMENT AND TEST)
YES
2
WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS
CHECK RUDDER CONTROLS FOR EXCESSIVE FRICTION:
WITH YAW TRIM AT ZERO, RUDDER FORCE SHOULD BE 12 POUNDS AT BREAKOUT TO 45 POUNDS AT FULL RUDDER (WITHOUT CONTRACTING RUDDER SERVO OR RUDDER PEDAL STOP). 1
IS RUDDER CONTROL SYSTEM FRICTION EXCESSIVE?
YES
6 REFER TO FIGURE 105 (RUDDER PEDAL OPERATION STIFF OR NOTCHY)
NO
3 OPEN ACCESS DOOR 313FR IN RIGHT SIDE OF DORSAL FIN TO GAIN ACCESS TO UPPER AFTERBODY. WHILE OPERATING RUDDER PEDALS, CHECK OPERATION OF RUDDER FEEL SPRING.
DOES FEEL SPRING OPERATE SMOOTHLY WITHOUT BINDING?
NO
7 REPLACE RUDDER FEEL SPRING (MM27-21-06)
YES
4 AT RUDDER SERVO, DISCONNECT BOTH INPUT PUSHRODS FROM INPUT ARMS
WARNING
SERVO OPERATION IS SENSITIVE WITH BOTH INPUT PUSHRODS DISCONNECTED. USE EXTREME CAUTION.
OPERATE EITHER SERVO INPUT ARM. SERVO SHOULD OPERATE SMOOTHLY WITH A FORCE NO GREATER THAN 1.5 POUNDS.
IS RUDDER SERVO OK? (RECONNECT RUDDER SERVO INPUT PUSHRODS IF RUDDER SERVO OK)
YES
8 CHECK RIGGING OF RUDDER TRIM SYSTEM (MM27-22-00, ADJUSTMENT AND TEST).
IF TRIM RIG IS OK, CHECK RUDDER SYSTEM RIGGING (MM27-21-00, ADJUSTMENT AND TEST).
RERIG AS NECESSARY
NO
9 REPLACE RUDDER SERVO (MM27-21-07)
1 NOTE
IF RUDDER FORCE INCREASES ABRUPTLY AT FULL RUDDER, SERVO OR PEDAL STOP IS BEING CONTRACTED
M1-0006-27-622

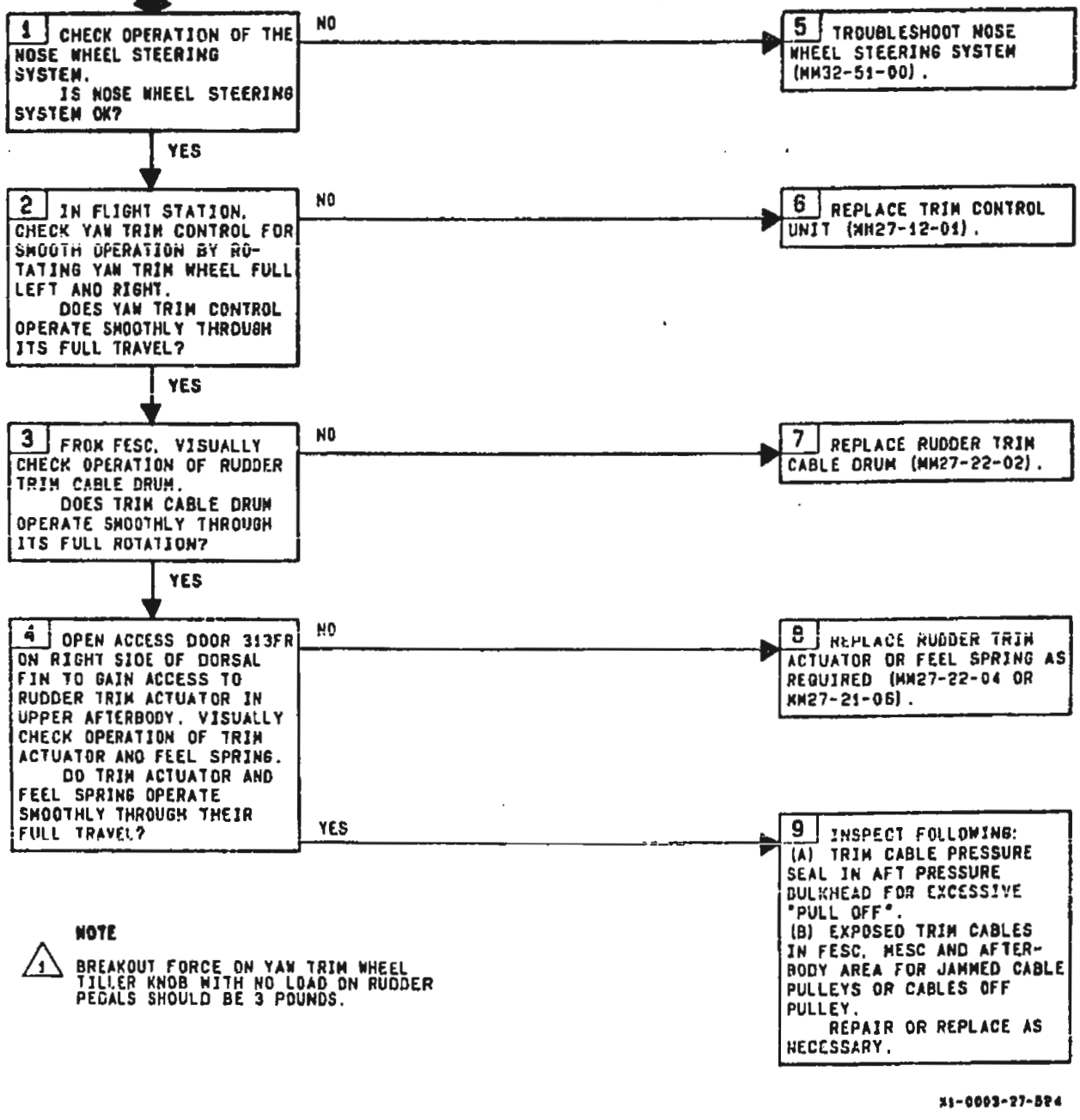
R Rudder Pedals Do Not Center
R Figure 106

EFFECTIVITY: ALL

001B

PREREQUISITES
HYDRAULIC POWER: SYS C (MM29-11-00)

WARNING
VERIFY THAT FLIGHT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS

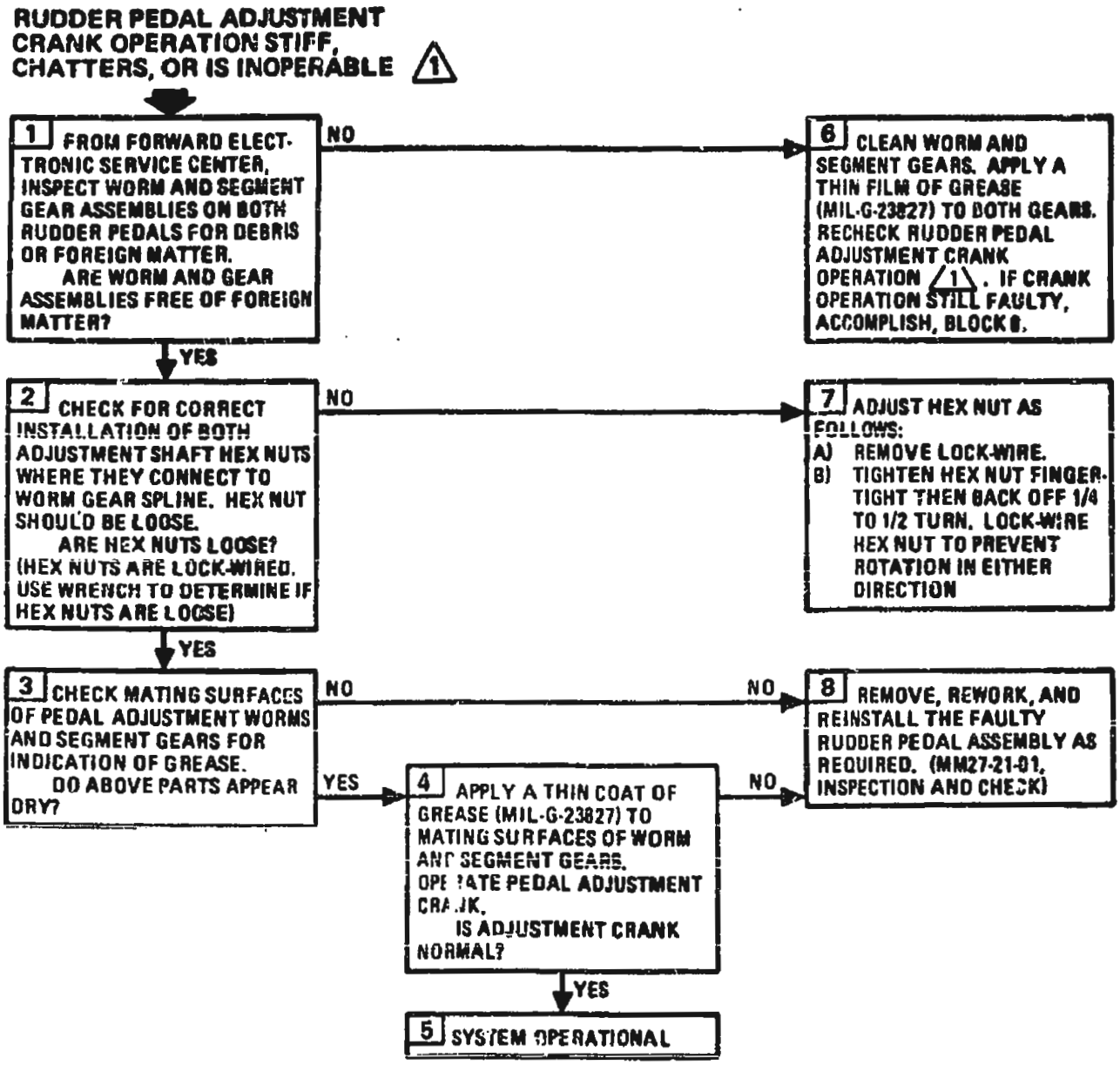

YAW TRIM WHEEL OPERATION STIFF OR NOTCHY/1\
1 CHECK OPERATION OF THE NOSE WHEEL STEERING SYSTEM.
IS NOSE WHEEL STEERING SYSTEM OK?
NO
5 TROUBLESHOOT NOSE WHEEL STEERING SYSTEM (MM32-51-00).
YES
2 IN FLIGHT STATION, CHECK YAW TRIM CONTROL FOR SMOOTH OPERATION BY ROTATING YAW TRIM WHEEL FULL LEFT AND RIGHT.
DOES YAW TRIM CONTROL OPERATE SMOOTHLY THROUGH ITS FULL TRAVEL?
NO
6 REPLACE TRIM CONTROL UNIT (MM27-12-01).
YES
3 FROM FESC, VISUALLY CHECK OPERATION OF RUDDER TRIM CABLE DRUM.
DOES TRIM CABLE DRUM OPERATE SMOOTHLY THROUGH ITS FULL ROTATION?
NO
7 REPLACE RUDDER TRIM CABLE DRUM (MM27-22-02).
YES
4 OPEN ACCESS DOOR 313FR ON RIGHT SIDE OF DORSAL FIN TO GAIN ACCESS TO RUDDER TRIM ACTUATOR IN UPPER AFTERBODY. VISUALLY CHECK OPERATION OF TRIM ACTUATOR AND FEEL SPRING.
DO TRIM ACTUATOR AND FEEL SPRING OPERATE SMOOTHLY THROUGH THEIR FULL TRAVEL?
NO
8 REPLACE RUDDER TRIM ACTUATOR OR FEEL SPRING AS REQUIRED (MM27-22-04 OR MM27-21-06).
YES
9 INSPECT FOLLOWING:
(A) TRIM CABLE PRESSURE SEAL IN AFT PRESSURE BULKHEAD FOR EXCESSIVE "PULL OFF".
(B) EXPOSED TRIM CABLES IN FESC, MESC AND AFTERBODY AREA FOR JAMMED CABLE PULLEYS OR CABLES OFF PULLEY.
REPAIR OR REPLACE AS NECESSARY.

NOTE

/1\ BREAKOUT FORCE ON YAW TRIM WHEEL TILLER KNOB WITH NO LOAD ON RUDDER PEDALS SHOULD BE 3 POUNDS.

X1-0003-27-5R4

R Yaw Trim Wheel Operation Stiff or Notchy
R Figure 107


RUDDER PEDAL ADJUSTMENT CRANK OPERATION STIFF, CHATTERS, OR IS INOPERABLE (1)
1 FROM FORWARD ELECTRONIC SERVICE CENTER, INSPECT WORM AND SEGMENT GEAR ASSEMBLIES ON BOTH RUDDER PEDALS FOR DEBRIS OR FOREIGN MATTER. ARE WORM AND GEAR ASSEMBLIES FREE OF FOREIGN MATTER?
NO
6 CLEAN WORM AND SEGMENT GEARS. APPLY A THIN FILM OF GREASE (MIL-G-23827) TO BOTH GEARS. RECHECK RUDDER PEDAL ADJUSTMENT CRANK OPERATION (1). IF CRANK OPERATION STILL FAULTY, ACCOMPLISH, BLOCK 8.
YES
2 CHECK FOR CORRECT INSTALLATION OF BOTH ADJUSTMENT SHAFT HEX NUTS WHERE THEY CONNECT TO WORM GEAR SPLINE. HEX NUT SHOULD BE LOOSE. ARE HEX NUTS LOOSE? (HEX NUTS ARE LOCK-WIRED. USE WRENCH TO DETERMINE IF HEX NUTS ARE LOOSE)
NO
7 ADJUST HEX NUT AS FOLLOWS:
A) REMOVE LOCK-WIRE.
B) TIGHTEN HEX NUT FINGER-TIGHT THEN BACK OFF 1/4 TO 1/2 TURN. LOCK-WIRE HEX NUT TO PREVENT ROTATION IN EITHER DIRECTION
YES
3 CHECK MATING SURFACES OF PEDAL ADJUSTMENT WORMS AND SEGMENT GEARS FOR INDICATION OF GREASE. DO ABOVE PARTS APPEAR DRY?
NO
NO
8 REMOVE, REWORK, AND REINSTALL THE FAULTY RUDDER PEDAL ASSEMBLY AS REQUIRED. (MM27-21-01, INSPECTION AND CHECK)
YES
4 APPLY A THIN COAT OF GREASE (MIL-G-23827) TO MATING SURFACES OF WORM AND SEGMENT GEARS. OPERATE PEDAL ADJUSTMENT CRANK. IS ADJUSTMENT CRANK NORMAL?
NO
YES
5 SYSTEM OPERATIONAL

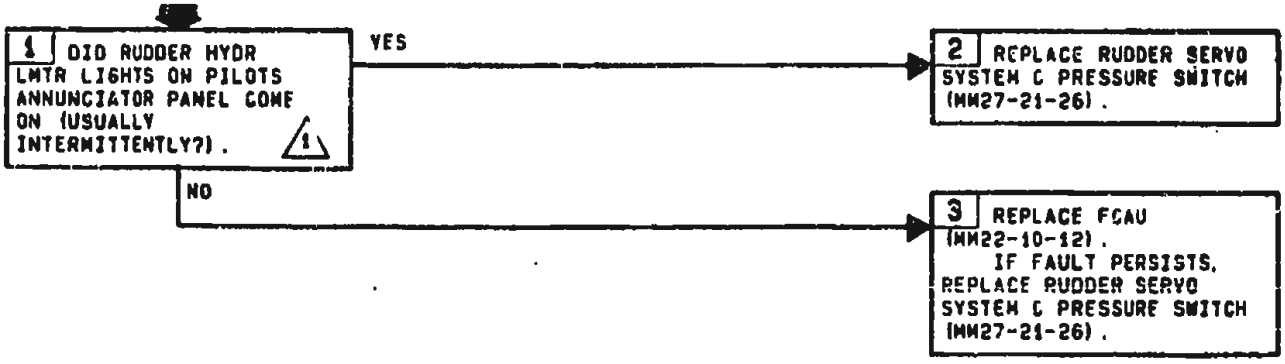
(1) NOTE
CHECK RUDDER PEDAL ADJUSTMENT CRANK OPERATION AS FOLLOWS:
A) POSITION YAW TRIM WHEEL TO ZERO
B) WITH NO LOAD ON RUDDER PEDALS, CYCLE PEDAL ADJUSTMENT CRANK THROUGH SEVERAL FULL FWD TO FULL AFT CYCLES. THE PEDAL ADJUSTMENT CRANK SHOULD OPERATE SMOOTHLY WITHOUT CHATTER, AND SHOULD NOT REQUIRE A FORCE GREATER THAN 15 POUNDS TO BREAK AWAY FROM FWD OR AFT STOP

M1-0103-27-300

Rudder Pedal Adjustment Crank Operation
is Stiff or Chatters
Figure 108

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
HYDRAULIC POWER SYS A, B, AND C (MM29-11-00)
CB'S C91-B7
CB2-H12, H20, K12, K13, K14, K15, K16
CB3-68, 69

RUDDER LIMITER PUSH LIGHT (ON OVERHEAD RUDDER LIMITER PANEL) ON DIMLY

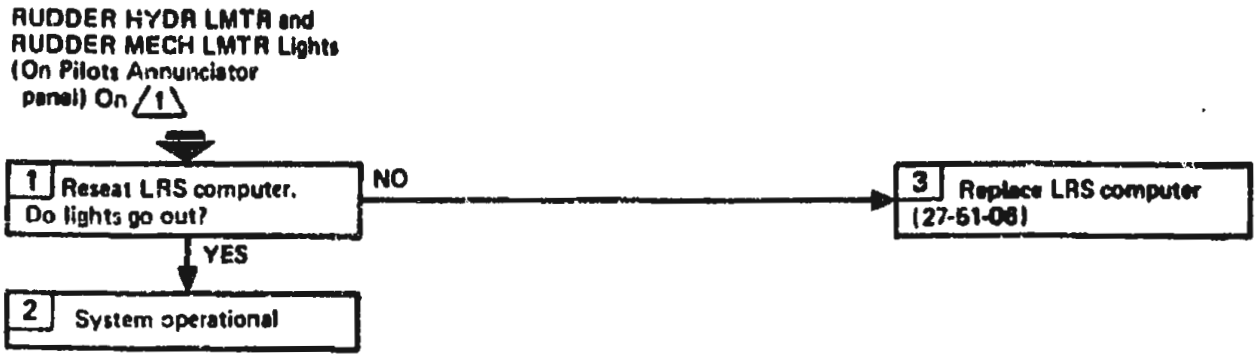

1 DID RUDDER HYDR LMTR LIGHTS ON PILOTS ANNUNCIATOR PANEL COME ON (USUALLY INTERMITTENTLY?).
1
YES
2 REPLACE RUDDER SERVO SYSTEM C PRESSURE SWITCH (MM27-21-26).
NO
3 REPLACE FCAU (MM22-10-12).
IF FAULT PERSISTS, REPLACE RUDDER SERVO SYSTEM C PRESSURE SWITCH (MM27-21-26).

NOTE

1 DURING LANDING GEAR OPERATION OCCASIONAL FLASHING IS CONSIDERED NORMAL.

M1-0001-27-023

R RUDDER LIMITER HYDRAULIC PUSH Light On Dimly
R Figure 109



PREREQUISITES

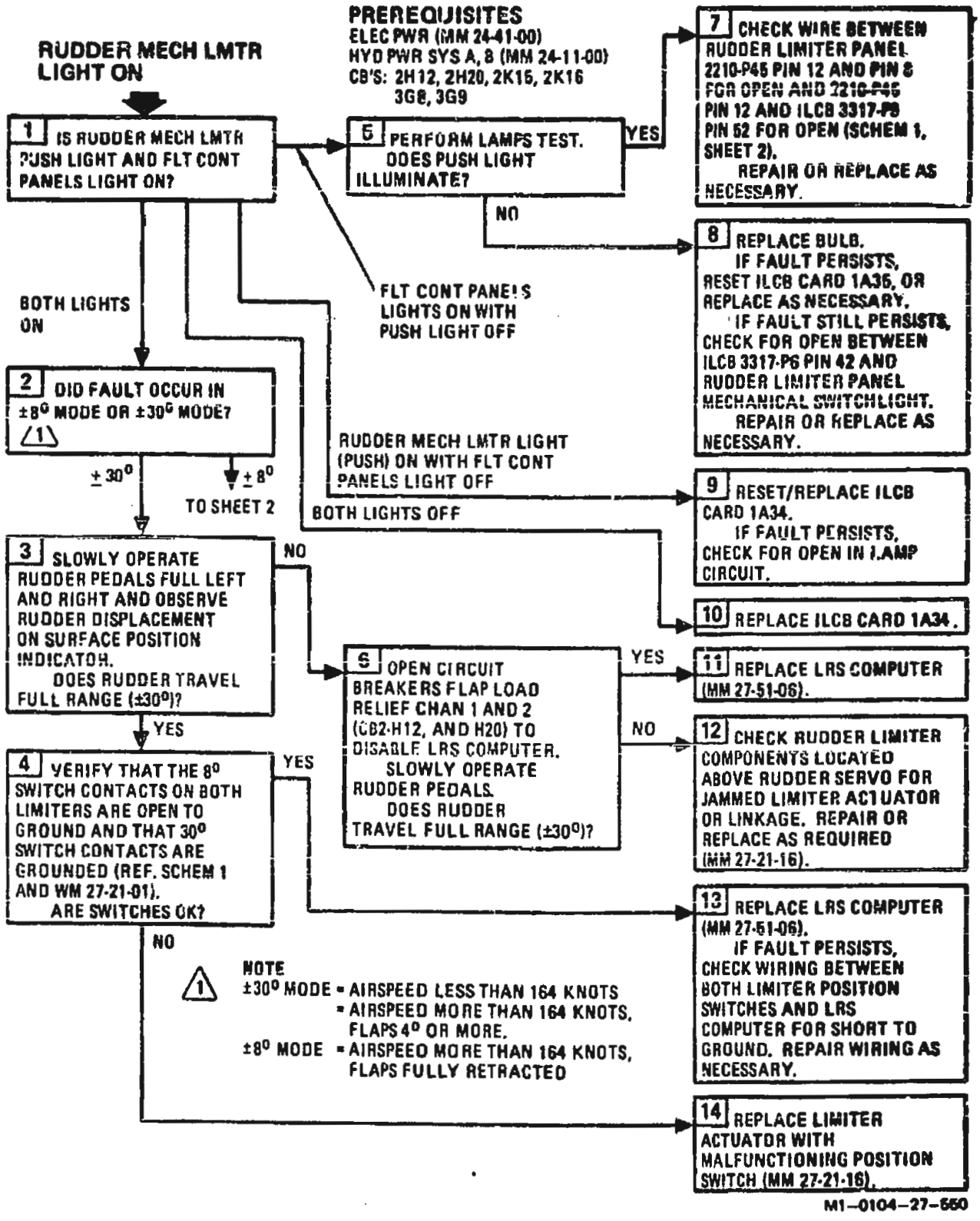
Elec Pwr (24-41-00)
Hyd Pwr (Sys A, B, C)
CB's CB1-B7
CB2-H12, H20, K12, K13
K14, K15, K16
CB3 G8, G9

/1\ **NOTE**

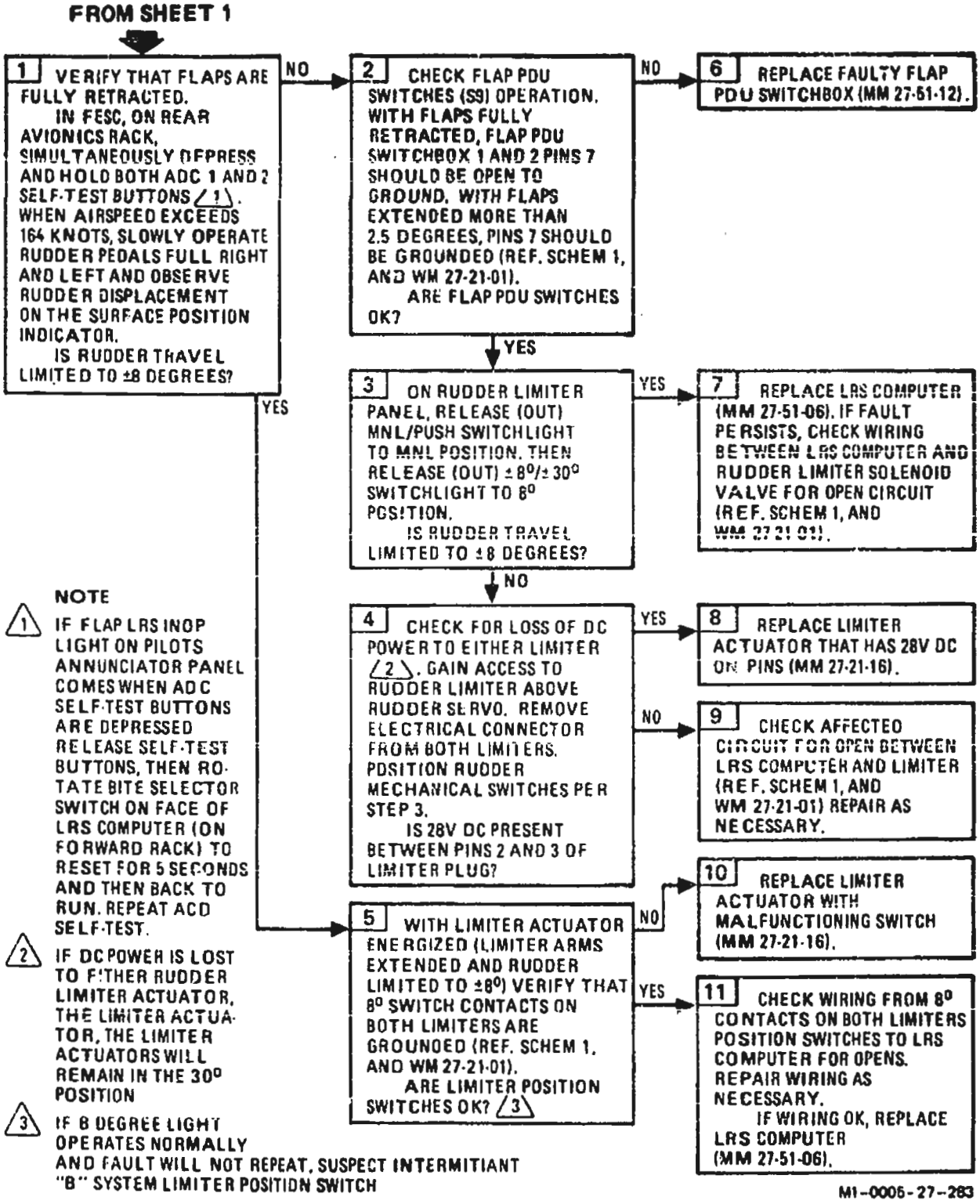
RUDDER HYDR and MECH LMTR lights may flash on/off in flight but not come on during ground check. If so, reseat LRS computer in rack. If fault still present during subsequent flights, replace LRS computer (27-51-08)

M1-0100-27-621

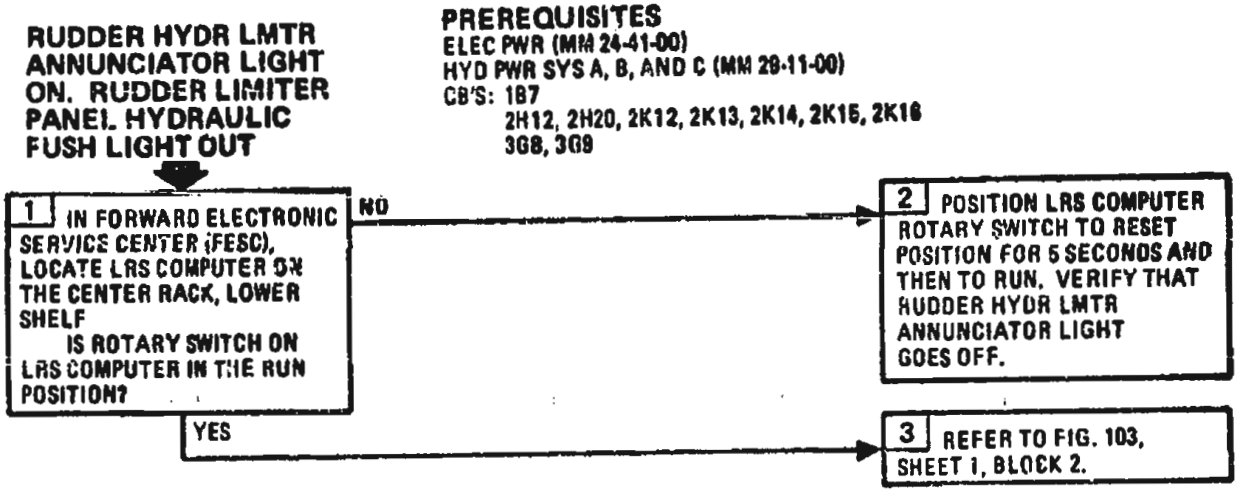
RUDDER MECH LMTR and RUDDER HYDR LMTR Annunciator Lights On
Figure 110


PREREQUISITES
ELEC PWR (MM 24-41-00)
HYD PWR SYS A, B (MM 24-11-00)
CB'S: 2H12, 2H20, 2K15, 2K16
3G8, 3G9
RUDDER MECH LMTR LIGHT ON
1 IS RUDDER MECH LMTR PUSH LIGHT AND FLT CONT PANELS LIGHT ON?
5 PERFORM LAMPS TEST. DOES PUSH LIGHT ILLUMINATE?
YES
7 CHECK WIRE BETWEEN RUDDER LIMITER PANEL 2210-P45 PIN 12 AND PIN 8 FOR OPEN AND 2210-P45 PIN 12 AND ILCB 3317-P8 PIN 52 FOR OPEN (SCHEM 1, SHEET 2). REPAIR OR REPLACE AS NECESSARY.
NO
8 REPLACE BULB. IF FAULT PERSISTS, RESET ILCB CARD 1A35, OR REPLACE AS NECESSARY. IF FAULT STILL PERSISTS, CHECK FOR OPEN BETWEEN ILCB 3317-P6 PIN 42 AND RUDDER LIMITER PANEL MECHANICAL SWITCHLIGHT. REPAIR OR REPLACE AS NECESSARY.
BOTH LIGHTS ON
FLT CONT PANELS LIGHTS ON WITH PUSH LIGHT OFF
2 DID FAULT OCCUR IN ±8° MODE OR ±30° MODE? (1)
±30°
±8°
TO SHEET 2
RUDDER MECH LMTR LIGHT (PUSH) ON WITH FLT CONT PANELS LIGHT OFF
9 RESET/REPLACE ILCB CARD 1A34. IF FAULT PERSISTS, CHECK FOR OPEN IN LAMP CIRCUIT.
BOTH LIGHTS OFF
10 REPLACE ILCB CARD 1A34.
3 SLOWLY OPERATE RUDDER PEDALS FULL LEFT AND RIGHT AND OBSERVE RUDDER DISPLACEMENT ON SURFACE POSITION INDICATOR. DOES RUDDER TRAVEL FULL RANGE (±30°)?
NO
6 OPEN CIRCUIT BREAKERS FLAP LOAD RELIEF CHAN 1 AND 2 (CB2-H12, AND H20) TO DISABLE LRS COMPUTER. SLOWLY OPERATE RUDDER PEDALS. DOES RUDDER TRAVEL FULL RANGE (±30°)?
YES
11 REPLACE LRS COMPUTER (MM 27-51-06).
NO
12 CHECK RUDDER LIMITER COMPONENTS LOCATED ABOVE RUDDER SERVO FOR JAMMED LIMITER ACTUATOR OR LINKAGE. REPAIR OR REPLACE AS REQUIRED (MM 27-21-16).
YES
4 VERIFY THAT THE 8° SWITCH CONTACTS ON BOTH LIMITERS ARE OPEN TO GROUND AND THAT 30° SWITCH CONTACTS ARE GROUNDED (REF. SCHEM 1 AND WM 27-21-01). ARE SWITCHES OK?
13 REPLACE LRS COMPUTER (MM 27-51-06). IF FAULT PERSISTS, CHECK WIRING BETWEEN BOTH LIMITER POSITION SWITCHES AND LRS COMPUTER FOR SHORT TO GROUND. REPAIR WIRING AS NECESSARY.
NO
14 REPLACE LIMITER ACTUATOR WITH MALFUNCTIONING POSITION SWITCH (MM 27-21-16).
(1) NOTE
±30° MODE = AIRSPEED LESS THAN 164 KNOTS
= AIRSPEED MORE THAN 164 KNOTS, FLAPS 4° OR MORE.
±8° MODE = AIRSPEED MORE THAN 164 KNOTS, FLAPS FULLY RETRACTED
M1-0104-27-550

RUDDER MECH LMTR Annunciator Light On
Figure 111 (Sheet 1)


FROM SHEET 1
1 VERIFY THAT FLAPS ARE FULLY RETRACTED.
IN FESC, ON REAR AVIONICS RACK, SIMULTANEOUSLY DEPRESS AND HOLD BOTH ADC 1 AND 2 SELF-TEST BUTTONS /1\. WHEN AIRSPEED EXCEEDS 164 KNOTS, SLOWLY OPERATE RUDDER PEDALS FULL RIGHT AND LEFT AND OBSERVE RUDDER DISPLACEMENT ON THE SURFACE POSITION INDICATOR.
IS RUDDER TRAVEL LIMITED TO ±8 DEGREES?
NO
YES
2 CHECK FLAP PDU SWITCHES (S9) OPERATION. WITH FLAPS FULLY RETRACTED, FLAP PDU SWITCHBOX 1 AND 2 PINS 7 SHOULD BE OPEN TO GROUND. WITH FLAPS EXTENDED MORE THAN 2.5 DEGREES, PINS 7 SHOULD BE GROUNDED (REF. SCHEM 1, AND WM 27-21-01).
ARE FLAP PDU SWITCHES OK?
NO
6 REPLACE FAULTY FLAP PDU SWITCHBOX (MM 27-51-12).
YES
3 ON RUDDER LIMITER PANEL, RELEASE (OUT) MNL/PUSH SWITCHLIGHT TO MNL POSITION. THEN RELEASE (OUT) ±8°/±30° SWITCHLIGHT TO 8° POSITION.
IS RUDDER TRAVEL LIMITED TO ±8 DEGREES?
YES
7 REPLACE LRS COMPUTER (MM 27-51-06). IF FAULT PERSISTS, CHECK WIRING BETWEEN LRS COMPUTER AND RUDDER LIMITER SOLENOID VALVE FOR OPEN CIRCUIT (REF. SCHEM 1, AND WM 27-21-01).
NO
4 CHECK FOR LOSS OF DC POWER TO EITHER LIMITER /2\. GAIN ACCESS TO RUDDER LIMITER ABOVE RUDDER SERVO. REMOVE ELECTRICAL CONNECTOR FROM BOTH LIMITERS. POSITION RUDDER MECHANICAL SWITCHES PER STEP 3.
IS 28V DC PRESENT BETWEEN PINS 2 AND 3 OF LIMITER PLUG?
YES
8 REPLACE LIMITER ACTUATOR THAT HAS 28V DC ON PINS (MM 27-21-16).
NO
9 CHECK AFFECTED CIRCUIT FOR OPEN BETWEEN LRS COMPUTER AND LIMITER (REF. SCHEM 1, AND WM 27-21-01) REPAIR AS NECESSARY.
5 WITH LIMITER ACTUATOR ENERGIZED (LIMITER ARMS EXTENDED AND RUDDER LIMITED TO ±8°) VERIFY THAT 8° SWITCH CONTACTS ON BOTH LIMITERS ARE GROUNDED (REF. SCHEM 1, AND WM 27-21-01).
ARE LIMITER POSITION SWITCHES OK? /3\
NO
10 REPLACE LIMITER ACTUATOR WITH MALFUNCTIONING SWITCH (MM 27-21-16).
YES
11 CHECK WIRING FROM 8° CONTACTS ON BOTH LIMITERS POSITION SWITCHES TO LRS COMPUTER FOR OPENS. REPAIR WIRING AS NECESSARY.
IF WIRING OK, REPLACE LRS COMPUTER (MM 27-51-06).
NOTE
/1\ IF FLAP LRS INOP LIGHT ON PILOTS ANNUNCIATOR PANEL COMES WHEN ADC SELF-TEST BUTTONS ARE DEPRESSED RELEASE SELF-TEST BUTTONS, THEN ROTATE BITE SELECTOR SWITCH ON FACE OF LRS COMPUTER (ON FORWARD RACK) TO RESET FOR 5 SECONDS AND THEN BACK TO RUN. REPEAT ADC SELF-TEST.
/2\ IF DC POWER IS LOST TO EITHER RUDDER LIMITER ACTUATOR, THE LIMITER ACTUATOR, THE LIMITER ACTUATORS WILL REMAIN IN THE 30° POSITION
/3\ IF 8 DEGREE LIGHT OPERATES NORMALLY AND FAULT WILL NOT REPEAT, SUSPECT INTERMITIANT "B" SYSTEM LIMITER POSITION SWITCH
M1-0006-27-283

RUDDER MECH LMTR Annunciator Light On
Figure 111 (Sheet 2)

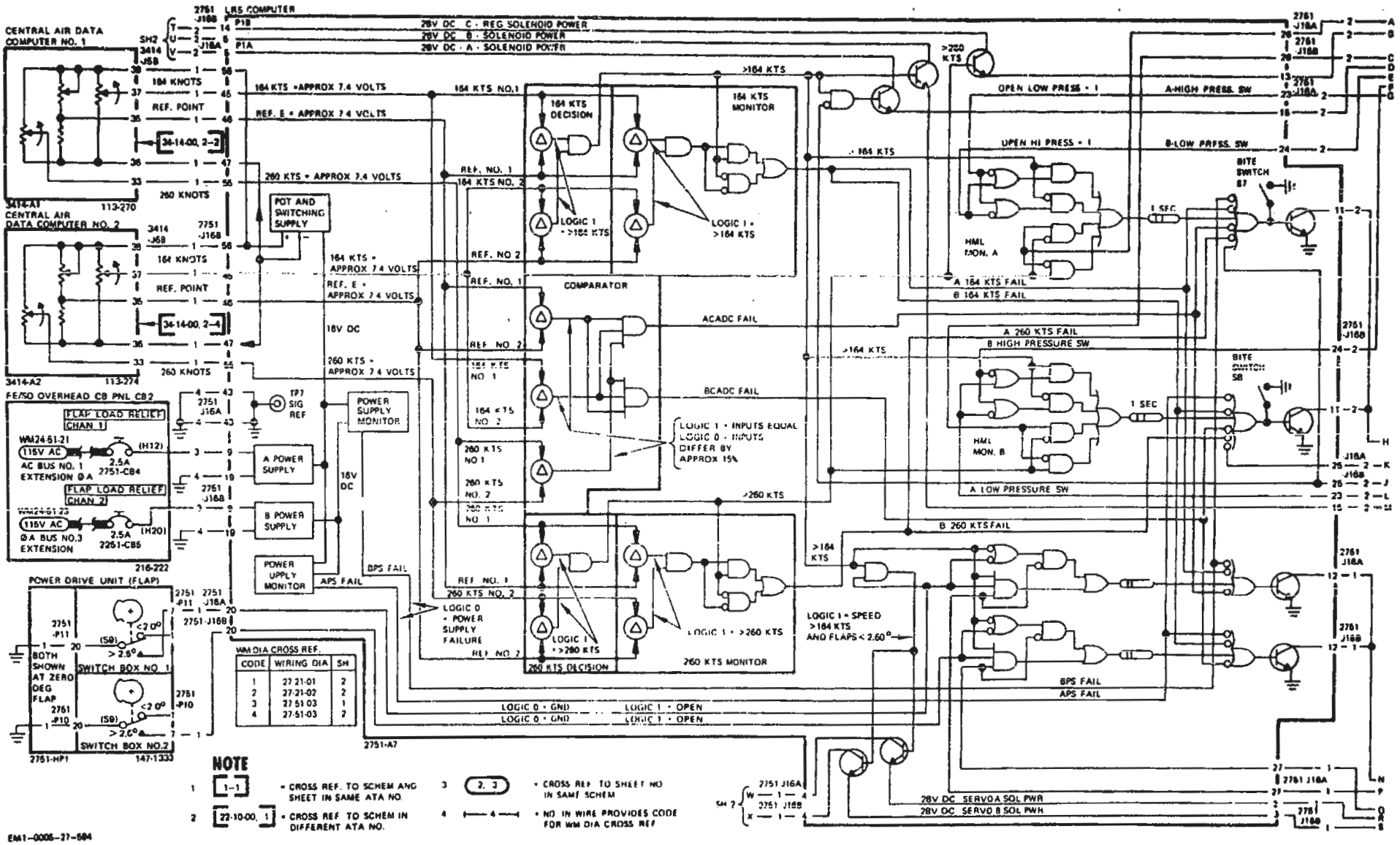

RUDDER HYDR LMTR ANNUNCIATOR LIGHT ON. RUDDER LIMITER PANEL HYDRAULIC FUSH LIGHT OUT
PREREQUISITES
ELEC PWR (MM 24-41-00)
HYD PWR SYS A, B, AND C (MM 29-11-00)
CB'S: 1B7
2H12, 2H20, 2K12, 2K13, 2K14, 2K15, 2K16
3G8, 3G9
1 IN FORWARD ELECTRONIC SERVICE CENTER (FESC), LOCATE LRS COMPUTER ON THE CENTER RACK, LOWER SHELF
IS ROTARY SWITCH ON LRS COMPUTER IN THE RUN POSITION?
NO
2 POSITION LRS COMPUTER ROTARY SWITCH TO RESET POSITION FOR 5 SECONDS AND THEN TO RUN. VERIFY THAT RUDDER HYDR LMTR ANNUNCIATOR LIGHT GOES OFF.
YES
3 REFER TO FIG. 103, SHEET 1, BLOCK 2.

M1-0002-27-703

R RUDDER HYDR LMTR Annunciator Light On, RUDDER LIMITER
R Panel HYDRAULIC PUSH Light Out
R Figure 112

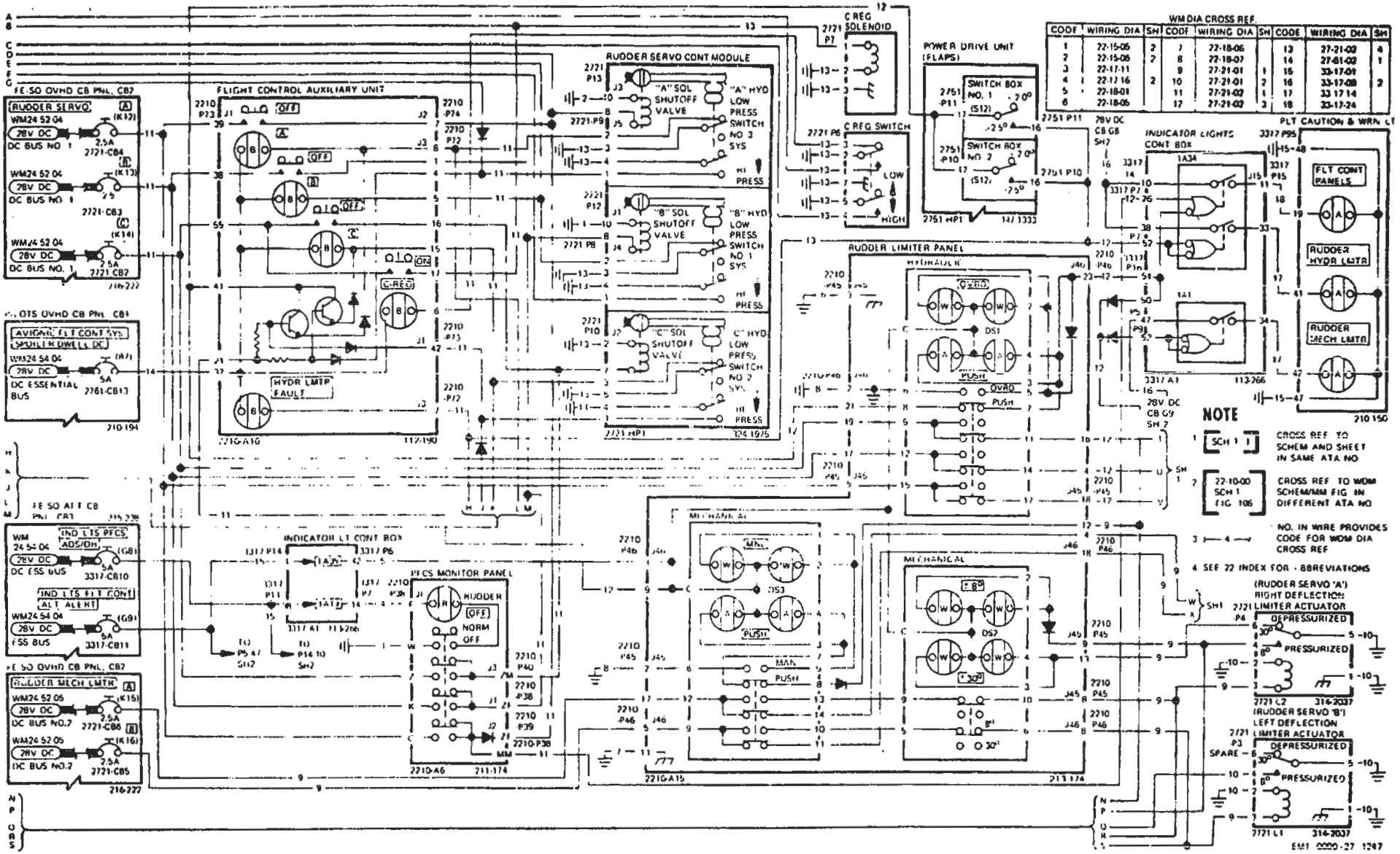
EFFECTIVITY: ALL

001B


CENTRAL AIR DATA COMPUTER NO. 1
CENTRAL AIR DATA COMPUTER NO. 2
LRS COMPUTER
28V DC · C · REG SOLENOID POWER
28V DC · B · SOLENOID POWER
28V DC · A · SOLENOID POWER
164 KTS · APPROX 7.4 VOLTS
REF. E · APPROX 7.4 VOLTS
260 KTS · APPROX 7.4 VOLTS
POT AND SWITCHING SUPPLY
16V DC
164 KTS NO.1
164 KTS NO.2
260 KTS NO.1
260 KTS NO.2
164 KTS DECISION
164 KTS MONITOR
260 KTS DECISION
260 KTS MONITOR
COMPARATOR
ACADC FAIL
BCADC FAIL
LOGIC 1 · INPUTS EQUAL
LOGIC 0 · INPUTS DIFFER BY APPROX 15%
POWER SUPPLY MONITOR
A POWER SUPPLY
B POWER SUPPLY
BPS FAIL
APS FAIL
LOGIC 0 · POWER SUPPLY FAILURE
OPEN LOW PRESS · 1
OPEN HI PRESS · 1
A HIGH PRESS SW
B LOW PRESS SW
HML MON. A
HML MON. B
A 164 KTS FAIL
B 164 KTS FAIL
A 260 KTS FAIL
B HIGH PRESSURE SW
A LOW PRESSURE SW
B 260 KTS FAIL
BITE SWITCH S7
BITE SWITCH S8
1 SEC
LOGIC 1 · SPEED >164 KTS AND FLAPS < 2.60°
28V DC SERVO A SOL PWR
28V DC SERVO B SOL PWR
FE/SO OVERHEAD CB PNL CB2
FLAP LOAD RELIEF CHAN 1
FLAP LOAD RELIEF CHAN 2
115V AC
AC BUS NO. 1 EXTENSION ØA
ØA BUS NO.3 EXTENSION
2.5A
POWER DRIVE UNIT (FLAP)
SWITCH BOX NO. 1
SWITCH BOX NO.2
BOTH SHOWN AT ZERO DEG FLAP
WM DIA CROSS REF.
CODE
WIRING DIA
SH
NOTE
CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
CROSS REF TO SHEET NO IN SAME SCHEM
CROSS REF TO SCHEM IN DIFFERENT ATA NO.
NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
EM1-0005-27-004

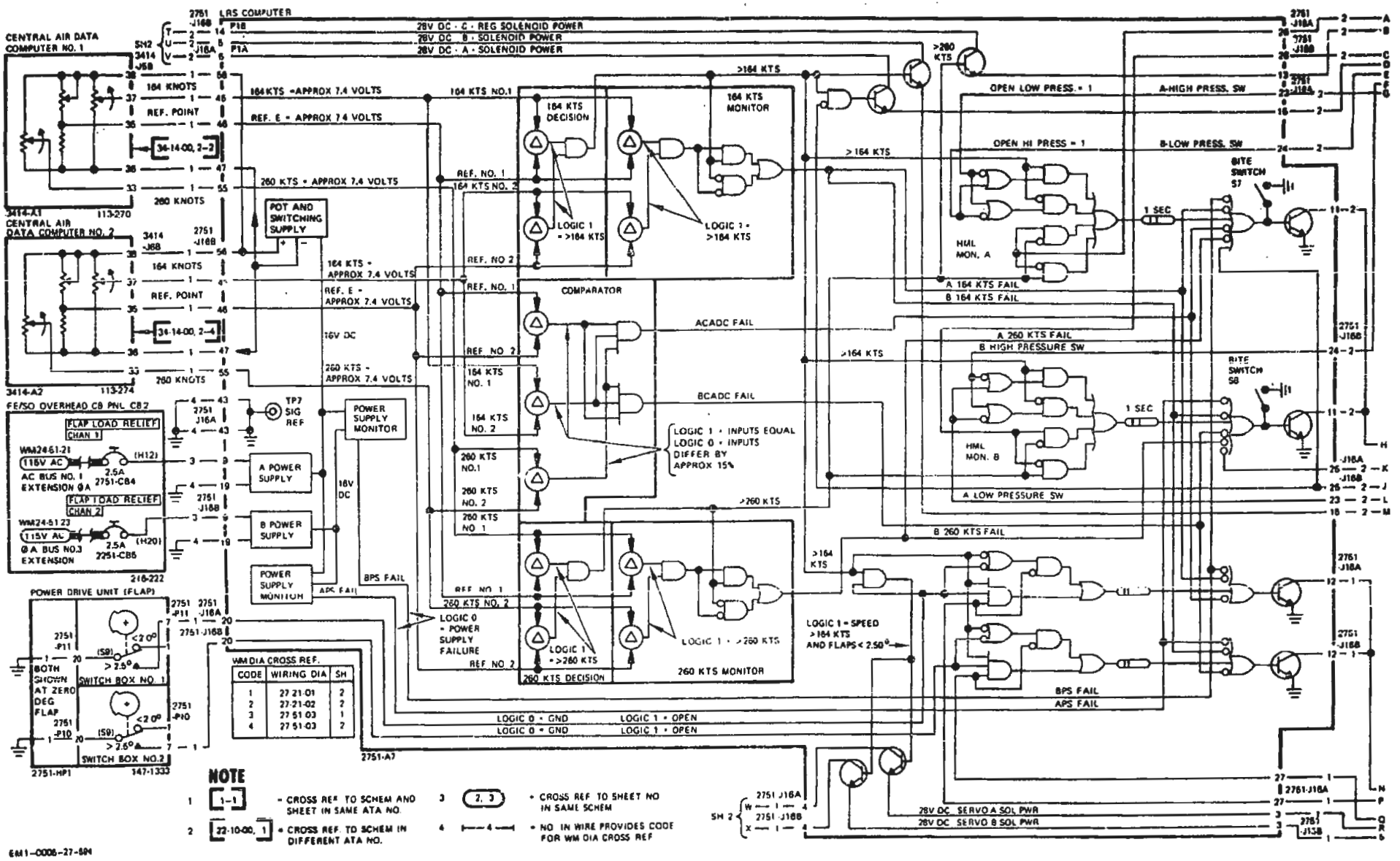
Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 1)

R EFFECTIVITY: WITH SB27-170 AND WITHOUT
R SB22-057, SB27-139, OR SB27-169
001B


FLIGHT CONTROL AUXILIARY UNIT
RUDDER SERVO CONT MODULE
RUDDER LIMITER PANEL
PFCS MONITOR PANEL
INDICATOR LT CONT BOX
POWER DRIVE UNIT (FLAPS)
C REG SOLENOID
C REG SWITCH
"A" SOL SHUTOFF VALVE
"B" SOL SHUTOFF VALVE
"C" SOL SHUTOFF VALVE
"A" HYD LOW PRESS SWITCH NO 3 SYS
"B" HYD LOW PRESS SWITCH NO 1 SYS
"C" HYD LOW PRESS SWITCH NO 2 SYS
HYDR LMTR FAULT
MECHANICAL
HYDRAULIC
INDICATOR LIGHTS CONT BOX
PLT CAUTION & WRN LT
FLT CONT PANELS
RUDDER HYDR LMTR
RUDDER MECH LMTR
WM DIA CROSS REF
NOTE
CROSS REF TO SCHEM AND SHEET IN SAME ATA NO
CROSS REF TO WDM SCHEM/MM FIG IN DIFFERENT ATA NO
NO. IN WIRE PROVIDES CODE FOR WDM DIA CROSS REF
SEE 22 INDEX FOR ABBREVIATIONS
(RUDDER SERVO 'A') RIGHT DEFLECTION LIMITER ACTUATOR
(RUDDER SERVO 'B') LEFT DEFLECTION LIMITER ACTUATOR
DEPRESSURIZED
PRESSURIZED
EM1 0000-27 1247

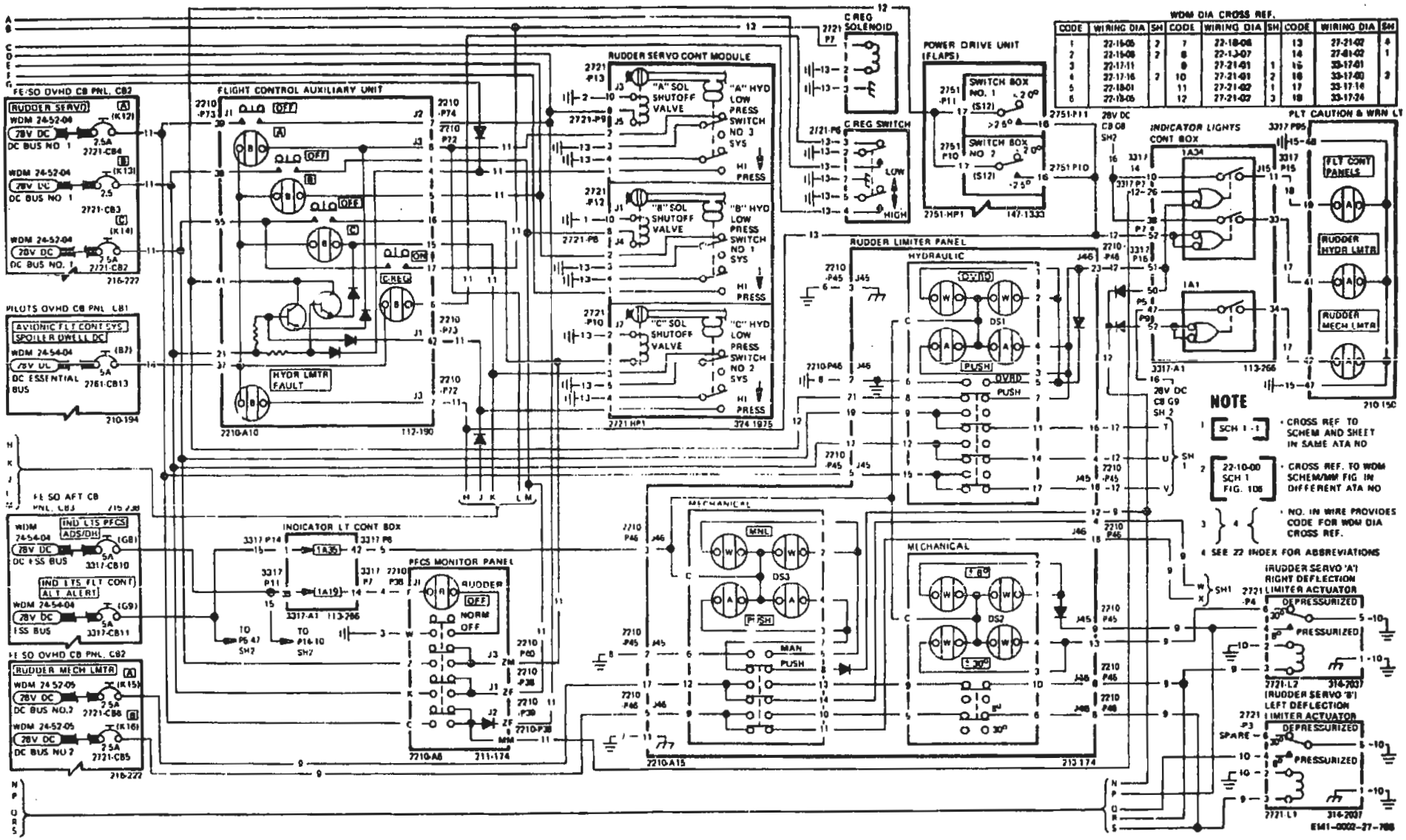
Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 2)

R EFFECTIVITY: WITH SB27-170 AND WITHOUT
R SB22-057, SB27-139, OR SB27-169
001B


LAS COMPUTER
28V DC - C - REG SOLENOID POWER
28V DC - B - SOLENOID POWER
28V DC - A - SOLENOID POWER
CENTRAL AIR DATA COMPUTER NO. 1
CENTRAL AIR DATA COMPUTER NO. 2
164 KNOTS
REF. POINT
260 KNOTS
164KTS = APPROX 7.4 VOLTS
REF. E = APPROX 7.4 VOLTS
260 KTS = APPROX 7.4 VOLTS
16V DC
POT AND SWITCHING SUPPLY
TP7 SIG REF
POWER SUPPLY MONITOR
A POWER SUPPLY
B POWER SUPPLY
FE/SO OVERHEAD CB PNL CB2
FLAP LOAD RELIEF CHAN 1
FLAP LOAD RELIEF CHAN 2
115V AC
2.5A
AC BUS NO. 1 EXTENSION
AC BUS NO.3 EXTENSION
POWER DRIVE UNIT (FLAP)
SWITCH BOX NO. 1
SWITCH BOX NO.2
BOTH SHOWN AT ZERO DEG FLAP
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 27-21-01 | 2
2 | 27-21-02 | 2
3 | 27-51-03 | 1
4 | 27-51-03 | 2
164 KTS NO.1
164 KTS NO. 2
260 KTS NO.1
260 KTS NO. 2
260 KTS NO 1
164 KTS DECISION
164 KTS MONITOR
260 KTS DECISION
260 KTS MONITOR
LOGIC 1 = >164 KTS
LOGIC 2 = >164 KTS
LOGIC 1 = >260 KTS
LOGIC 1 = >260 KTS
COMPARATOR
ACADC FAIL
BCADC FAIL
LOGIC 1 = INPUTS EQUAL
LOGIC 0 = INPUTS DIFFER BY APPROX 15%
LOGIC 0 = POWER SUPPLY FAILURE
BPS FAIL
APS FAIL
LOGIC 0 = GND
LOGIC 1 = OPEN
LOGIC 1 = SPEED >164 KTS AND FLAPS < 2.50°
>164 KTS
>260 KTS
OPEN LOW PRESS. = 1
OPEN HI PRESS = 1
A-HIGH PRESS. SW
B-LOW PRESS. SW
BITE SWITCH S7
BITE SWITCH S8
1 SEC
HML MON. A
HML MON. B
A 164 KTS FAIL
B 164 KTS FAIL
A 260 KTS FAIL
B HIGH PRESSURE SW
A LOW PRESSURE SW
B 260 KTS FAIL
28V DC SERVO A SOL PWR
28V DC SERVO B SOL PWR
NOTE
1 [1-1] - CROSS REF TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) - CROSS REF TO SHEET NO IN SAME SCHEM
4 - NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF

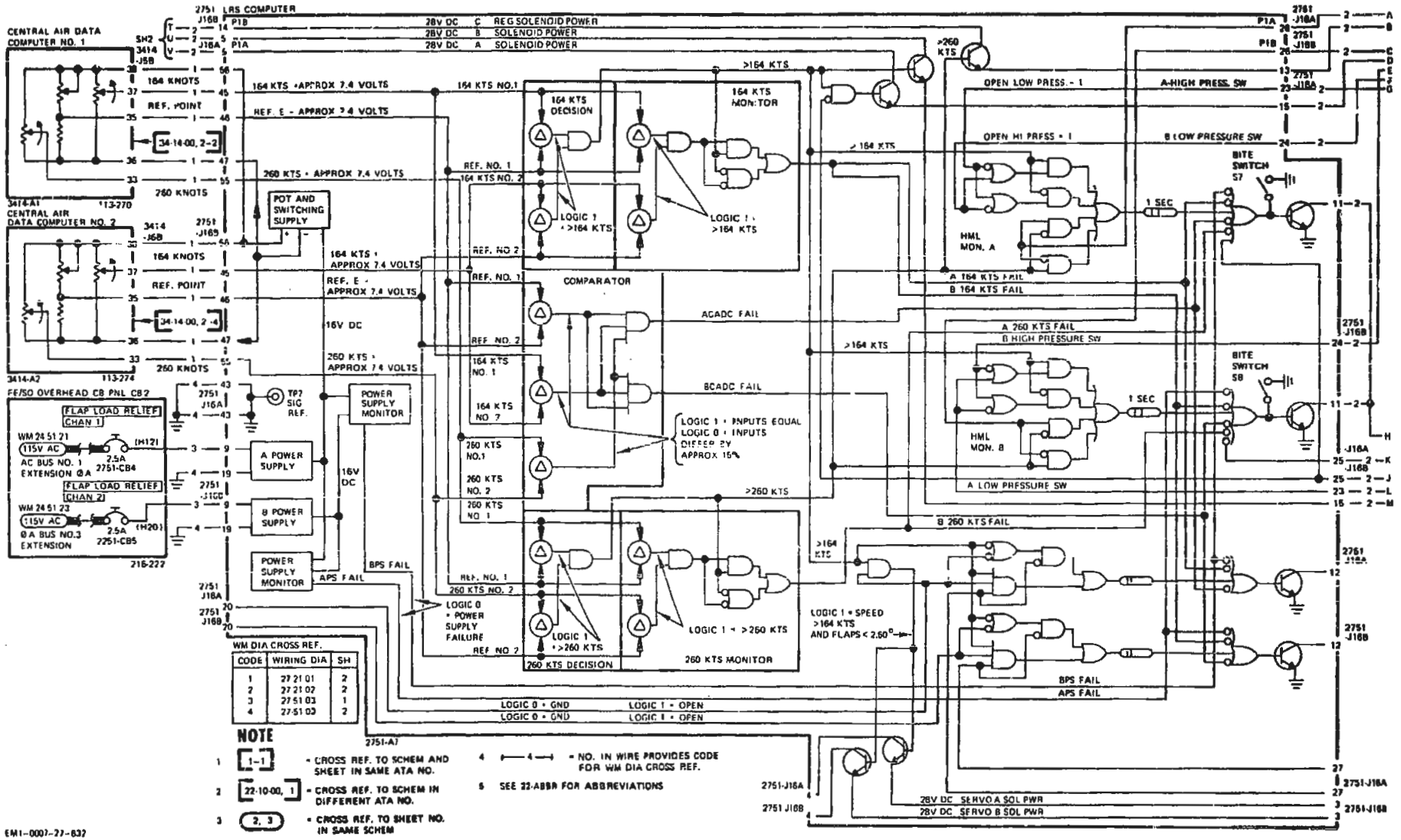
Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 1)

R EFFECTIVITY: WITH SB22-057 AND SB27-170 AND
R WITHOUT SB27-139 OR SB27-169
.001B



Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 2)

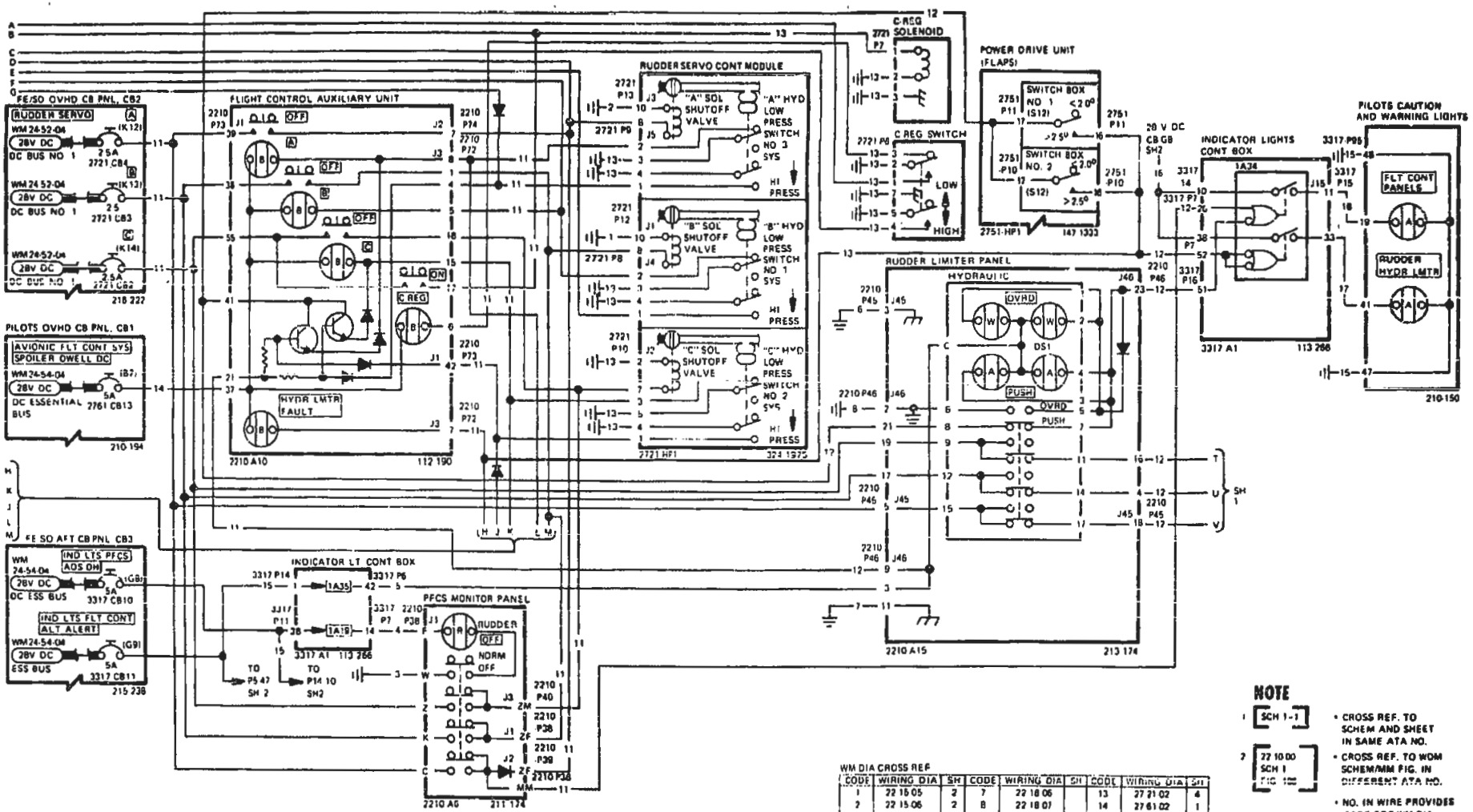
R EFFECTIVITY: WITH SB22-057 AND SB27-170 AND
R WITHOUT SB27-139 OR SB27-169
001B


CENTRAL AIR DATA COMPUTER NO. 1
CENTRAL AIR DATA COMPUTER NO. 2
FE/SO OVERHEAD CB PNL CB2
FLAP LOAD RELIEF CHAN 1
FLAP LOAD RELIEF CHAN 2
WM 24 51 21
WM 24 51 23
115V AC
AC BUS NO. 1 EXTENSION
ØA BUS NO. 3 EXTENSION
2751-CB4
2751-CB5
POT AND SWITCHING SUPPLY
POWER SUPPLY MONITOR
A POWER SUPPLY
B POWER SUPPLY
TP7 SIG REF.
16V DC
APS FAIL
BPS FAIL
164 KTS NO.1
164 KTS NO. 2
260 KTS NO.1
260 KTS NO. 2
164 KTS DECISION
260 KTS DECISION
LOGIC 1 = >164 KTS
LOGIC 1 = >260 KTS
164 KTS MONITOR
260 KTS MONITOR
COMPARATOR
ACADC FAIL
BCADC FAIL
LOGIC 1 = INPUTS EQUAL
LOGIC 0 = INPUTS DIFFER BY APPROX 15%
LOGIC 0 = POWER SUPPLY FAILURE
OPEN LOW PRESS. = 1
OPEN HI PRESS = 1
A-HIGH PRESS. SW
B LOW PRESSURE SW
HML MON. A
HML MON. B
A 164 KTS FAIL
B 164 KTS FAIL
A 260 KTS FAIL
B HIGH PRESSURE SW
A LOW PRESSURE SW
B 260 KTS FAIL
BITE SWITCH S7
BITE SWITCH S8
1 SEC
LOGIC 1 = SPEED >164 KTS AND FLAPS < 2.50°
BPS FAIL
APS FAIL
28V DC SERVO A SOL PWR
28V DC SERVO B SOL PWR
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 27 21 01 | 2
2 | 27 21 02 | 2
3 | 27 51 03 | 1
4 | 27 51 03 | 2
NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
EM1-0007-27-832

R Rudder Limiting Electrical Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: WITH SB27-169 AND WITHOUT SB22-057 OR SB27-139

001B



NOTE

1 [SCH 1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [22 10 00 SCH 1 FIG 1] • CROSS REF. TO WDM SCHEM/MM FIG. IN DIFFERENT ATA NO.

3 ⟵ 4 ⟶ • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

4 SEE 22 INDEX FOR ABBREVIATIONS

EM1-0001-27-1263

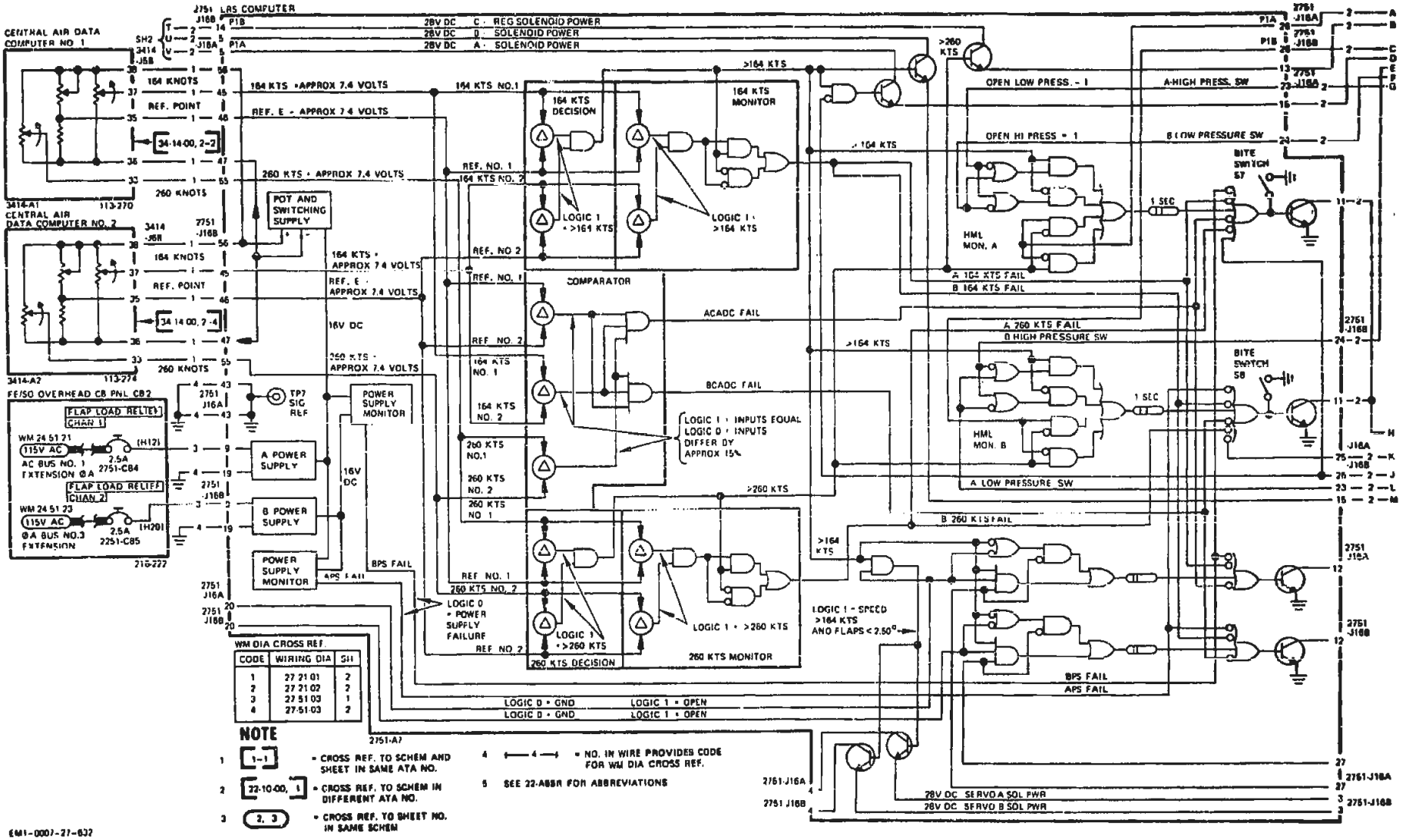
WM DIA CROSS REF

CODE	WIRING DIA	SH	CODE	WIRING DIA	SH	CODE	WIRING DIA	SH
1	22 15 05	2	7	22 18 06		13	27 21 02	4
2	22 15 06	2	8	22 18 07		14	27 61 02	1
3	22 17 11		9	27 21 01	1	15	33 17 01	
4	22 17 16	2	10	27 21 01	2	16	33 17 08	2
5	22 10-01		11	27 21 02	1	17	33 17-14	
6	22 18 05		12	27 21 02	3	18	33 17 24	

R Rudder Limiting Electrical Schematic
R SCHEM 1 (Sheet 2)

EFFECTIVITY: WITH SB27-169 AND WITHOUT SB22-057 OR SB27-139

001B

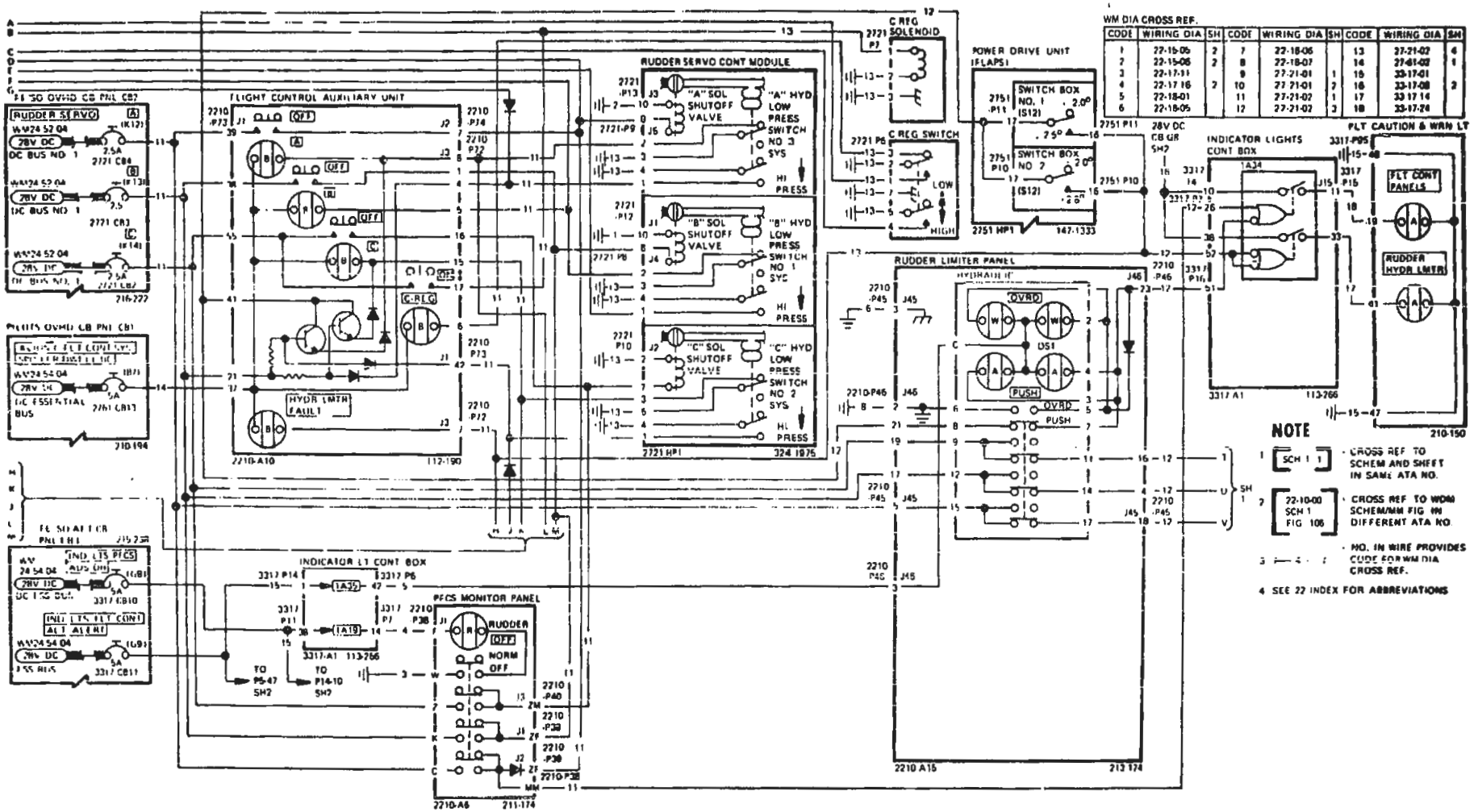

CENTRAL AIR DATA COMPUTER NO. 1
CENTRAL AIR DATA COMPUTER NO. 2
LAS COMPUTER
164 KNOTS
REF. POINT
260 KNOTS
164 KTS - APPROX 7.4 VOLTS
REF. E - APPROX 7.4 VOLTS
260 KTS - APPROX 7.4 VOLTS
16V DC
POT AND SWITCHING SUPPLY
TP7 SIG REF
POWER SUPPLY MONITOR
A POWER SUPPLY
B POWER SUPPLY
FE/SO OVERHEAD CB PNL CB2
FLAP LOAD RELIEF CHAN 1
FLAP LOAD RELIEF CHAN 2
115V AC
2.5A
APS FAIL
BPS FAIL
28V DC C - REG SOLENOID POWER
28V DC D - SOLENOID POWER
28V DC A - SOLENOID POWER
164 KTS NO.1
164 KTS NO.2
164 KTS DECISION
164 KTS MONITOR
COMPARATOR
ACADC FAIL
BCADC FAIL
LOGIC 1 = INPUTS EQUAL
LOGIC 0 = INPUTS DIFFER BY APPROX 15%
260 KTS NO.1
260 KTS NO.2
260 KTS DECISION
260 KTS MONITOR
LOGIC 0 = POWER SUPPLY FAILURE
LOGIC 1 = SPEED >164 KTS AND FLAPS < 2.50°
>164 KTS
>260 KTS
OPEN LOW PRESS. - 1
OPEN HI PRESS - 1
A-HIGH PRESS. SW
B LOW PRESSURE SW
HML MON. A
HML MON. B
A 164 KTS FAIL
B 164 KTS FAIL
A 260 KTS FAIL
B HIGH PRESSURE SW
A LOW PRESSURE SW
B 260 KTS FAIL
BITE SWITCH 57
BITE SWITCH 58
1 SEC
LOGIC 0 = GND
LOGIC 1 = OPEN
28V DC SERVO A SOL PWR
28V DC SERVO B SOL PWR
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 27 21 01 | 2
2 | 27 21 02 | 2
3 | 27 51 03 | 1
4 | 27-51-03 | 2
NOTE
1 = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 = SEE 22-A68R FOR ABBREVIATIONS

EMI-0007-27-632

R Rudder Limiting Electrical Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: WITH SB22-057 AND SB27-169 AND WITHOUT SB27-139

0018


WM DIA CROSS REF.
CODE | WIRING DIA | SH | CODE | WIRING DIA | SH | CODE | WIRING DIA | SH
1 | 27-15-05 | 2 | 7 | 27-18-05 | | 13 | 27-21-02 | 4
2 | 27-15-06 | 2 | 8 | 27-18-07 | | 14 | 27-61-02 | 1
3 | 27-17-11 | | 9 | 27-21-01 | 1 | 15 | 33-17-01 |
4 | 27-17-16 | 2 | 10 | 27-21-01 | 2 | 16 | 33-17-08 | 2
5 | 27-18-01 | | 11 | 27-21-02 | 1 | 17 | 33-17-14 |
6 | 27-18-05 | | 12 | 27-21-02 | 3 | 18 | 33-17-24 |
FLIGHT CONTROL AUXILIARY UNIT
RUDDER SERVO CONT MODULE
"A" SOL SHUTOFF VALVE
"B" SOL SHUTOFF VALVE
"C" SOL SHUTOFF VALVE
C REG SOLENOID
C REG SWITCH
POWER DRIVE UNIT (FLAPS)
SWITCH BOX NO. 1
SWITCH BOX NO. 2
RUDDER LIMITER PANEL
INDICATOR LIGHTS CONT BOX
PFCS MONITOR PANEL
INDICATOR LT CONT BOX
FLT CAUTION & WRN LT
FLT CONT PANELS
RUDDER HYDR LMTR
HYDR LMTR FAULT
NOTE
1 [SCH 1 1] · CROSS REF TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00 SCH 1 FIG 106] · CROSS REF TO WDM SCHEM/MM FIG IN DIFFERENT ATA NO.
3 · NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4 SEE 22 INDEX FOR ABBREVIATIONS

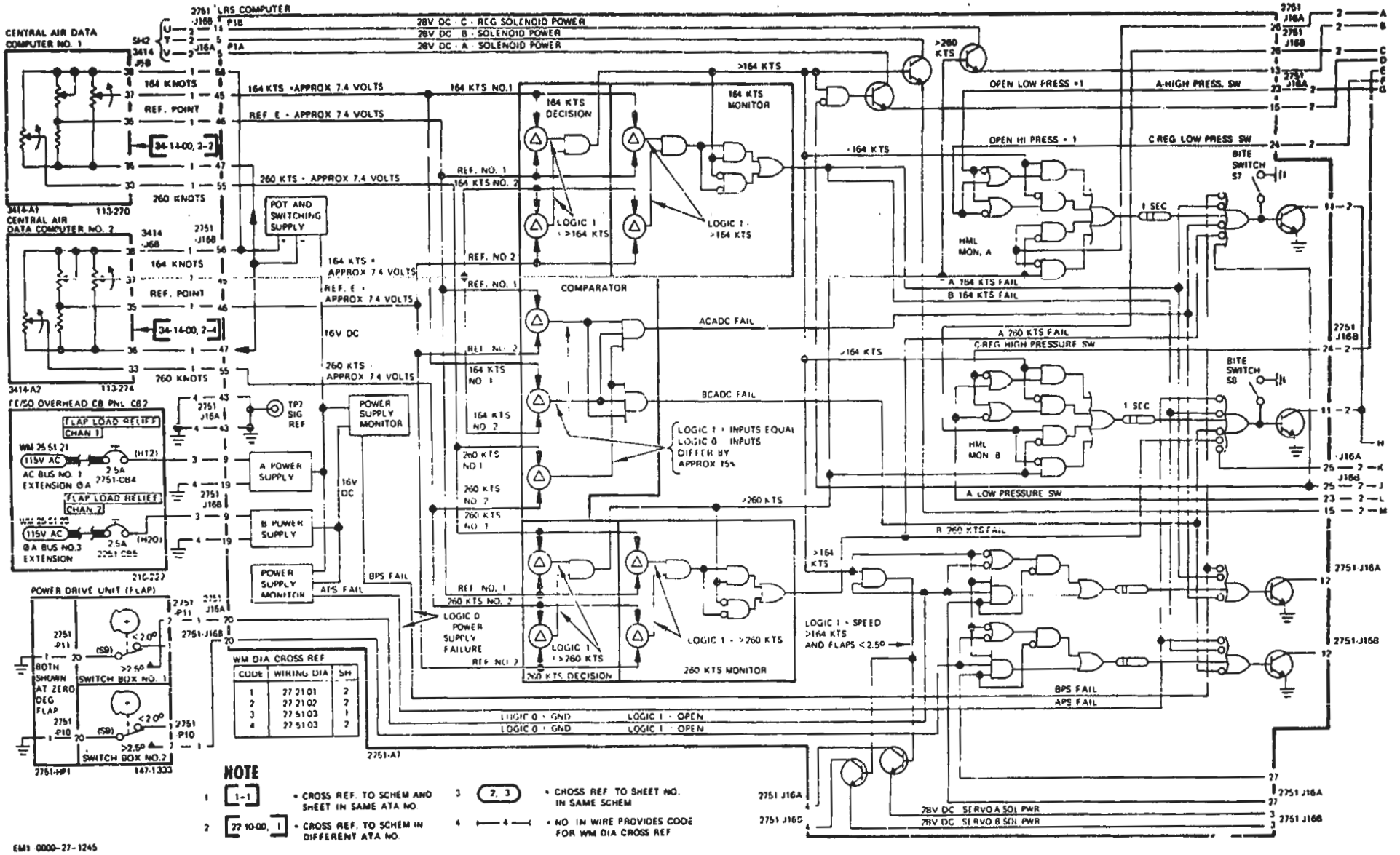
EMI-0001-27-1284

R
R

Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 2)

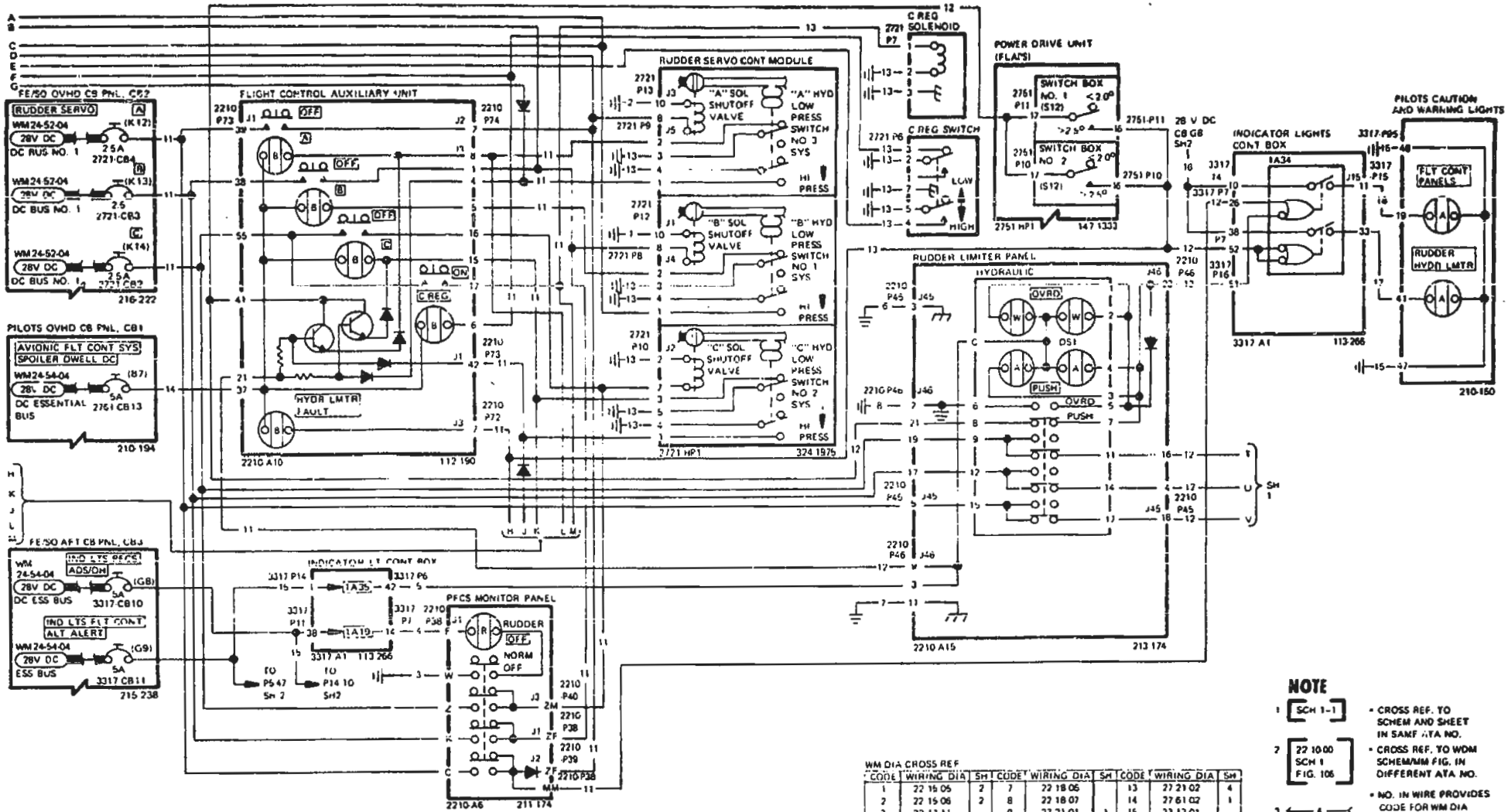
EFFECTIVITY: WITH SB22-057 AND SB27-169 AND WITHOUT SB27-139

001B


CENTRAL AIR DATA COMPUTER NO. 1
CENTRAL AIR DATA COMPUTER NO. 2
164 KNOTS
REF. POINT
260 KNOTS
164 KTS - APPROX 7.4 VOLTS
REF. E - APPROX 7.4 VOLTS
260 KTS - APPROX 7.4 VOLTS
16V DC
POT AND SWITCHING SUPPLY
POWER SUPPLY MONITOR
A POWER SUPPLY
B POWER SUPPLY
TP2 SIG REF
164 KTS DECISION
164 KTS MONITOR
260 KTS DECISION
260 KTS MONITOR
COMPARATOR
LOGIC 1 = >164 KTS
LOGIC 1 = >260 KTS
LOGIC 1 = INPUTS EQUAL
LOGIC 0 = INPUTS DIFFER BY APPROX 15%
LOGIC 0 POWER SUPPLY FAILURE
ACADC FAIL
BCADC FAIL
BPS FAIL
APS FAIL
A 164 KTS FAIL
B 164 KTS FAIL
A 260 KTS FAIL
B 260 KTS FAIL
OPEN LOW PRESS SW
OPEN HI PRESS SW
A-HIGH PRESS. SW
C REG LOW PRESS SW
C REG HIGH PRESSURE SW
A LOW PRESSURE SW
BITE SWITCH S7
BITE SWITCH S8
1 SEC
HML MON. A
HML MON. B
LOGIC 1 = SPEED >164 KTS AND FLAPS <2.5°
POWER DRIVE UNIT (FLAP)
SWITCH BOX NO. 1
SWITCH BOX NO. 2
BOTH SHOWN AT ZERO DEG FLAP
WM DIA CROSS REF
CODE | WIRING DIA | SH
1 | 27 2101 | 2
2 | 27 2102 | 2
3 | 27 5103 | 1
4 | 27 5103 | 2
LOGIC 0 = GND LOGIC 1 = OPEN
28V DC C - REG SOLENOID POWER
28V DC B - SOLENOID POWER
28V DC A - SOLENOID POWER
28V DC SERVO A SOL PWR
28V DC SERVO B SOL PWR
NOTE
1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [27 10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) - CROSS REF TO SHEET NO. IN SAME SCHEM
4 —4— - NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
EM1 0000-27-1245

Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 1)

EFFECTIVITY: WITH SB27-139 AND WITHOUT SB22-057



NOTE

1 [SCH 1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [22 10 00 SCH 1 FIG. 106] - CROSS REF. TO WDM SCHEM/MM FIG. IN DIFFERENT ATA NO.

3 ←4→ - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

4 SEE 22 INDEX FOR ABBREVIATIONS

EM1-0000-27-1248

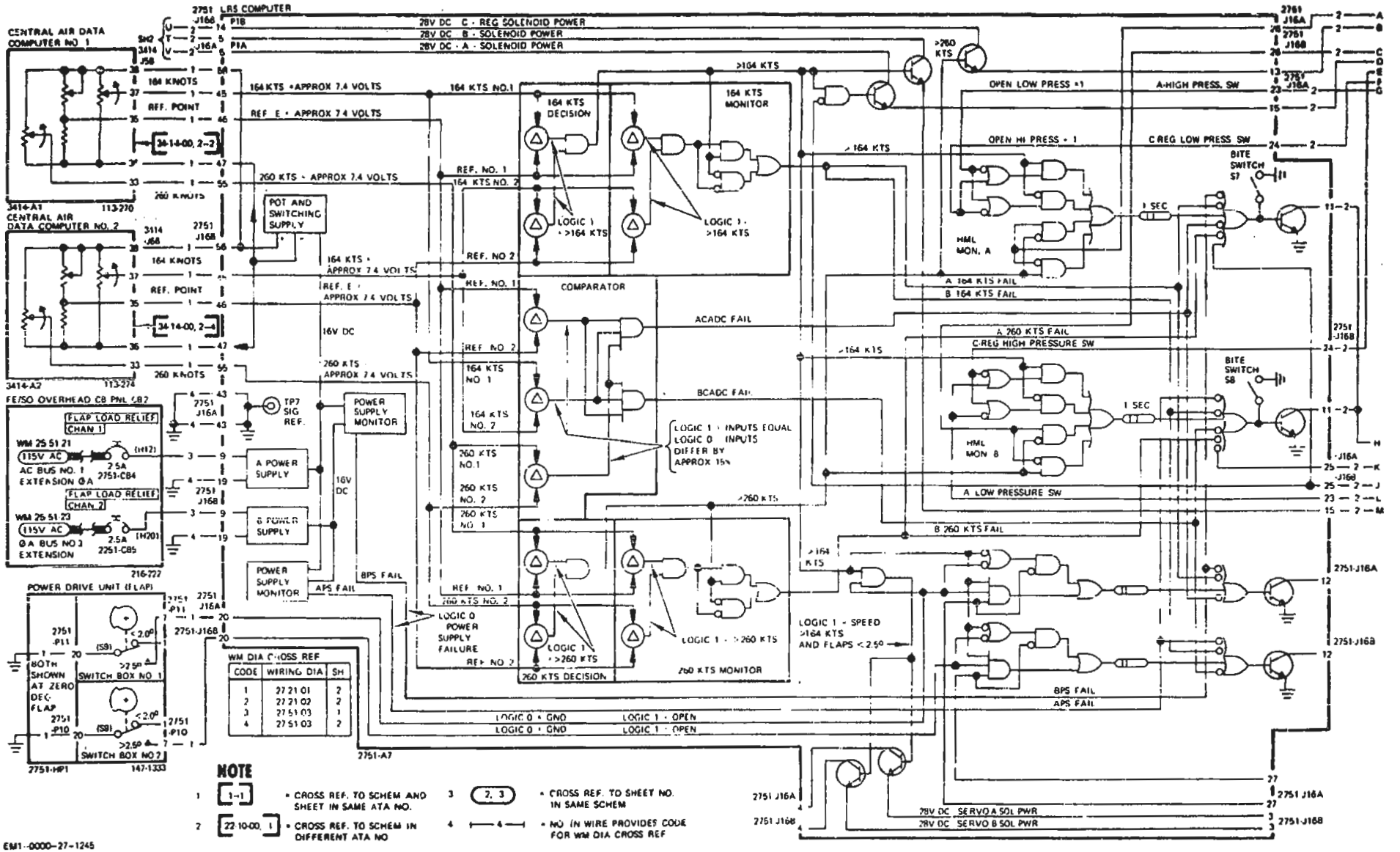
WM DIA CROSS REF

CODE	WIRING DIA	SH	CODE	WIRING DIA	SH	CODE	WIRING DIA	SH
1	22 15 05	2	7	22 18 05		13	27 21 02	4
2	22 15 06	2	8	22 18 07		14	27 61 02	1
3	22 17 11		9	27 21 01	1	15	33 17 01	
4	22 17 16	2	10	27 21 01	2	16	33 17 06	2
5	22 18 01		11	27 21 02	1	17	33 17 14	
6	22 18 06		12	27 21 02	3	18	33 17 24	

R R Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 2)

EFFECTIVITY: WITH SB27-139 AND WITHOUT SB22-057

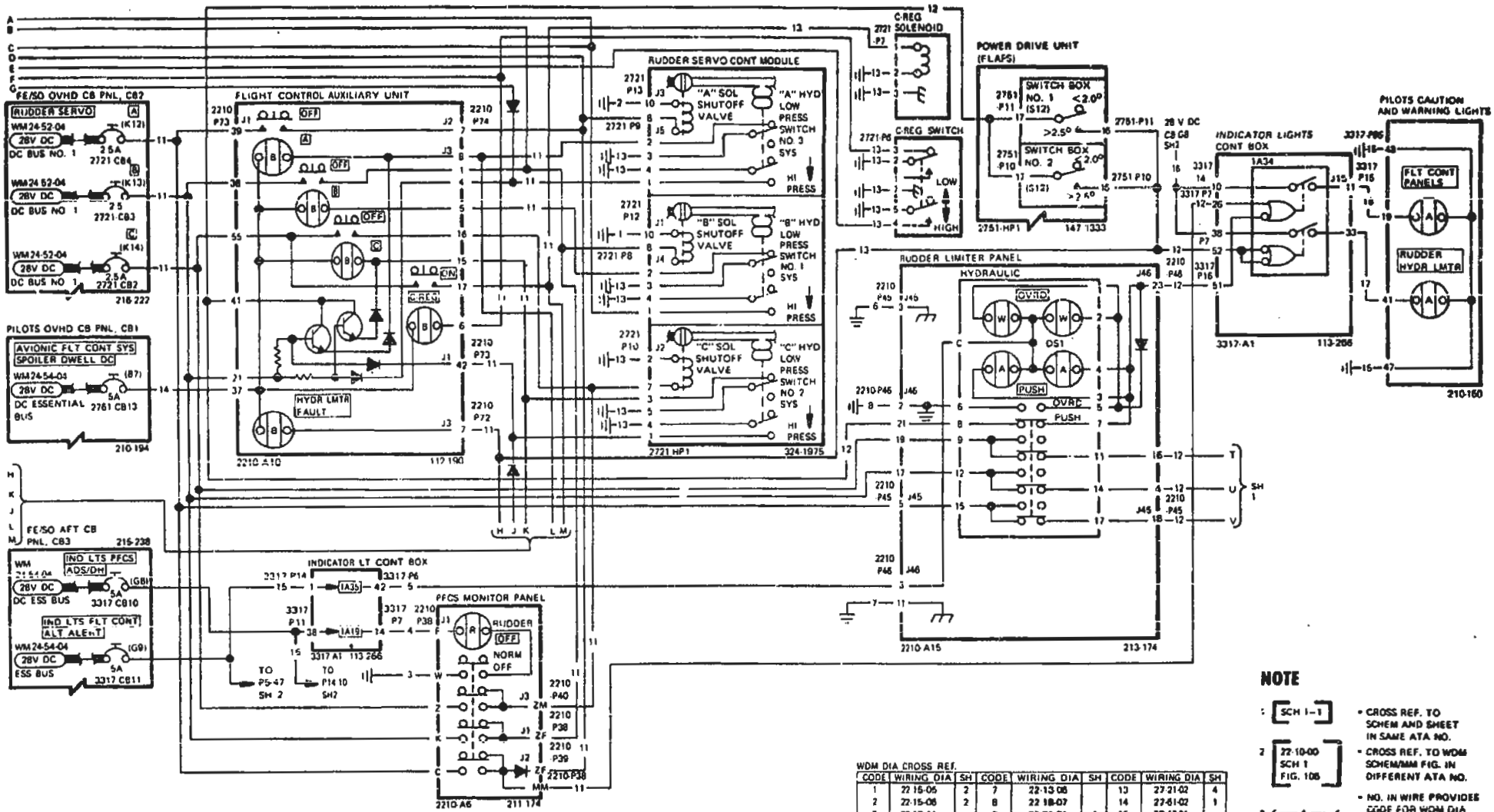
001B



EM1-0000-27-1245

Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 1)

R EFFECTIVITY: WITH SB22-057 AND SB27-139
R
001B



NOTE

1 [SCH 1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [27-10-00 SCH 1 FIG. 105] - CROSS REF. TO WDM SCHEM/MM FIG. IN DIFFERENT ATA NO.

3 ⟵ 4 ⟶ - NO. IN WIRE PROVIDES CODE FOR WDM DIA CROSS REF

4 SEE 22 INDEX FOR ABBREVIATIONS

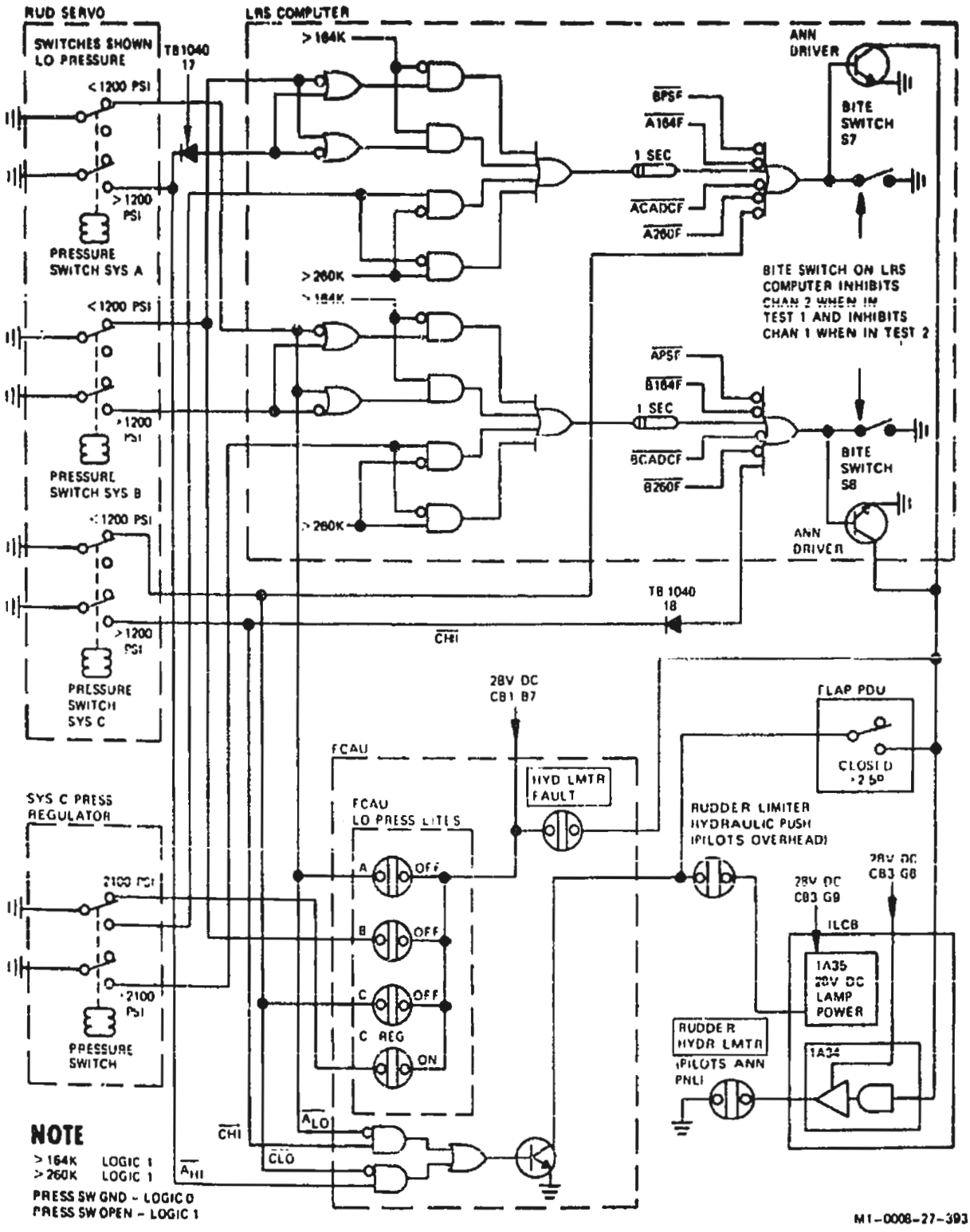
EM1-0004-27-63

WDM DIA CROSS REF.

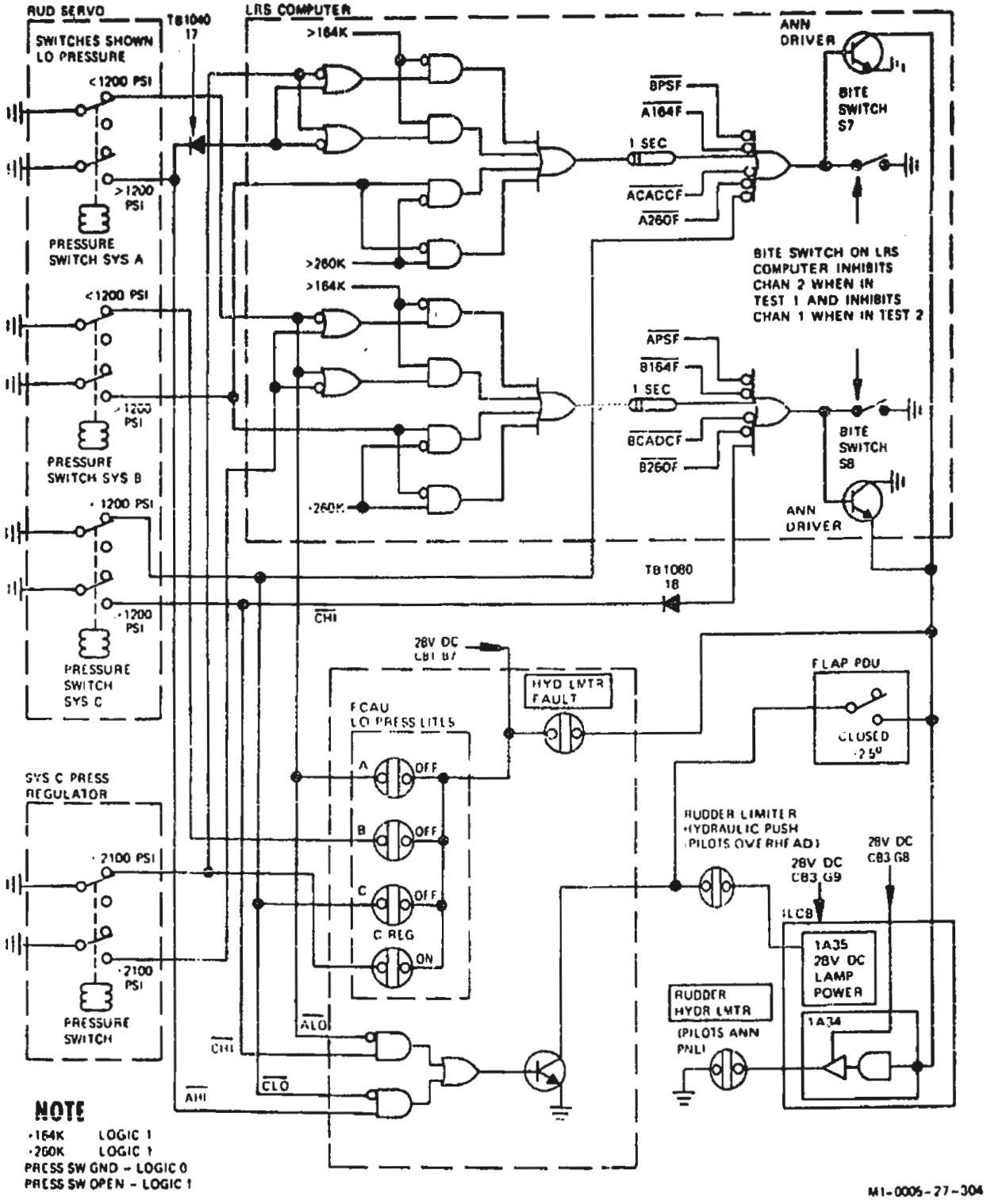
CODE	WIRING DIA	SH	CODE	WIRING DIA	SH	CODE	WIRING DIA	SH
1	22-15-06	2	7	22-13-08		13	27-21-02	4
2	22-15-08	2	8	22-18-07		14	27-61-02	1
3	22-17-11		9	27-21-01	1	15	33-17-01	
4	22-17-16	2	10	27-21-01	2	16	33-17-08	2
5	22-18-01		11	27-21-02	1	17	33-17-14	
6	22-18-06		12	27-21-02	3	18	33-17-24	

Rudder Limiting Electrical Schematic
SCHEM 1 (Sheet 2)

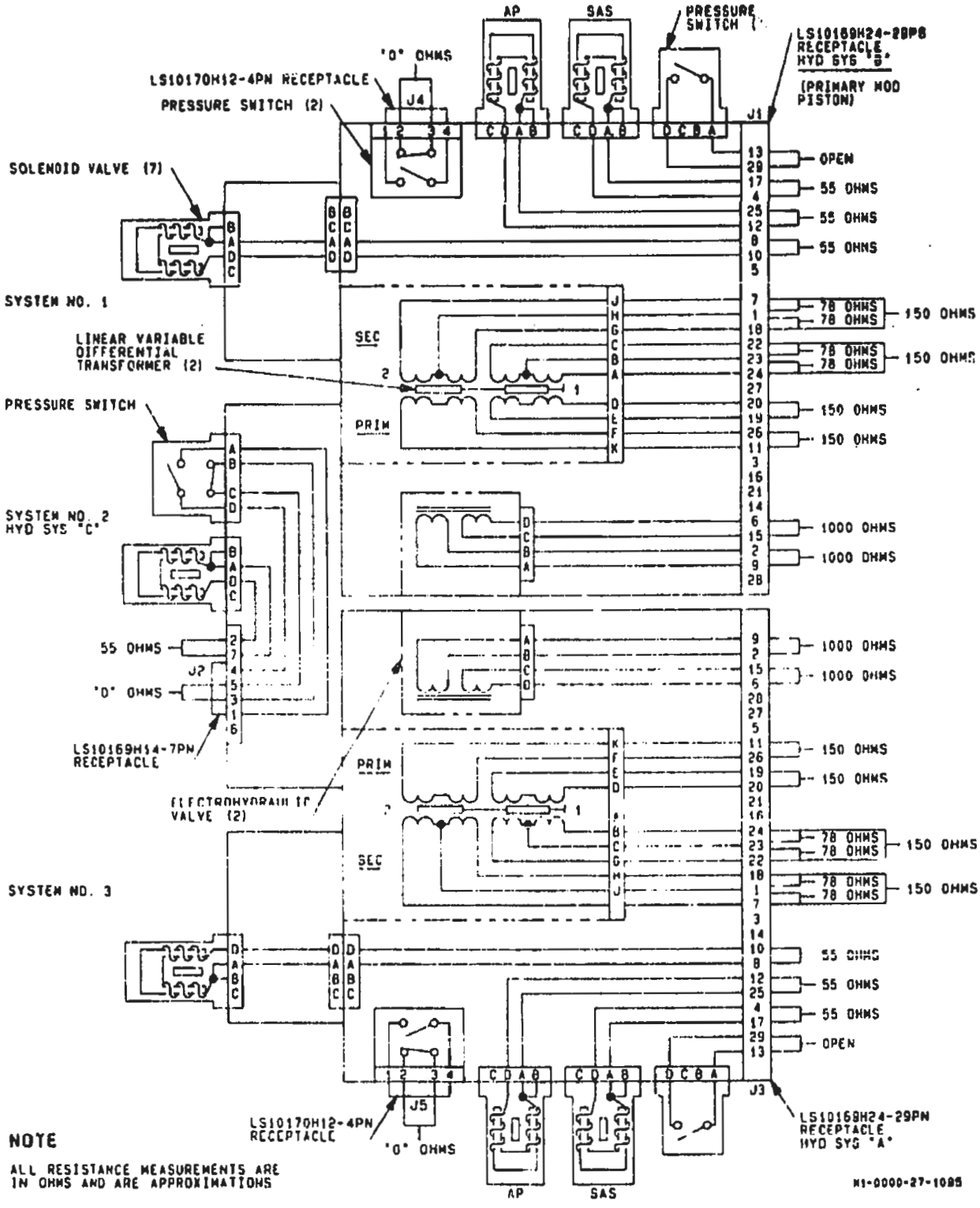
R EFFECTIVITY: WITH SB22-057 AND SB27-139
R
001B



Rudder Hydraulic Limiter Fault Monitoring Simplified Schematic
SCHEM 2



Rudder Hydraulic Limiter Fault Monitoring Simplified Schematic
SCHEM 2



Rudder Servo Simplified Schematic
SCHEM 3

R
R
001B

EFFECTIVITY: ALL

RUDDER CONTROL SYSTEM - ADJUSTMENT AND TEST

1. Adjustment/Test

This section covers the various operational tests (Ref. Para. 4) and rigging and adjustment checks (Ref. Para. 5) required for the rudder control system.

R NOTE: On aircraft 001, the adjustment of the YAW trim wheel has been biased to provide straight and level flight with the YAW trim wheel at zero. A decal located at the left underside of the alternate landing gear control cover specifies .5 mark R YAW for aircraft 001. It should be noted that for the .5 mark NOSE R bias specified, the YAW trim wheel is set to .5 mark NOSE L with the rig pin in the YAW cable drum. Removing the rig pin and positioning the YAW trim wheel to zero produces a NOSE R bias.

2. Equipment and Materials

Lockclad Cable Tensiometer, Pacific Scientific PN 1601009-03, or equivalent.

Rig Pin Kit - Empennage Controls, PN B734, or equivalent

Push rod force gage.

Rig pin kit includes the following 5/16-inch diameter pins:

Rig Pin	Grip Length (Inches)	Color
R1	1	Blue
R2	2	Red
R3	3	Green
R4	4	Yellow

3. Referenced Procedures

6-40-00 Exterior Access Doors and Panels

24-41-00 External Power/Ground Service System - Maintenance

4. Operational Tests

The following operational tests are provided in this section:

Rudder control system Test (Para. 4A)

Rudder Servo Shutoff Valve Test (Para. 4B)

Rudder Servo Hydraulic Integrity Test (Para. 4C)

Rudder Primary Cable Loop Friction Check (Para. 4D)

Rudder Actuator Manifold Visco Jet Restrictor Check (Para. 4E)

A. Rudder Control System Test

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that following circuit breakers are closed:

Avionics Flight Control System

FCES - COMPUTERS (B4-5)

SPOILER DWELL - DC (B7)

26 VAC NAV EXCITATION

SURF POSN IND (J23)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that following circuit breakers are closed:

RUDDER SERVO - A, B, and C (K12, K13, K14)

On aircraft 001-018, 021, 022,
RUDDER MECH LMTR - A and B (K15, K16)

FLAP LOAD RELIEF - CHAN 1 and CHAN 2 (H12, H20)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that following circuit breakers are closed:

IND LT - PFCS ADS/DH and FLT CONT ALT ALERT (G8, G9)

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

(4) On the pilots overhead panel, zone 210, verify that the following switchlights are depressed and latched (flush with panel):

(a) On PFCS panel:

RUDDER

(b) On RUDDER LIMITER panel:

HYDRAULIC OVRD/PUSH

On aircraft 001-017,
MECHANICAL MNL/PUSH and ±80°/±30°

R (5) On aircraft 001,
R position YAW trim control wheel on center console to .5
R mark NOSE L position.

R NOTE: On aircraft 001, the adjustment of the YAW trim wheel has been biased to provide straight and level flight with the YAW trim wheel at zero. A decal located at the left underside of the alternate landing gear control cover specifies .5 mark R YAW for aircraft 001. It should be noted that for the .5 mark NOSE R bias specified, the YAW trim wheel is set to .5 mark NOSE L with the rig pin in the YAW cable drum. Removing the rig pin and positioning the YAW trim wheel to zero produces a NOSE R bias.

R (5) On aircraft 002-999,
R position YAW trim control wheel on center console to
R 0-degree position.

(6) Operate Captains rudder pedal to full left rudder and hold. Verify the following:

(a) Rudder moves full left. (Use surface position indicator to verify surface displacement.)

(b) RUD pointer on surface position indicator on pilots instrument panel, zone 210, follows pedal movement.

(c) Rudder operates smoothly (no binding).

(7) Operate Captains rudder pedal to full right rudder and hold. Verify the following:

(a) Rudder moves full right. (Use surface position indicator to verify surface displacement.)

(b) RUD pointer on surface position indicator follows pedal movement.

(c) Rudder operates smoothly (no binding).

(8) Allow rudder pedals to return to neutral position.

(9) Lift guard and release (out) RUDDER switchlight on PFCS panel to shut off all three hydraulic systems. Verify the following:

(a) OFF light on RUDDER switchlight comes on.

(b) FLT CONT PANELS and RUDDER HYDR LMTR lights on caution and warning annunciator panel flash.

NOTE: FLT CONT panels light will not go off if other faults are present in flight control system.

(c) HYDRAULIC switchlight PUSH light on pilots overhead RUDDER LIMITER panel comes on.

(d) Rudder pedal movement is limited, and rudder does not respond to rudder pedal.

(10) Lift guard and depress (in) RUDDER switchlight on PFCS panel. Verify the following:

(a) OFF light on RUDDER switchlight goes off.

(b) FLT CONT PANELS and RUDDER HYDR LMTR lights on caution and warning annunciator panel go off.

(c) RUDDER LIMITER HYDRAULIC switchlight PUSH light goes off.

(d) Rudder operation returns to normal.

C (11) On aircraft 001-017, on the pilots overhead RUDDER LIMITER panel, release (out) MECHANICAL MNL/PUSH switchlight. Verify that MNL light on left switchlight comes on (the ±30° light on right switchlight is normally on).

C (12) On aircraft 001-017, slowly operate rudder pedals to left and right Verify that full rudder travel (±30 degrees) is available (use surface position indicator to verify surface displacement).

C (13) On aircraft 001-017, RUDDER LIMITER PANEL, release ±8°/±30° switchlight. Verify the following:

(a) ±30° light goes off.

(b) ±8° light comes on.

(c) FLT CONT PANELS and RUDDER MECH LMTR lights on caution and warning annunciator panel flash.

(d) Rudder left and right travel is limited to 8 degrees. (Operate rudder pedals slowly to reduce bottoming loads on limiter arms.)

C (14) On aircraft 001-017, depress (in) both RUDDER LIMITER MECHANICAL MNL/PUSH and ±8°/±30° switchlights. Verify the following:

(a) ±8° light on right switchlight goes off and ±30° light comes on.

(b) MNL light on left switchlight goes off.

(c) FLT CONT PANELS light and RUDDER MECH LMTR light on caution and warning annunciator panel go off.

(d) Full left and right rudder travel (30 degrees) is available.

(15) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(16) Turn off electrical power if no longer required (Ref. 24-41-00).

B. Rudder Servo Shutoff Valve Test

This test is performed to verify proper operation of the servo shutoff valves and the servo actuation channels.

(1) Verify that the following circuit breakers are closed:

(a) On the pilots overhead circuit breaker panel CB1, zone 210:

SURF POSN IND (J23)

(b) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: RUDDER SERVO A, B, C (K12, K13, K14).

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Pressurize hydraulic system A, B, and C (Ref. 29-11-00).

(4) Lift guard and release (out) the RUDDER switchlight on the PFCS panel to energize the three servo shutoff valves. The switchlight OFF light must come on, and the FLT CONT PNLS light on the pilots caution and warning panel will flash for 10 seconds and then go steady.

(5) Move rudder pedals in both directions to verify that the rudder is inoperative. Use the surface position indicator.

(6) Open the RUDDER SERVO C circuit breaker to deenergize the system servo shutoff valve and activate the servo C channel.

(7) Move rudder pedals in both directions. Verify that rudder responds to pedal movement.

(8) Close the RUDDER SERVO C circuit breaker. Open the RUDDER SERVO B circuit breaker to activate the servo B channel.

(9) Move rudder pedals in both directions. Verify that rudder responds to pedal movement.

(10) Close the RUDDER SERVO B circuit breaker. Open the RUDDER SERVO A circuit breaker to activate the servo A channel.

(11) Move rudder pedals in both directions. Verify that rudder responds to pedal movement.

(12) Close the RUDDER SERVO A circuit breaker.

(13) Depress (in) the RUDDER switchlight on the PFCS panel. The switchlight OFF light must go off.

(14) Move rudder pedals in both directions. Verify that rudder responds to pedal movement.

(15) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(16) Turn off electrical power if no longer required (Ref. 24-41-00).

C. Rudder Servo Hydraulic Integrity Test

This test verifies that the rudder servo and actuator hydraulic lines are properly connected.

(1) Verify that the following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1, zone 210: SURF POS IND (J23).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel, CB2, zone 215: RUDDER SERVO A, B, C (K12, K13, K14).

(2) Verify that the RUDDER switchlight on the PFCS panel is depressed and latched (flush with panel).

(3) On aircraft 001,
position YAW trim wheel to .5 mark NOSE L.

NOTE: On aircraft 001,
the adjustment of the YAW trim wheel has been biased to provide straight and level flight with the YAW trim wheel at zero. A decal located at the left underside of the alternate landing gear control cover specifies .5 mark R YAW for aircraft 001. It should be noted that for the .5 mark NOSE R bias specified, the YAW trim wheel is set to .5 mark NOSE L with the rig pin in the YAW cable drum. Removing the rig pin and positioning the YAW trim wheel to zero produces a NOSE R bias.

(3) On aircraft 002-999,
position YAW trim wheel to zero.

(4) Check hydraulic servo A channel as follows:

R CAUTION: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES
R AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL
R AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (a) Pressurize only hydraulic system A using ground
R test cart or engine driven pump.

R NOTE: It is extremely important that only the
R hydraulic systems specified be pressurized,
R and that only the hydraulic sources
R specified be used.

(b) Push left rudder pedal full forward. Verify that rudder moves to full left (use surface position indicator).

(c) Push right rudder pedal full forward. Verify that rudder moves to full right. Release rudder pedal.

(d) Turn off hydraulic system A.

C (e) If ground test cart or engine pump cannot be used, Test A channel as follows:

1) Lift guard and release (out) the rudder switchlight on the PFCS panel.

2) Pressurize "B" system with ATM or AC pump.

3) Pull Rudder Servo A C/B CB2 (K12).

4) Move rudder pedals to verify rudder is inoperative.

5) Pressurize A system with B-A PTU.

6) Push left rudder pedal full forward. Verify rudder moves full left (use surface position indicator).

7) Push right rudder pedal full forward. Verify rudder moves full right.

8) Reset Rudder Servo A C/B.

9) Depress (in) the rudder switchlight on PFCS panel. The switchlight "OFF" light must go out.

10) Move rudder pedals both directions. Verify that rudder responds.

11) Depressurize hydraulic systems.

(5) Check hydraulic servo B channel as follows:

(a) Pressurize only hydraulic system B.

NOTE: For hydraulic source, use ground test cart, ATM, or AC pump.

(b) Push left rudder pedal full forward. Verify that rudder moves to full left.

(c) Push right rudder pedal full forward. Verify that rudder moves to full right. Release rudder pedal.

(d) Turn off hydraulic system B.

(6) Check hydraulic servo C channel as follows:

(a) Pressurize only hydraulic systems C.

NOTE: For hydraulic source, use ground test cart, ATM, or AC pump.

(b) Push left rudder pedal full forward. Verify that rudder moves to full left.

(c) Push right rudder pedal full forward. Verify that rudder moves to full right. Release rudder pedal.

(d) Turn off hydraulic system C.

(7) Turn off electrical power if no longer required (Ref. 24-41-00).

D. Rudder Primary Cable Loop Friction Check

This procedure should be used to isolate excessive rudder control system friction to the rudder cable loop.

WARNING: VERIFY THAT ALL HYDRAULIC SYSTEMS ARE TURNED OFF AND HYDRAULIC CONTROL PANELS ARE TAGGED.

(1) Open access door 313FR in dorsal fin to gain access to rudder cable aft quadrant located in the upper afterbody area (Ref. 6-40-00).

(2) Remove clevis bolt that connects pushrod (23) to aft cable quadrant arm (15). Clear pushrod from quadrant so that cable system can cycle freely.

(3) Use a 0-10 pound chattillion gauge (on equal) and place foot of gauge horizontally on either Captain's or First Officer's left pedal hump (over the pivot). Apply force to slowly drive pedal full forward. Repeat with right pedal and take several readings.

(4) Maximum force to drive either pedal shall not exceed 10 lbs. except for the last 1.00 inch of travel which shall not exceed 12 lbs. maximum.

(5) Reinstall and safety wire bolt removed by step (2).

(6) If system friction exceeds forces in step (4), investigate the following, listed in the order of probable cause:

(a) Alignment and tightness of aft pressure bulkhead cable seals.

(b) Horizontal pulleys forward of seals.

(c) Bearings in cable driver crank (First Officer's side).

(d) Bearings in aft quadrant.

(e) Steering interconnect.

(f) Brush seal on pedal trim panel.

E. Rudder Actuator Manifold Visco Jet Restrictor Check

This check determines if restrictors have been inadvertently omitted from the tubing assembly for the R.H. rudder dual tandem actuator.

(1) Turn on A/C ELECTRIC PWR/NO HYD PWR.

(2) Turn on B System AC motor driven hydraulic pump.

(3) Note and record HYD SYS B pressure indicated on Flt. Engineers panel. _____PSI.

(4) Engage 8 degree mech rudder limiter stops with switches on overhead instrument panel.

(5) Slowly push rudder pedals to move rudder against travel limiter then continue to push pedal until stop is felt.
(6) Note and record SYS B HYD Pressure. If pressure is at least 200 PSI lower than recorded in step (3), visco jet restrictor is missing. _____PSI.

(7) Release pedal.

(8) Turn on HYD SYS PWR TRANSFER UNIT B TO A.

(9) Open circuit breaker K-12 on CB-2 panel - RUDDER SERVO A.

(10) Switch OFF rudder servo with guarded switch on overhead instrument panel.

(11) Note and record system A hydraulic pressure on Flt. Engineers panel. If pressure fluctuates widely turn ON/OFF servos as required to minimize fluctuations. _____PSI.

(12) Repeat step (5).

(13) Note and record system A hydraulic pressure. If pressure is at least 200 PSI lower than recorded in step (11), visco jet restrictor is missing. _____PSI.

(14) Release pedal.

(15) Close circuit breaker K-12. Switch on rudder servo. Return MECH RUD LIMITER to NORMAL.

(16) Turn off hydraulic and electric power.

(17) Replace A SYS RESTRICTOR if required and repeat check.

(18) Replace B SYS RESTRICTOR if required and repeat check.

NOTE: P/N 19XVC112DN1 or P/N VXCA2501112D Restrictor, use tool set Nbr. CUTA2500106CD.

5. Rigging Check and Adjustment

Rigging check and adjustment procedures are presented separately for each part of the rudder control system. Each part may be rigged individually without disturbing the remainder of the system. The preparation and completion check procedures must be accomplished before and after any rigging check and adjustment. In addition, a quick rigging check and a Rudder Travel and Pedal Forces check are provided. The following are the individual procedures:

PARAGRAPH	PROCEDURE
5A	Quick Rigging Check
5B	Preparation
5C	Rudder Pedals
5D	Rudder Primary Cables
5E	Rudder Servo Control
5F	Rudder Deflection Limiter
5G	Rudder Travel and Pedal Forces Check
5H	Completion Check

NOTE: Before making a rigging check or adjustment, allow aircraft structure and cable temperature to stabilize. Do not operate air conditioning equipment while rigging the rudder control system.

After making push rod adjustment, check for minimum thread engagement by verifying that rod end thread is

visible at inspection hole.

After making turnbuckle adjustment, check for minimum thread engagement by verifying that no more than three threads are exposed on cable terminal. Also verify that cable terminals are not threaded so far into turnbuckle as to block hole in center of turnbuckle and prevent proper engagement of locking clip.

Some cables are covered with polyolefin clear tubing to protect cables from corrosive spillage. When checking cable tension, verify that tensiometer is NOT positioned on the polyolefin tubing area of the cable or results will be erroneous. Cables without polyolefin tube is most available in FESC area.

A. Quick Rigging Check

(1) On pilots overhead PFCS panel, verify that RUDDER switchlight is depressed (in).

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic system A, B, and C (Ref. 29-11-00).

(4) Cycle rudder pedals several times to normalize rudder servo. Cycle rudder pedals slowly (at least 4 seconds stop-to-stop) to prevent damaging rudder damper seals.

R (5) On aircraft 001,
R position YAW trim wheel on center console to .5 mark
R NOSE L.

R NOTE: On aircraft 001, the adjustment of the YAW trim wheel has been biased to provide straight and level flight with the YAW trim wheel at zero. A decal located at

the left underside of the alternate landing gear control cover specifies .5 mark R YAW for aircraft 001. It should be noted that for the .5 mark NOSE R bias specified, the YAW trim wheel is set to .5 mark NOSE L with the rig pin in the YAW cable drum. Removing the rig pin and positioning the YAW trim wheel to zero produces a NOSE R bias.

(5) On aircraft 002-999, position YAW trim wheel on center console to zero.

(6) On First Officers control column, remove screws attaching shield to control column and shroud to floor. Rotate shroud to expose rudder quadrant rig pin hole in forward right corner.

(7) Insert rig pin R2 through bracket and rudder pedal interconnect lever (1) (Ref. Fig. 501).

(8) With rig pin in rudder pedal lever, rudder must be faired (±0.75 inch, measured between rudder lower trailing edge and fixed fairing).

(9) Remove rig pin.

(10) Position rudder pedals to full left rudder. Rudder must displace left 29.5 - 31.0 degrees (42.6 to 44.7 inches). (Use surface position indicator to verify surface displacement.)

(11) Position rudder pedals to full right rudder. Rudder must displace right 29.5 - 31.0 degrees (42.6 to 44.7 inches).

(12) Return rudder to faired.

(13) If the rudder faired position or full throw positions are out of tolerance, refer to Para. 5B through 5G to locate problem.

(14) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(15) Shut off electrical power if no longer required (Ref. 24-41-00).

(16) Install control column shield and shroud.

B. Preparation - Rigging Check and Adjustment

(1) Shut off all four hydraulic systems (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

C. Rudder Pedals - Rigging Check and Adjustment

CAUTION: DO NOT PULL ON TOP OF RUDDER PEDALS. RUDDER PEDAL BRAKE INPUT ROD DESIGNED TO ACCEPT TENSION LOADS ONLY. PULLING ON TOP OF RUDDER PEDAL CAN DAMAGE BRAKE INPUT ROD.

(1) On both control columns, remove screws attaching shield to control column and shroud to floor. Rotate shroud to expose rig pin hole (forward left corner for Captains; forward right corner for First Officers).

(2) Verify that all four hydraulic systems are shut off and that hydraulic control panels are tagged.

(3) Install rig pin R2 in First Officers rudder interconnect lever (1) (Ref. Fig. 501). Rig pin R4 must fit freely through Captains rudder interconnect lever (2). If not, open access door 112AB to gain access to forward electronic service center and adjust interconnecting pushrod (3).

CAUTION: DO NOT DISCONNECT INTERCONNECT PUSHROD (3) WITHOUT FIRST VERIFYING THAT THE RIG PIN IS INSTALLED IN CAPTAINS INTERCONNECT LEVER (2). ROTATING CAPTAINS RUDDER PEDALS TO EXTREME THROWS WITH INTERCONNECTING PUSHROD DISCONNECTED CAN ALLOW THE NOSE STEERING FOLLOWER ROLLER TO DISENGAGE FROM THE DRIVER SLOT (REF 32-51-04, FIG. 502, VIEW B).

(4) With rig pins installed in Captains and First Officers interconnect levers (1) and (2), upper attach point of rudder output levers (4) must be 13.0 (±0.06) inches from aft face of beam cap (5). If not, adjust output push rods (6).

(5) Rotate rudder pedal adjustment crank (8) on the pedal trim cover until the adjustment crank pointer is at mid-travel. At this point, the center of the rudder pedal levers (7) must be 1.58 (±0.06) inches forward of upper attach point of rudder pedal output lever (4). If not, perform the following:

(a) Disconnect the flex shaft (9) from the worm gear (10) on the bottom of output lever (4).

(b) Manually rotate worm gear until center of the rudder pedal lever is 1.58 (±0.06) inches forward of upper attach point of pedal output lever.

(c) With adjustment crank pointer at mid-travel, reconnect flex shaft (9) to worm gear (10). Tighten flex shaft hex nut finger-tight, then back off 1/4 to 1/2 turn. Lock-wire nut to prevent rotation in either direction.

(6) Rotate pedal adjustment crank to full FWD position. Pedals must move forward 4.0 (±0.25) inches.

(7) Rotate pedal adjustment crank to full AFT position. Pedals must move aft 5.0 (±0.25) inches. If not, repeat Step (5).

(8) Remove all rig pins.

D. Rudder Primary Cables - Rigging Check and Adjustment

(1) Remove access panel 313FR to internal area of upper afterbody (Ref. 6-40-00).

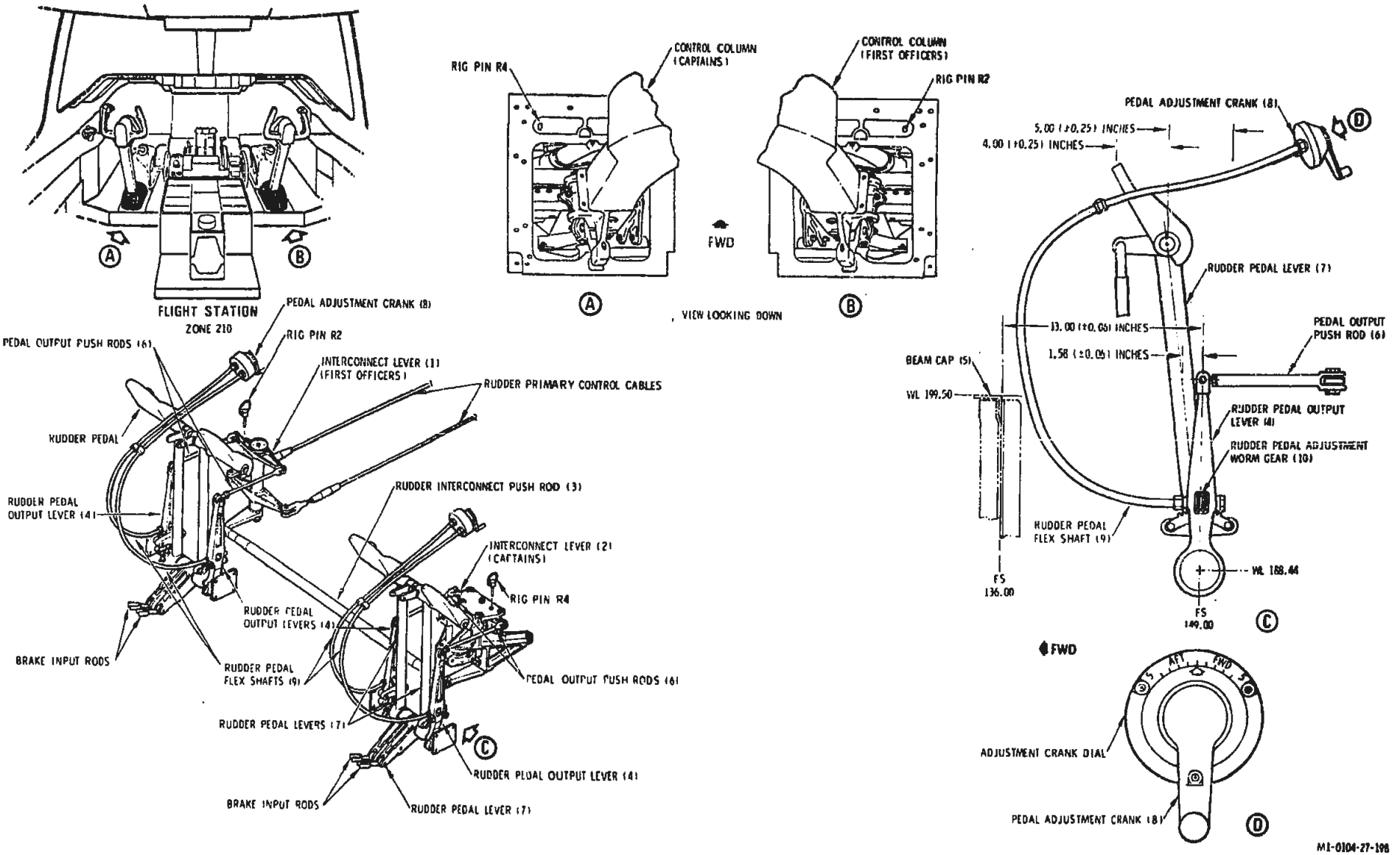
(2) Verify that all four hydraulic systems are shut off and that hydraulic control panels are tagged.

(3) On aircraft 001, position YAW trim wheel on center console to .5 mark NOSE L.

NOTE: On aircraft 001, the adjustment of the YAW trim wheel has been biased to provide straight and level flight with the YAW trim wheel at zero. A decal located at the left underside of the alternate landing gear control cover specifies .5 mark R YAW for aircraft 001. It should be noted that for the .5 mark NOSE R bias specified, the YAW trim wheel is set to .5 mark NOSE L with the rig pin in the YAW cable drum. Removing the rig pin and positioning the YAW trim wheel to zero produces a NOSE R bias.

(3) On aircraft 002-999, position YAW trim wheel on center console to zero.

(4) On First Officers control column, remove screws attaching shield to control column and shroud to floor. Rotate shroud to expose rig pin hole in forward right corner (Ref. Fig. 501, View B).



Rudder Pedals - Rigging Check and Adjustment
Figure 501

R
R
001B EFFECTIVITY: ALL

(5) Install rig pin R2 in First Officers rudder pedal interconnect lever (1) (Ref. Fig. 502).

(6) With rig pin installed in First Officers rudder pedal interconnect lever, verify following:

(a) The center of the cable attach bolt (12) on the forward idler bellcrank (RR cable) is 5.84 (±0.20) inches from the aft face of FS 267 floor beam web.

(b) The center of the cable attach bolt (13) on the aft idler bellcrank (RL cable) is 5.84 (±0.20) inches from the aft face of the FS 281.5 floor beam web.

(c) Rig pin R2 fits freely through aft cable quadrant arm (15) in the upper afterbody.

(d) Cable tension conforms to temperature compensation chart (Ref. Fig. 502). (Use Lockclad cable tensiometer only on bare Lockclad cable; do not use on Lockclad cable with polyolefin plastic jacket as results will be erroneous.)

NOTE: Cable tension can be checked on the short cable run (cable drive arm to the idler bellcrank) or the long cable run (idler bellcrank to aft cable quadrant). The short cable run in the FESC is the most accessible however, because of the lever ratio change at the idler bellcrank, the short cable run tension is much higher (Ref. Fig. 502).

The aft cable quadrant arm can be installed on the cable quadrant spline one spline off and the arm clamping bolt forced in place. To ensure correct installation, verify that centerline through arm is approximately centered with a centerline through the cable quadrant vee openings.

R CAUTION: AFTER MAKING A TURNBUCKLE ADJUSTMENT, VERIFY THAT
R NO MORE THAN THREE THREADS ARE EXPOSED ON CABLE
R TERMINAL, OR THAT CABLE TERMINAL IS NOT FLUSH OR
R EXTENDING INTO THE SAFETY HOLE IN THE MIDDLE OF
R THE TURNBUCKLE (THIS WOULD PREVENT FULL ENGAGEMENT
R OF THE LOCKING CLIP IN THE TURNBUCKLE).

(7) If any of the four requirements are not met, adjust turnbuckles (14), (16), and (17) as necessary (Ref. Fig. 502).

NOTE: If rudder cable adjustment is made, turn on hydraulic power (Ref. 29-11-00), and cycle rudder full left and right a minimum of five times to stabilize cables before rechecking cable tension or making a rig pin check.

(8) Remove all rig pins.

E. Rudder Servo Control - Rigging Check and Adjustment

(1) Open following access panels (Ref. 6-40-00):

(a) 313FR to aft cable bellcrank area, upper afterbody.

(b) 324AL and 324AR to rudder servo.

(2) Verify that all four hydraulic systems are shut off and that hydraulic control panels are tagged.

(3) On aircraft 001, position YAW trim wheel on center console to .5 mark NOSE L.

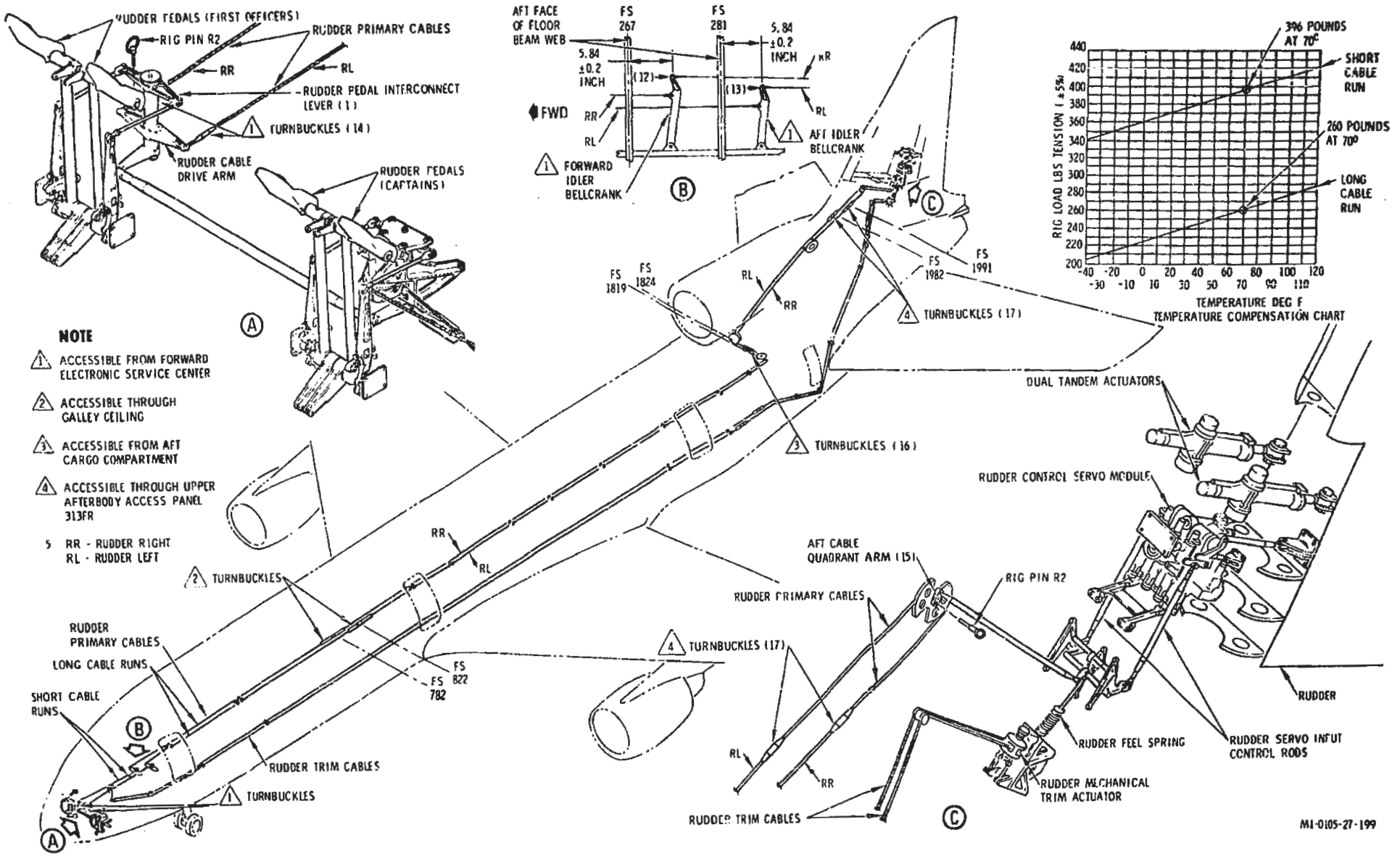
NOTE: On aircraft 001, the adjustment of the YAW trim wheel has been biased to provide straight and level flight with the YAW trim wheel at zero. A decal located at the left underside of the alternate landing gear control cover specifies .5 mark R YAW for aircraft 001. It should be noted that for the .5 mark NOSE R bias specified, the YAW trim wheel is set to .5 mark NOSE L with the rig pin in the YAW cable drum. Removing the rig pin and positioning the YAW trim wheel to zero produces a NOSE R bias.

(3) On aircraft 002-999, position YAW trim wheel on center console to zero.

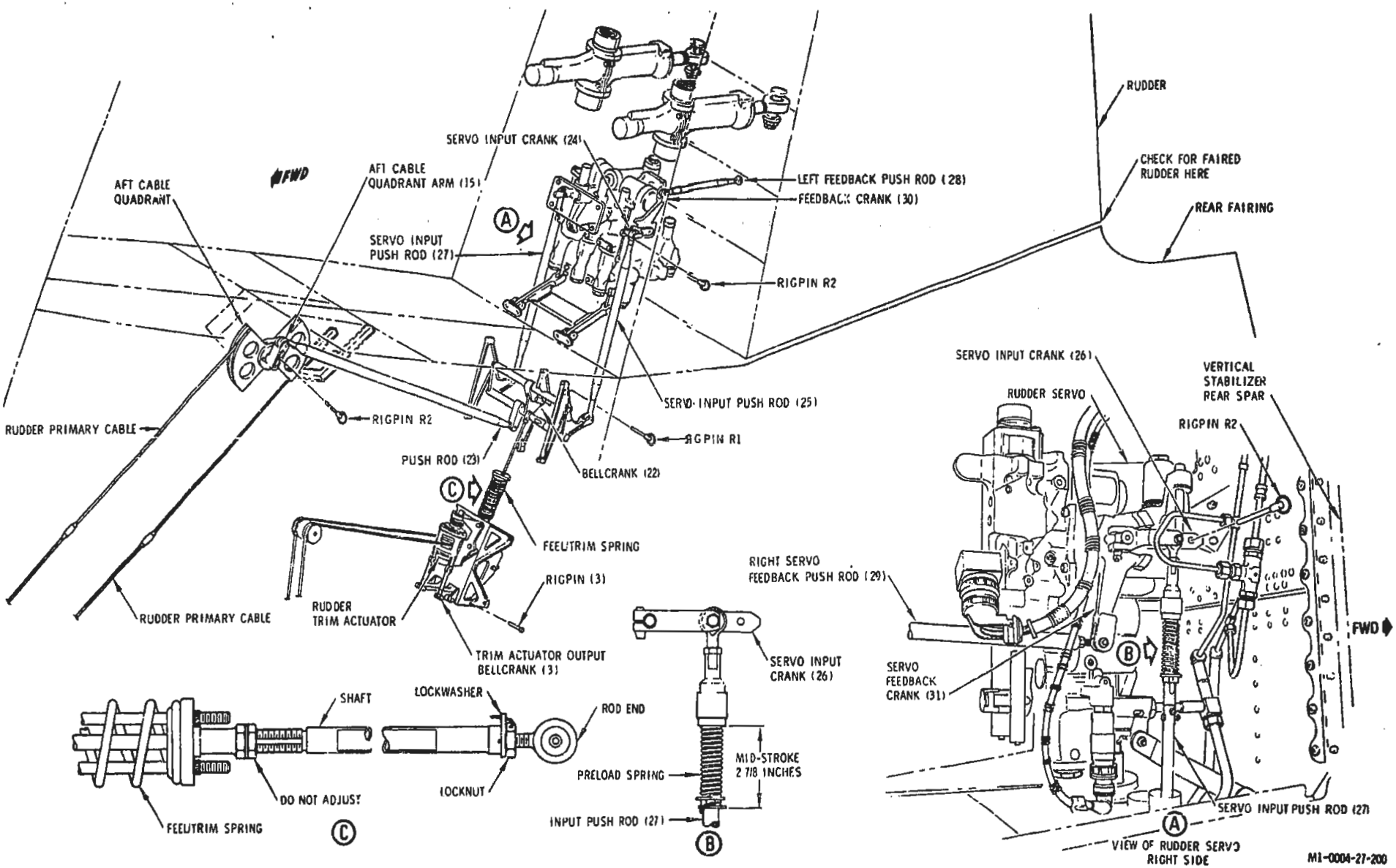
(4) Verify that rudder is faired.

(5) In upper afterbody, install rig pin R2 in aft cable quadrant arm (15) (Ref. Fig. 503). Rig pin R1 must fit freely through bellcrank (22). If not, adjust push rod (23).

CAUTION: VERIFY THAT PUSHROD (23) IS INSTALLED WITH ADJUSTABLE ROD-END FACING FORWARD (CONNECTED TO AFT CABLE QUADRANT). IF PUSHROD IS REVERSED, IT WILL BE DIFFICULT TO ENGAGE LOCKWASHER TANG IN PUSHROD SLOT.



Rudder Primary Cables - Rigging Check and Adjustment
Figure 502



Rudder Servo Control - Rigging Check and Adjustment
Figure 503

(6) Check rigging of feel/trim spring in the upper afterbody as follows:

(a) Disconnect upper end of feel/trim spring from bellcrank (22) by removing connecting bolt.

(b) Install rig pin R3 in the rudder trim actuator output bellcrank (3). The connecting bolt must fit freely through bellcrank (22) and the feel/trim spring rod end, with no force applied to the feel/trim spring. If not, adjust the feel/trim spring length by adjusting the rod end.

CAUTION: DO NOT ADJUST FEEL/TRIM SPRING LENGTH AT THE SHAFT-TO-FEEL/TRIM SPRING CONNECTION. THIS IS A SHOP ADJUSTMENT AND CAN AFFECT FEEL/TRIM SPRING LASH (REF. FIG. 503, View C).

(c) Install the bolt, washer, and nut connecting feel/trim spring rod end to bellcrank (22). Install cotter pin.

NOTE: If rod end is adjusted, verify that lockwasher tang is engaged in the feel/trim spring shaft slot as locknut is tightened. Lock-wire lock nut to lockwasher.

R (d) Remove rig pin R3 from the rudder trim actuator
R output bellcrank (3).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

(7) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

(8) With rig pin R1 in bellcrank (22), the rudder must be faired at lower trailing edge (±0.75 inch). If not, proceed as follows:

(a) Shut off all hydraulic power (Ref. 29-11-00).

(b) Disconnect servo input pushrods (25) and (27) from the servo input cranks (24) and (26).

(c) Install rig pins R2 in servo input cranks (24) and (26).

WARNING: WITH HYDRAULIC PRESSURE ON, RUDDER SERVO IS SENSITIVE AND DANGEROUS IF THE SERVO INPUT PUSHRODS ARE DISCONNECTED FROM SERVO (OR SERVO INPUT ARMS ARE NOT PINNED), OR IF BOTH FEEDBACK PUSHRODS ARE DISCONNECTED FROM SERVO.

(d) Disconnect right feedback pushrod (29) from the servo feedback crank (31) (Ref. Fig. 503). Position pushrod outboard to provide clearance for rudder movement. Turn on hydraulic systems A, B, and C. If rudder moves to the faired position (±0.75 inch), adjust and reconnect right feedback pushrod to hold rudder in the faired position. Proceed to Step (j).

(e) If rudder does not move to faired (±0.75 inch) with right feedback pushrod disconnected, accomplish following Steps (f) through (i).

(f) Note direction rudder is out of faired. Adjust right feedback pushrod half the required correction (but not more than two turns). Reconnect right feedback pushrod to the servo feedback crank.

NOTE: One turn of feedback pushrod changes rudder position approximately 0.75 inch at trailing edge. Lengthening the right feedback pushrod moves the rudder left; lengthening the left feedback pushrod moves the rudder right.

(g) Disconnect left feedback pushrod (28) from the servo feedback crank (30).

(h) Note direction and amount rudder is out of faired. Adjust left feedback pushrod half the required correction (but not more than two turns). Reconnect left pushrod to servo.

(i) Repeat Step (d).

NOTE: If rudder is several inches out of faired, it may require several adjustments of the feedback pushrods to safely "walk" the

rudder to the faired position by adjusting one feedback pushrod at a time.

(j) Verify that right input pushrod (27) (containing preload spring) is 0.110 inch longer than required to install with no compression load applied to preload spring. Compress spring and connect to input crank.

(k) Adjust left input pushrod (25) so that it can be connected to input crank (24), then shorten one turn.

(l) Remove rig pins from input cranks (24) and (26). Connect left input pushrod (25) to input crank (24).

NOTE: When installed, pushrod (27) preload spring should be in mid-stroke (Ref. Fig. 503, View B).

(m) With input pushrod (27) connected, verify that rudder returns to faired (±0.75 inch). If not, disconnect left input push rod (25) from input crank (24); position input crank to fair rudder, then adjust push rod (25) and reconnect.

(n) Verify that rudder deflection with rig pin installed only in servo left input crank (24) is opposite and approximately equal to rudder deflection with rig pin installed only in servo right input crank (26).

(o) Verify that rudder is faired (±0.75 inch) with all rig pins removed from servo.

(p) Verify that preload spring is at approximately mid-stroke (Ref. Fig. 503, View B).

(9) Remove all rig pins.

(10) Position rudder pedals to full left rudder. Rudder must displace left 29.5° - 31° (42.6 to 44.7 inches).

(11) Position rudder pedals to full right rudder. Rudder must displace right 29.5-31 degrees (42.6 to 44.7 inches).

(12) Return rudder to faired.

(13) Verify connecting bolts on rudder servo input and feedback pushrods are properly torqued and install cotter pins.

(14) Shut off hydraulic power if no longer required (Ref. 29-11-00)

F. On aircraft 001-017,
Rudder Deflection Limiter - Rigging Check and Adjustment

(1) Open access doors 324L and 324R to rudder servo area.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on electrical power (Ref. 24-41-00).

(3) Turn on hydraulic system A and B (Ref. 29-11-00). (System A supplies the right limiter; system B, the left limiter.)

(4) On the pilots overhead flight control panel, release (out) the RUDDER LIMITER MECHANICAL MNL/PUSH switchlight. The MNL light must come on.

(5) On the same panel, release (out) the ±8°/±30° pushlight. The rudder limiter arms will extend and the ±8° light must come on.

(6) Slowly move the rudder control system (left rudder) to position the rudder against the left limiter arm. The left limiter arm end contour must match the rudder fitting bumper contour.

NOTE: The deflection limiter will restrict rudder deflection to 8 (±1) degree [(11.67 (±1.46) inches measured between rudder lower trailing edge and fixed fairing)].

Each rudder limiter arm is a dual arm that

contacts dual rudder fitting bumpers. A maximum gap of 0.080 inch between one leg of the limiter and its corresponding bumper is permissible when the second leg of the limiter arm makes full contact with its corresponding bumper.

(7) Slowly move the rudder control system (right rudder) to position the rudder against the right limiter arm. The right limiter arm end contour must match the rudder fitting bumper contour.

(8) If the requirement of either Step (6) or (7) cannot be met, accomplish following:

(a) Allow rudder to return to neutral.

(b) Turn off hydraulic power. Tag hydraulic control panels.

(c) Disconnect both limiter arm interconnecting links at the left limiter arm.

(d) Remove tags from hydraulic control panels. Turn on hydraulic system A and B. Both limiter arm will extend.

(e) Slowly position rudder against left limiter arm. Left limiter arm end contour must match the rudder fitting bumper contour. If not, adjust left limiter rod end (Ref. Fig. 504).

NOTE: Rod end locking key must be fully disengaged before adjusting rod end.

(f) Slowly position rudder against right limiter arm. Right limiter arm end contour must match the rudder fitting bumper contour. If not, adjust right limiter rod end.

(g) With both limiter arms maintained in the matched contour condition, adjust interconnecting links to fit between limiter arms.

(h) Verify adjustment by cycling limiter actuators (depress ±8°/±30° switchlight in and then out). With limiter arm extended, slowly position rudder left and right against limiter arms and recheck that limiter arms and bumper fitting contours still match.

(i) Verify that locking keys are properly installed, that jam nuts are tightened, and that all adjustments are lock-wired.

(9) Allow rudder to return to neutral.

(10) Depress ±8°/±30° switchlight. Limiter arms must retract and ±30° light must come on.

(11) Depress MNL/PUSH switchlight. MNL light must go off.

(12) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(13) Shut off electrical power if no longer required (Ref. 24-41-00).

(14) Inspect around rudder servo and limiter arm to be sure area is clear of any tools or loose equipment.

(15) Close access doors.

G. Rudder Travel and Pedal Forces Check

R NOTE: This procedure may be used for troubleshooting rudder
R control system but it is not intended to replace any
R required test procedure.

(1) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

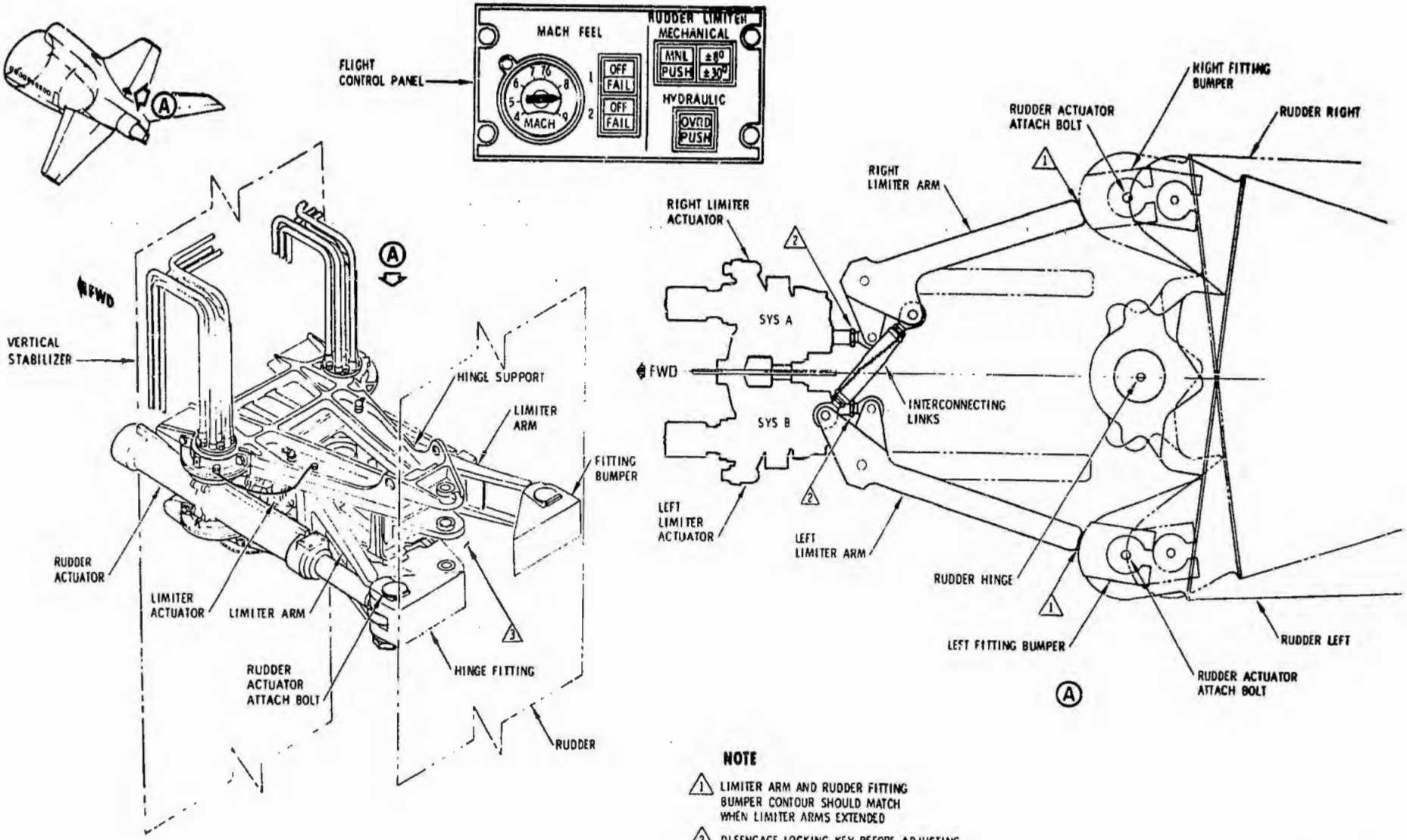
TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC POWER.

(3) Turn on hydraulic systems A, B or C (Ref. 29-11-00).

(4) On aircraft 001,
verify rudder trim is set at .5 mark NOSE L.

(4) On aircraft 002-999,
verify rudder trim is set at zero.



NOTE

1. LIMITER ARM AND RUDDER FITTING BUMPER CONTOUR SHOULD MATCH WHEN LIMITER ARMS EXTENDED
2. DISENGAGE LOCKING KEY BEFORE ADJUSTING ROD END
3. RUDDER HINGE OMITTED FOR CLARITY

MI-0101-27-360

Rudder Deflection Limiter - Adjustment and Test
Figure 504

(5) Slowly apply pressure to the left rudder pedal with a push rod force gage. Verify pedal moves with less than 17.5 lbs force.

(6) Verify force required to move left rudder pedal to stop does not exceed 68.0 lbs.

(7) Verify left rudder travel is 29.5 to 31.0 degrees (42.6 to 44.7 inches from rudder trailing edge to fixed trailing edge).

(8) Verify rudder pedal travel is 3.8 inches maximum.

(9) Set rudder trim 10 degrees right.

(10) Slowly apply pressure to the left rudder pedal with a push rod force gage. Verify pedal moves with less than 17.5 lbs force.

(11) Verify force required to move left rudder pedal to stop does not exceed 85.0 lbs.

(12) Repeat Steps 5G(4) through 5G(11) for right rudder pedal. Set rudder trim 10 degrees left in Step 9.

(13) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(14) Turn off electrical power if no longer required (Ref. 24-00-00).

H. Completion Check

(1) Turn off all hydraulic power if no longer required (Ref. 29-11-00).

(2) Tighten and safety all connecting bolts and adjustments.

(3) Remove all rig pins.

(4) Install all access panels and doors.

(5) Remove warning tags from hydraulic panels.

(6) Perform Quick Rigging Check (Ref. Para. 5A).

RUDDER PEDAL - REMOVAL AND INSTALLATION

1. Equipment and Materials

Main Landing Gear Wheel Chocks, PN B723, or equivalent

Rig Pin Kit, PN B734, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

2. Referenced Procedure

R	25-11-01	Captains Seat Assembly - Removal and Installation
R R	25-11-02	First Officers Seat Assembly - Removal and Installation
	29-11-00	Hydraulic Power - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

CAUTION: DO NOT PULL ON TOP OF RUDDER PEDAL. BRAKE INPUT ROD (2) (REF. FIG. 401) IS DESIGNED FOR TENSION LOADS ONLY. PULLING ON TOP OF RUDDER PEDAL APPLIES COMPRESSION LOADS AND CAN DAMAGE INPUT ROD.

A. Removal (Ref. Fig. 401)

(1) Manually move rudder to the faired position and secure.

(2) Chock main landing gear wheels and release parking brake.

NOTE: Rudder pedal removal will be facilitated by removing the associated seat (Captains or First Officers) (Ref. 25-11-01, 25-11-02).

R

(3) In the flight station, zone 210, remove screws, washers, bolts, and washers attaching both side panels on rudder pedal trim cover and remove panels (Ref. Fig. 401).

(4) Remove screws and washers attaching rudder pedal trim cover.

(5) Rotate rudder pedal adjustment crank handle to align arrow with mid position.

(6) Open forward electronic service center access door 112AB.

(7) In the forward electronic service center, zone 112, loosen retaining hex nuts attaching pedal adjustment shaft assemblies to worm gear spline on pedal levers.

(8) Disengage pedal adjustment shaft from worm gear splines and tag LEFT and RIGHT to facilitate installation.

(9) In the flight station, remove rudder pedal trim cover with pedal adjustment shafts attached.

(10) In the forward electronic service center, remove bolts that connect both brake idler arms to brake input rod.

(11) Remove bolts that connect both pedal levers to output pushrods.

(12) If removing Captains pedals, remove bolt that connects pedal position potentiometer link to Captains left pedal lever.

(13) Remove bolts from both rudder pedal supports, and remove rudder pedal assembly by lowering through floor beam opening.

B. Installation (Ref. Fig. 401)

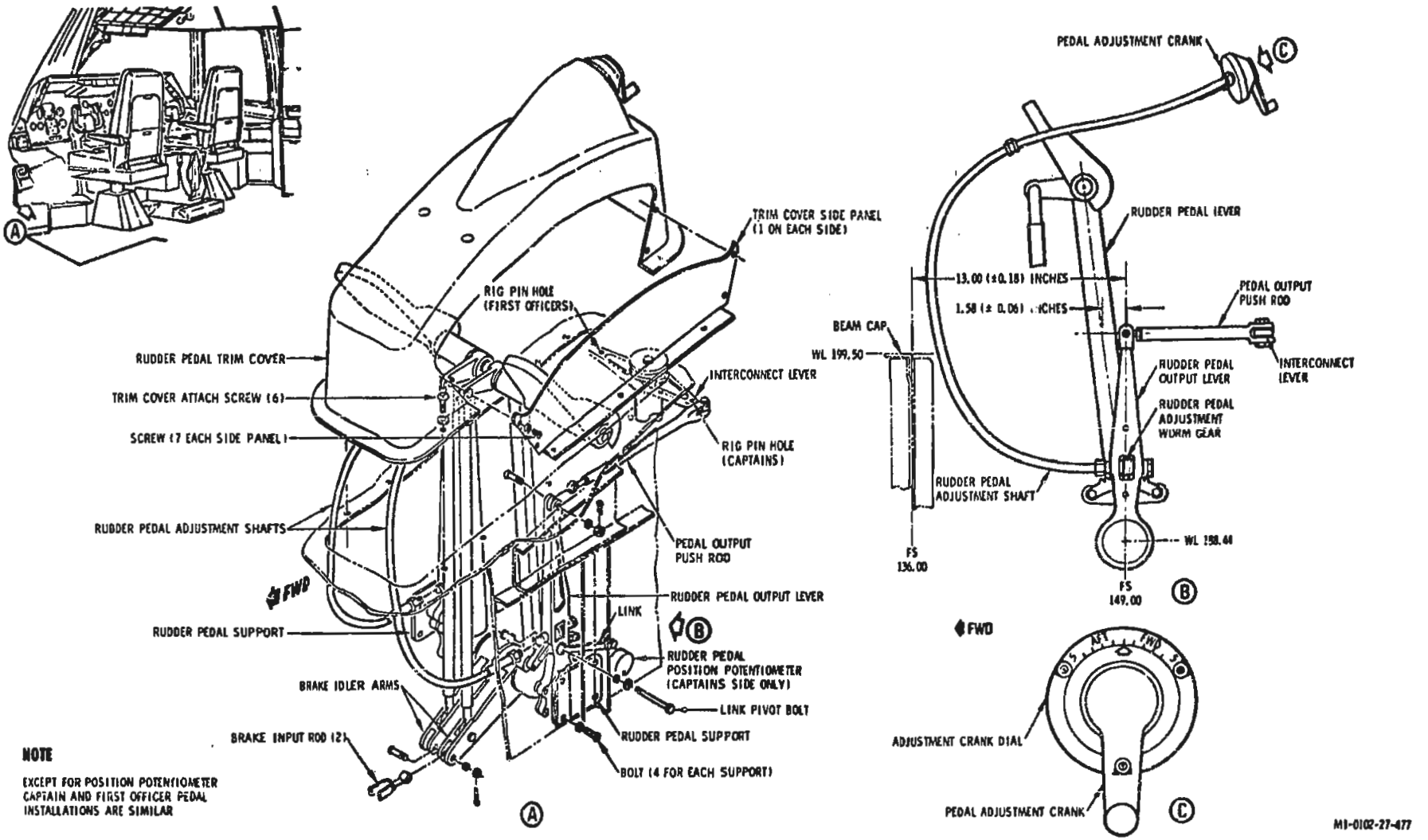
(1) Verify that rudder is secured in faired position, and the main landing gear wheels are chocked.

(2) In the forward electronic service center, install rudder pedal assembly through floor beam opening and secure both rudder pedal supports with bolts, washers, and nuts.

NOTE: Longest bolts are installed in lower holes.

(3) Lock rudder control system in neutral as follows:

NOTE: To expose rudder interconnect lever rig pin hole, remove screws attaching associated control column shield and shroud at base of control column. Rotate shroud to expose rig pin hole



R Rudder Pedal - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

0018

(forward left corner for Captains; forward right corner for First Officers).

(a) For First Officers rudder pedal installation, insert 5/16-inch diameter by 2-inch long (R2) rig pin into right-hand rudder interconnect lever.

(b) For Captains rudder pedal installation, insert 5/16-inch diameter by 4-inch long (R4) rig pin into left-hand rudder interconnect lever.

(4) Connect both pedal levers to rudder pedal output pushrods and secure with bolts, washers, nuts, and cotter pins.

CAUTION: IF RUDDER PEDAL OUTPUT PUSHRODS USE HI-TIGUE FASTENERS INSTEAD OF RIVETS TO ATTACH ROD ENDS, VERIFY THAT PUSHRODS ARE INSTALLED WITH HIGH-TIGUE COLLARS ON BOTH ENDS OF PUSHROD FACING EITHER DOWN OR SIDEWAYS BUT NOT UP.

(5) Check pedal output pushrod adjustment: Dimension from center of each pedal lever connecting bolt to aft face of FS136 beam cap must be 13 (±0.18) inches. If not, adjust output pushrod.

(6) Install both brake idler arms to brake input rod assemblies and secure with bolts, washers, nuts, and cotter pins.

(7) In the flight station, install rudder pedal trim cover with adjustment shaft attached. Secure cover with washers and screws.

(8) Install both side panels on rudder pedal trim cover and secure with washers, bolts, washers, and screws.

(9) Verify that rudder adjustment crank handle arrow is aligned with mid position.

(10) In the forward electronic service center, rotate both pedal adjustment worm gears so that center of pedal lever is 1.58 (±0.60) inches forward of center of pedal output lever bolt (mid position of worm and sector pedal adjustment).

(11) Connect both adjustment shafts to worm gear splines. Tighten adjustment shaft hex nut finger-tight, then back off hex nut 1/4 to 1/2 turn. Lock-wire hex nut to prevent rotation in either direction. Remove tags from adjustment shafts.

NOTE: If crank handle and the worm gear are not in their mid positions when shaft assembly is connected, the worm gear can run off the segment gear at full FWD or AFT position.

(12) If installing Captains pedals, connect rudder pedal position potentiometer link to Captains left pedal with bolt, washers, and nut. Install cotter pin.

(13) Remove rig pin from rudder pedal interconnect lever.

(14) Remove rudder holding device.

(15) Remove placards from hydraulic control panels.

(16) Set parking brake and remove chocks from main landing gear wheels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(17) Turn on hydraulic system A, B, or C (Ref. 29-11-00).

(18) Cycle pilots rudder pedals in flight station, zone 210, from full left to full right position five times. Visually determine that rudder pedals operate freely through full pedal travel and clear all structure. Verify that full rudder travel of ±30.5 degrees is available. Use surface position indicator to check.

NOTE: Pedal travel is limited by the First Officers rudder interconnect lever contacting fixed stops on the interconnect lever housing.

(19) Cycle rudder pedal adjustment crank handle from 5 AFT to 5 FWD; verify that pedals operate freely through full adjustment stroke without binding.

NOTE: If rudder pedal adjustment does not operate freely, it is permissible to butter-lube the

C worm and sector gear with grease MIL-G-21164. Wipe off excess grease after problem corrected.

(20) Close forward electronic service center access door.

(21) Turn off hydraulic power if no longer required (Ref. 29-11-00).

RUDDER PEDALS - INSPECTION AND CHECK

1. General

This procedure checks the operation of the rudder pedal adjustment mechanism for binding or chatter, and provides the steps necessary to rework the rudder pedal adjustment mechanism
CR for smooth operation. A limit is also given for the pedal arm
CR side play.

2. Inspection/Check

A. Rudder Pedal Adjustment Mechanism

(1) With no load on rudder pedals, cycle both the Captains and First Officers rudder pedals by rotating the pedal adjustment crank to position rudder pedals full forward to full aft and back to full forward.

(2) The pedal adjustment crank should operate smoothly without chatter, and should not require a force greater than 15 pounds to break away from the forward or aft stops.

NOTE: If rudder pedal adjustment does not operate smoothly, it is permissible to butter-lube the worm and sector gear on the rudder pedal output levers with grease MIL-G-21164 (Ref. 27-21-01,
C Removal and Installation, Fig. 401). Wipe off
C excess grease after problems corrected.

C (3) Replace defective parts if lube does not correct.

CR B. Rudder Pedal Arm, 1504138, Side Play

CR (1) The individual rudder pedal arms may have a side play
CR of 0.070 inches measured 16-3/4 ± 1/4 inch or 0.050
CR inches measured 12 inches from the lower pivot
CR centerline. This measurement is taken by applying an
CR approximate 10 pound reversing side load to the arm.
CR The pedal arm must clear all structure by 0.25 inches
CR throughout full travel with a side load applied in each
CR direction to remove all side play in the inboard and
CR outboard direction.

R # RUDDER PEDAL ADJUSTMENT SYSTEM

R 1. General

R Correct rudder pedal adjustment is essential to safe flight. This procedure can be used to adjust the rudder pedals if the rudder pedal adjustment mechanism is jammed.

R NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

R 2. Equipment and Materials

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent.

R Cotter Pin, MS24665-149, or equivalent.

R 3. Referenced Procedures:

R 6-50-00 Interior Access Doors and Removable Panels

R 4. Deactivation Procedure

R A. Rudder Pedal Adjustment System

R (1) Placard flight controls against inadvertent movement.

R (2) If rudder pedal adjustment crank will turn and move one pedal, move that pedal to the correct position.

R (3) Open access panel 211CB to gain access to the forward electronic service center (FESC) (Ref. 6-50-00).

R (4) Adjust jammed pedals to correct location as follows.

R (a) Attempt to turn pedal adjustment worm gear by hand (Ref. Fig. 201) and move pedal to correct position. If both pedals are now in correct position, go to Step 4A(5).

R (b) If worm gear will not turn, disconnect rudder pedal adjustment shaft from worm gear. Attempt to turn worm gear by hand and move pedal to correct position. If both pedals are now in correct position, go to Step 4A(4)(j).

R (c) If worm gear will not turn, loosen (do not remove) the two bolts that attach the sector gear to the rudder pedal lever.

R NOTE: If a potentiometer is installed next to the pedal adjustment mechanism, disconnect the potentiometer link to gain access to sector gear.

R (d) Attempt to turn worm gear by hand and move pedal to correct position. If both pedals are now in correct position, go to Step 4A(4)(h).

R (e) If worm gear will not turn, remove aft bolt attaching sector gear to rudder pedal lever. Note shim and washer distribution for reinstallation. Location of shims and washers must not be altered.

R (f) Rotate sector gear down away from worm gear. Move rudder pedal lever to correct position.

R NOTE: If worm and sector gear do not disengage it may be necessary to remove forward bolt attaching sector gear to rudder pedal lever. Note shim and washer distribution for reinstallation. Location of shims and washers must not be altered.

R (g) Move sector gear up to engage teeth on worm gear. Reinstall sector gear attach bolts with sims and washers in their original locations.

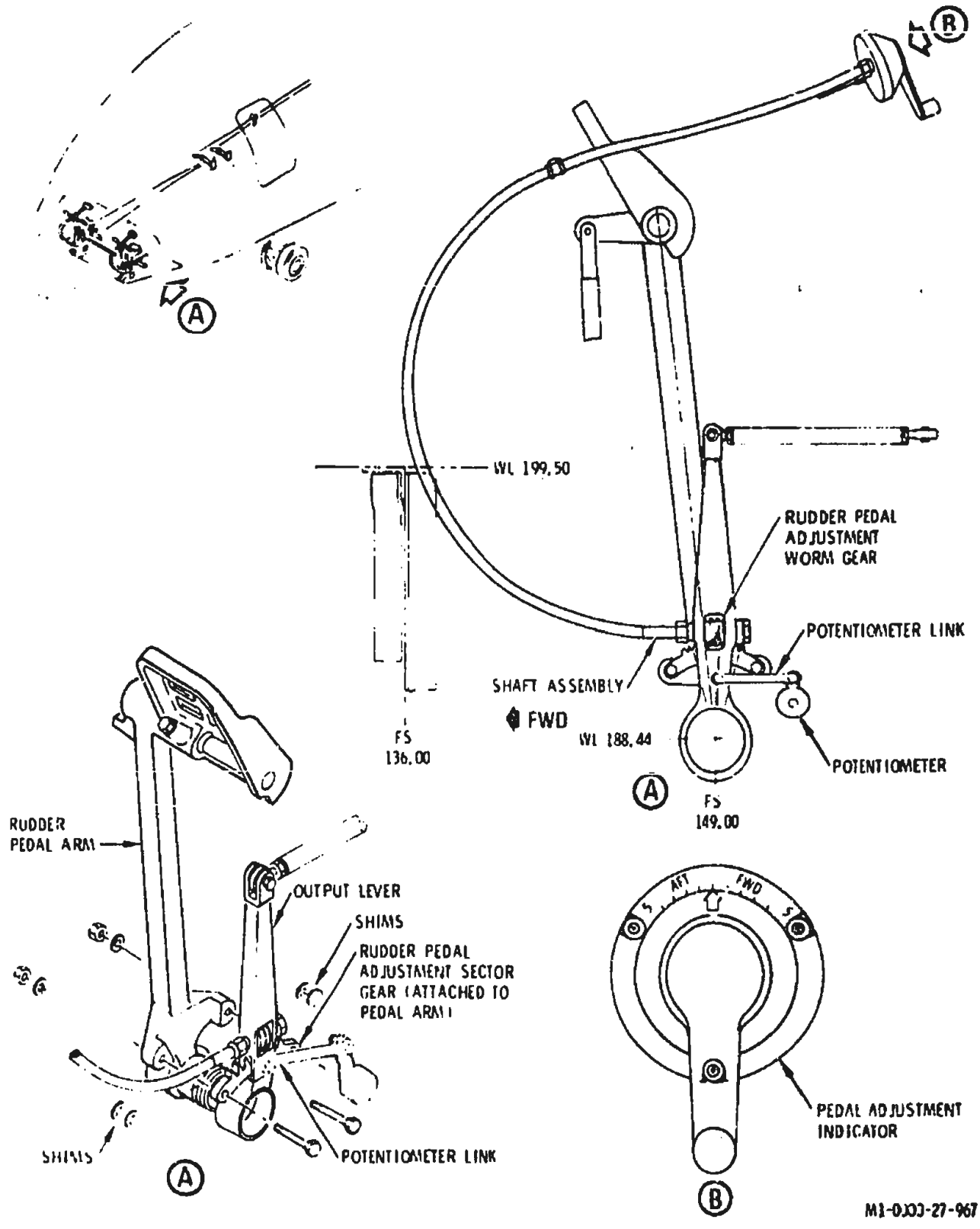
R (h) Verify pedals are even and in correct location.

R (i) Torque both sector gear attach bolts to 65 pound inches.

R (j) Reinstall rudder pedal adjustmentshaft. Tighten hex nut finger tight, then back off 1/4 to 1/2 turn. Install lock-wire to prevent rotation in either direction.

R (k) If potentiometer link was disconnected from rudder pedal lever, reinstall link with bolt through rudder pedal lever. Torque bolt and install cotter pin.

R (5) Placard rudder pedal adjustment crank.



R Rudder Pedal Adjustment Mechanism
R Figure 201

R EFFECTIVITY: ALL
R
001B

RUDDER PEDAL ADJUSTMENT CRANK - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

2. Removal/Installation

A. Removal

R NOTE: Removal and replacement of the rudder pedal
R adjustment shaft is covered in 27-21-20.

(1) In the flight station, zone 210, remove screws and washers, attaching both side panels on rudder pedal trim cover and remove panels (Ref. Fig. 401).

R (2) Remove nuts, washers, and bolts attaching both pedal
R adjustment shaft clamps to top of rudder pedal trim cover.

R (3) Rotate crank handle to align arrow with mid position.

R (4) Remove nuts, washers, and screws attaching rudder pedal
R adjustment crank to rudder pedal trim cover. Pull
R crank assembly from trim cover for access and remove
R retaining hex nuts attaching shaft assemblies to rudder
R pedal adjustment crank.

(5) Remove shaft assembly square drives from crank and tie shaft assemblies to right and left sides with twine.

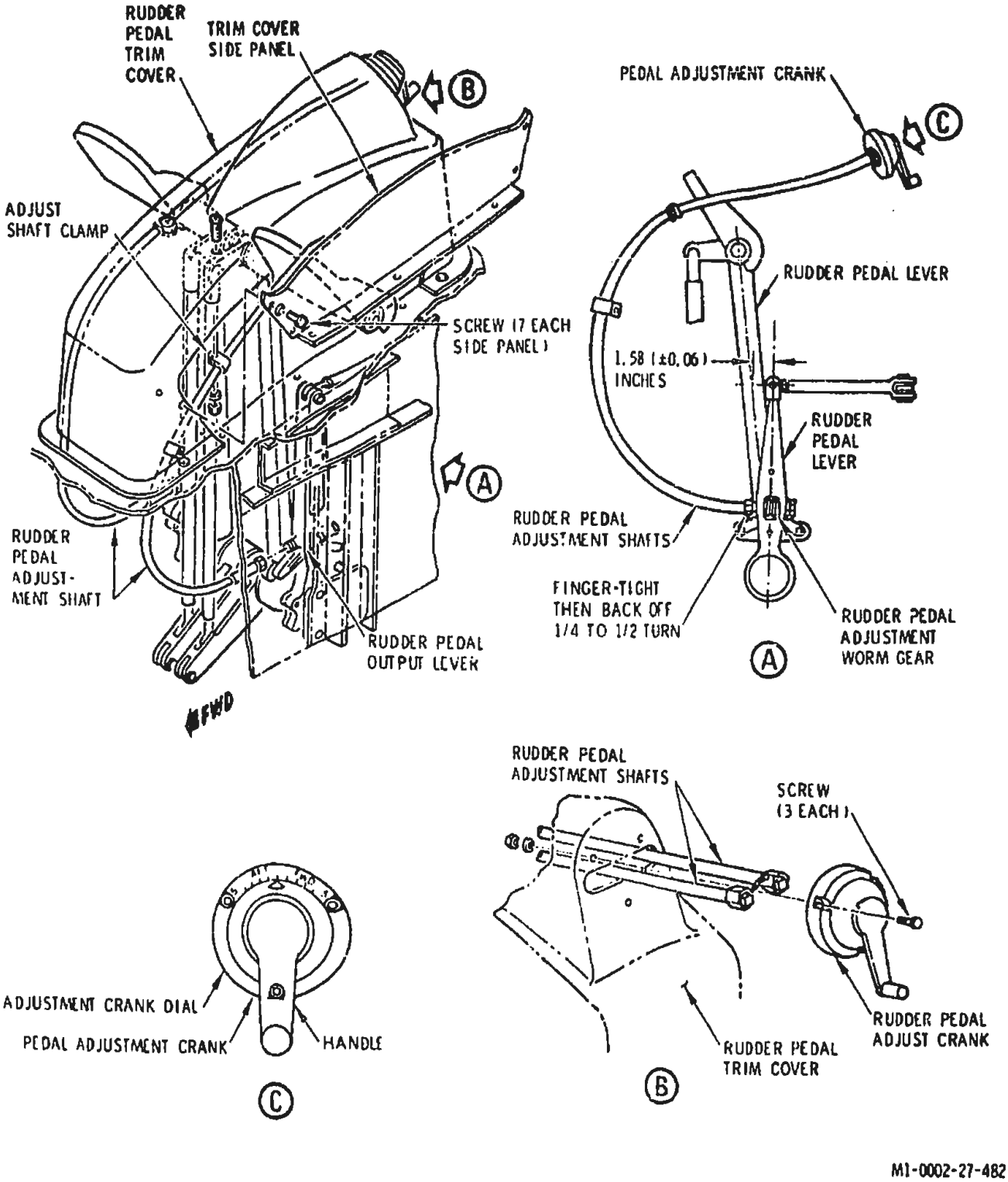
B. Installation

R (1) Rotate crank handle to align arrow with mid position.

R (2) If mid position of rudder pedal adjustment is lost or
R is suspect, accomplish following:

R (a) Rotate each shaft assembly square drive until the
R center of the pedal lever is 1.58 (±0.060) inches
R forward of the center of the pedal output lever
R bolt (Ref. Fig. 401). This is the rudder pedal
R adjustment mid position.

R (3) Install shaft assembly square drives to rudder pedal
R adjustment crank with attaching hex nuts; tighten and
R lock-wire.



M1-0002-27-482

R Rudder Pedal Adjustment Crank - Removal and Installation
R Figure 401

R (4) Install rudder pedal adjustment crank to rudder pedal trim cover with screws, washers, and nuts.

R (5) Install bolts, washers, and nuts to secure both shaft
R assembly clamps to top of trim cover.

R (6) Cycle crank handle to 5 AFT, reverse to 5 FWD and return to align arrow with mid position. Pedal adjustment crank should operate smoothly without binding.

R (7) If crank operation is not smooth, check that the
R adjustment shaft hex nut that connects to the rudder
R pedal adjustment worm gear is not tight. Hex nut
R should be finger-tight then backed off 1/4 to 1/2 turn
R and lock-wired to prevent rotation in either direction.

R (8) Install both side panels to trim cover with screws and washers.

R RUDDER FEEL SPRING ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin (R3), 5/16-inch diameter by 3 inches long (2 each) (Part of Rig Pin Kit PN B-734)

2. Referenced Procedures

6-40-00 Exterior Access Doors and Panels

29-11-00 Hydraulic Power System - Maintenance Practices

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

3. Removal/Installation

R A. Removal (Ref. Fig. 401)

(1) Remove dorsal saddle area access panel 313FR (Ref. 6-40-00).

(2) Gain access to rudder trim actuator installation.

(3) Remove attaching bolt connecting idler and feel spring fitting (Ref. Fig. 401).

(4) Remove attaching bolt connecting crank and spring fitting.

(5) Remove attaching bolt connecting spring rod end and bellcrank. Remove feel spring.

R B. Installation (Ref. Fig. 401)

(1) Verify that all hydraulic power is shut off (Ref. 29-11-00).

(2) Gain access to rudder trim control installation.

(3) Insert rig pin (R3) through trim actuator bracket and trim output crank (Ref. Fig. 401).

(4) Insert rig pin (R3) in the rudder control bellcrank assembly.

(5) Install feel spring assembly. Install bolt, bushing, spacer, washer, nut and cotter pin, to connect crank and feel spring fitting.

(6) Install bolt, bushing, washer nut and cotter pin to connect idler and feel spring fitting.

(7) Adjust spring rod end so that with no force applied to feel spring, the bolt fits freely through bellcrank and spring rod end. Install washer, nut and cotter pin.

NOTE: If rod end is adjusted, verify that lock washer tang is engaged in the spring shaft slot as lock nut is tightened. Lock-wire lock washer to lock nut.

(8) Remove all rig pins.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

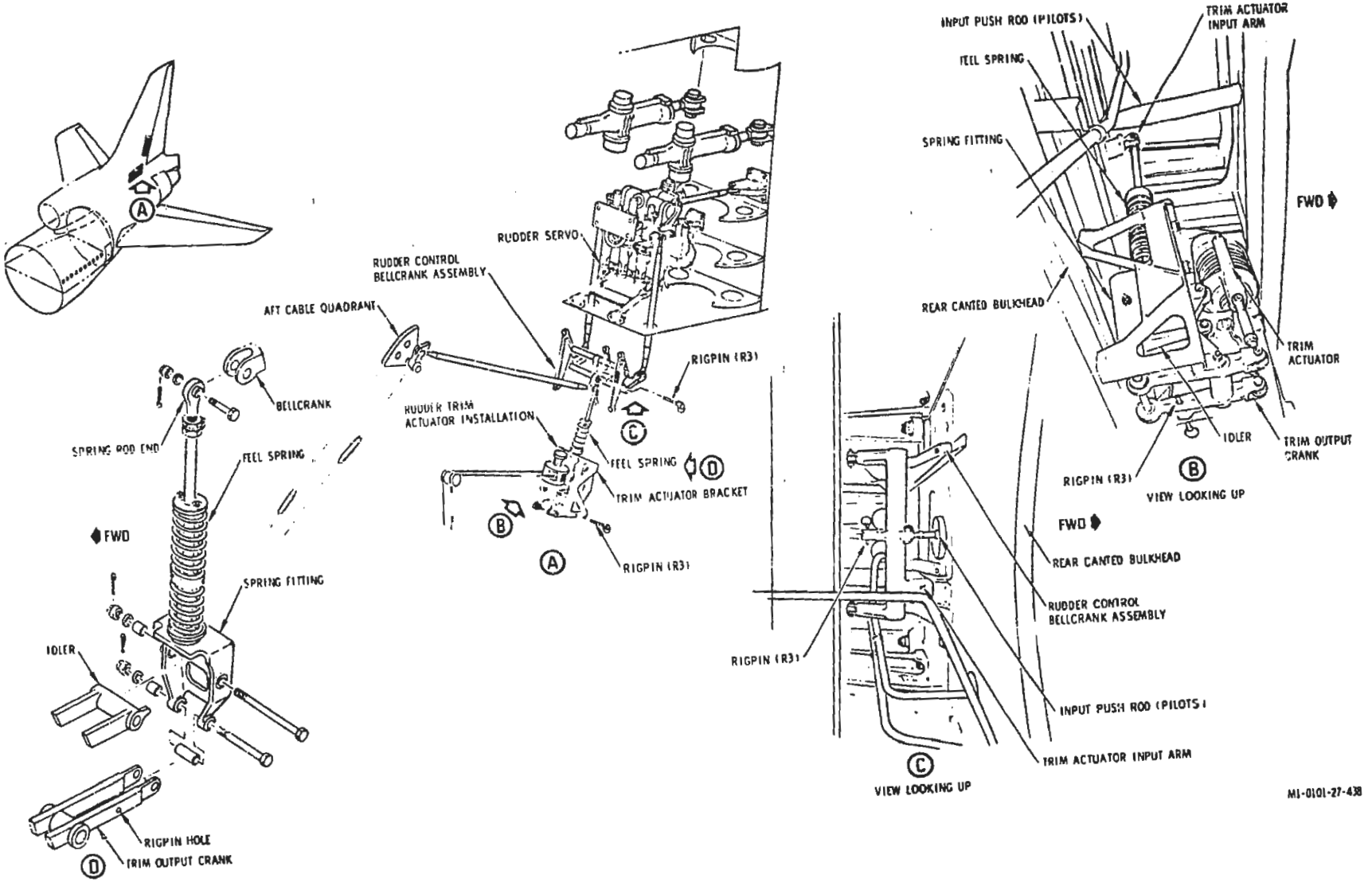
THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Remove tags from hydraulic panels.

(10) Turn on hydraulic system A, B, or C (Ref. 29-11-00).

(11) Slowly operate rudder pedals (minimum of four seconds stop to stop) to cycle rudder from full left to full right rudder. Rudder must operate smoothly without binding. Center rudder pedals.

(12) Cycle rudder trim control from full NOSE L to NOSE R. Trim control system must operate smoothly without binding. The rudder must respond smoothly to trim inputs (use surface position indicator to follow rudder movement). Position rudder trim to 0.



R Rudder Feel Spring Assembly - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001e

R CAUTION: ON AIRCRAFT 008-017,
R WITHOUT SB53-064 INCORPORATED, CHECK FOR
R POSSIBLE INTERFERENCE OF THE FEEL SPRING WITH
R THE CANTED BULKHEAD HORIZONTAL STIFFENER AS
R FOLLOWS:

R SET RUDDER (YAW) TRIM CONTROL TO FULL NOSE L.
R APPLY FULL LEFT RUDDER. VERIFY THAT THE
R UPPER AFT END OF THE FEEL SPRING DOES NOT
R CONTACT THE HORIZONTAL STIFFENER THAT IS JUST
R BELOW WHERE THE PILOTS INPUT PUSHROD GOES
R THROUGH THE CANTERED BULKHEAD. IF THERE IS
R CONTACT, REWORK THE HORIZONTAL STIFFENER IN
R ACCORDANCE WITH SB53-064. (REPOSITION RUDDER
R PEDALS AND RUDDER TRIM TO NEUTRAL AFTER
R CHECK.)

R (13) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(14) Check that dorsal area is clear of tools and equipment.

(15) Install access panel 313FR.

RUDDER SERVO CONTROL MODULE - REMOVAL AND INSTALLATION

1. General

A. When returning to dual system operation from single system operation, fluid flow up to 7.0cc is normal from the cavity relief valve.

C NOTE: Before changing an aileron servo that is leaking from
C the staic cavity relief valve, first replace the
C valve (TWA Stk. Nbr. 73-6866) (Drain line is attached
C to relief valve).

C If, after replacing the relief valve leakage is still
C excessive, contact MCIMD to have correction to
C leakage setup.

C Aircraft dispatch is permissible providing hydraulic
C fluid servicing has not been required on previous
C flight legs with associated hydraulic systems.

B. The following is a list of rudder servo module line replaceable units (LRU's) and the ATA location of the procedures:

R Solenoid Shutoff Valve, 27-21-08

R Electrohydraulic Servo Valve, 27-21-09

R Filter Element, 27-21-10

R Pressure Switch - Autopilot, 27-21-24

R Pressure Switch - System A and B, 27-21-25

R Pressure Switch - System C, 27-21-26

CR Static Cavity Relief Valve - 27-21-31

2. Equipment and Materials

Hydraulic fitting caps

Rudder Servo Valve Support Fixture, PN B972-101, or equivalent

Lock-wire, Fed Spec QQ-W-423, Form I, Cond A, 0.032-inch diameter, or equivalent

Cotter Pin, MS24665-149, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-13-01	Hydraulic Bootstrap Reservoir - Servicing
20-12-00	Hydraulic Tube Connections and Fittings
22-15-03	Rudder Dual Position Transducer - Adjustment and Test
24-41-00	External Power/Ground Service Systems - Maintenance Practices
27-21-00	Rudder Control System - Adjustment and Test
27-21-07	Rudder Servo Control Module - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices
29-11-74	Rudder Hydraulic Fusing Shutoff Valve - Adjustment and Test

4. Removal/Installation

WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) On pilots overhead circuit breaker panel CB1, open and tag tag circuit breakers NO. 1 SYSTEMS - YAW SAS (A5), No. 2 SYSTEMS - YAW SAS (A23). On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open and tag the three RUDDER SERVO circuit breakers A(K12), B(K13), C(K14).

(2) Accomplish following to gain access to rudder servo (Ref. Fig. 401 and 6-40-00).

(a) Open access doors 324AL and 324AR (Ref. 6-40-00).

(b) Remove access door support on side servo will be removed.

(c) Remove rudder leading edge shroud panel 325CL and 325CR.

(d) Remove the three rudder leading edge shroud ribs.

(3) Block rudder in faired position to prevent rudder movement.

NOTE: Carefully tag hydraulic lines to prevent crossing lines on installation.

(4) Disconnect hydraulic lines from servo. Install protective caps on servo fittings and pressure plugs on hydraulic lines.

CR CR CR NOTE: It may be necessary to transfer hydraulic attach fittings from the removed unit to the installed unit.

(5) Disconnect electrical connectors from servo module. Install protective caps and covers over connectors (Ref. Fig. 401).

(6) Disconnect left and right servo feedback pushrods at servo feedback arms. On side the servo will be removed, disconnect feedback pushrod at rudder fitting and remove feedback pushrod.

(7) Disconnect left and right rudder servo input pushrods at servo input arms.

(8) Remove servo lower mounting bolts that attach gate link to servo mounting lugs. Push gate link down and out of way.

(9) Install attach plate support fixture on each side of servo with three bolts. Install balance bar on left support fixture and secure with locking pin. Connect hoist cable to balance bar lug. Operate hoist to take up slack until cable and fixture supports servo (Ref. Fig. 401).

NOTE: If hoist is not available, use attach plate support fixtures to manually remove rudder servo. Do not install balance bar.

(10) Remove servo upper mounting bolts.

(11) Remove servo by moving aft then outboard to clear servo input push rods. (As an aid in removing rudder servo, have someone in flight station apply full left rudder to position servo input pushrods down and out of way.)

(12) Carefully lower rudder servo to transportation cart.

NOTE: Rudder servo weighs approximately 120 pounds.

B. Installation

WARNING: VERIFY ALL HYDRAULIC POWER IS TURNED OFF AND HYDRAULIC CONTROL PANELS TAGGED.

(1) Verify circuit breakers opened in Step 4A(1) are open and tagged.

(2) Verify rudder is blocked in faired position.

(3) Install mounting plate support fixtures on servo with mounting bolts. Install balance bar on left support fixture and secure with lock pin. Connect hoist cable to support fixture.

(4) Raise servo to access area. Remove protective caps and plugs from servo and hydraulic fittings.

(5) Using support fixture, place servo into mounting position. Verify input push rods are positioned between the servo input arm clevises.

(6) Verify slip-fit bushings are installed in servo upper attach bracket. Install servo upper attach bracket mounting bolts, washers, and nuts. Do not tighten.

(7) Disconnect and remove balance bar from support fixture and support fixtures from servo.

(8) Verify slip-fit bushings are installed in gate link. Position servo and gate link to allow installation of servo lower mounting bolts. Install servo lower mounting bolts, washers and nuts. Do not tighten.

NOTE: Access to hydraulic lines is limited. Success in connecting hydraulic lines depends on proper alignment of hydraulic lines to servo.

Use care when connecting hydraulic lines to servo to prevent crossing hydraulic lines (Ref. Fig. 401).

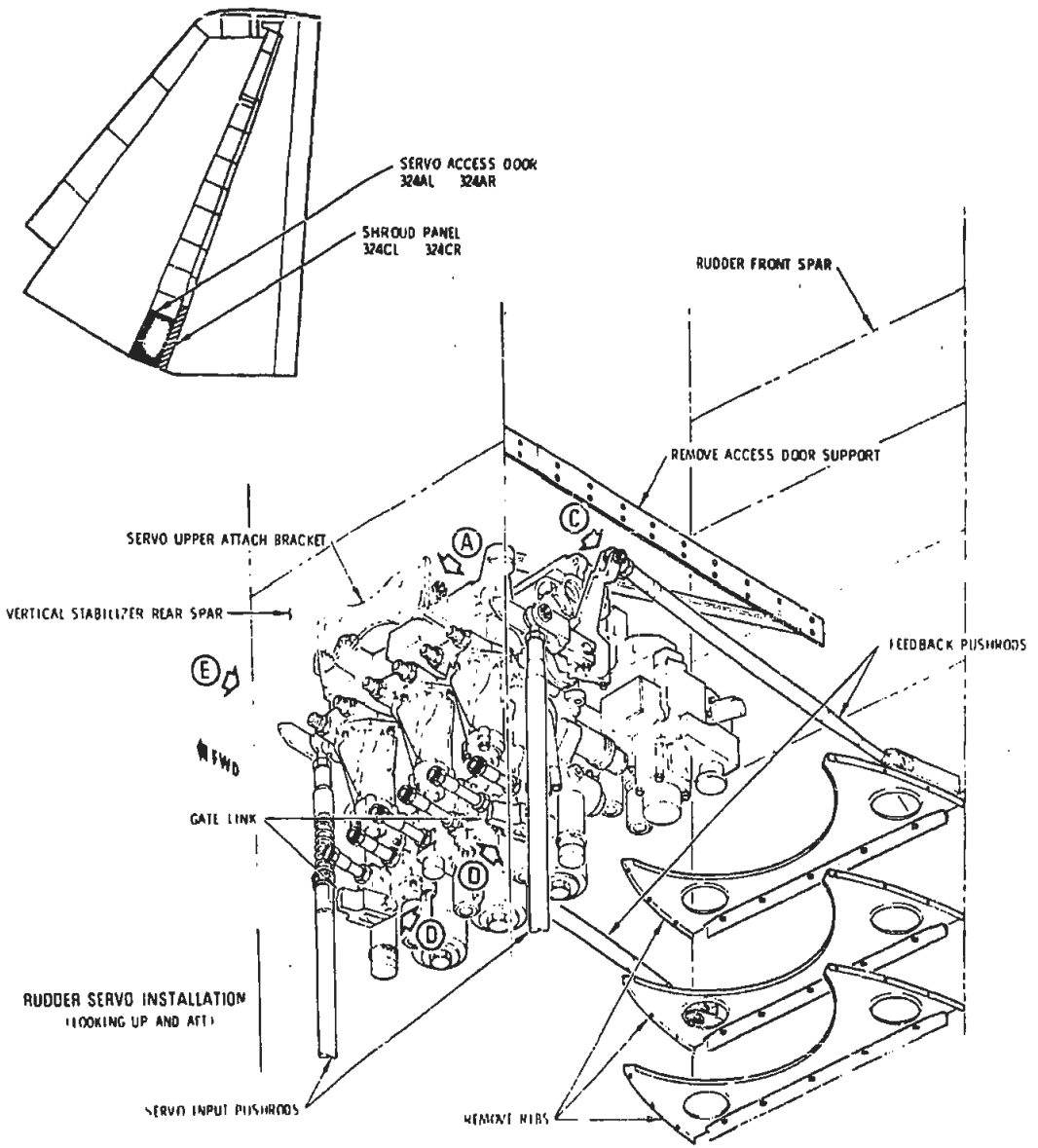
(9) Torque upper servo mounting bolts (190 to 390 lb in).

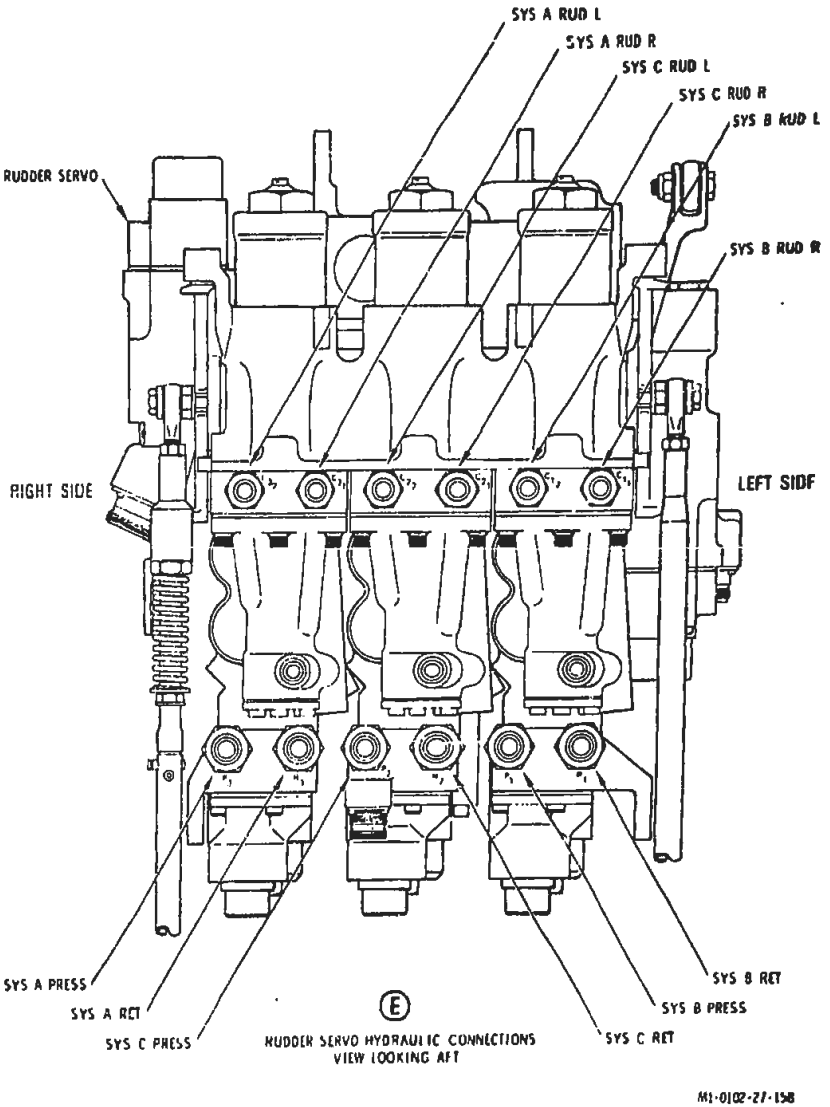
(10) Torque lower servo mounting bolts (70 to 100 lb in.).

(11) Lockwire bolt head to attach bracket.

(12) Install electrical connectors and lock-wire.

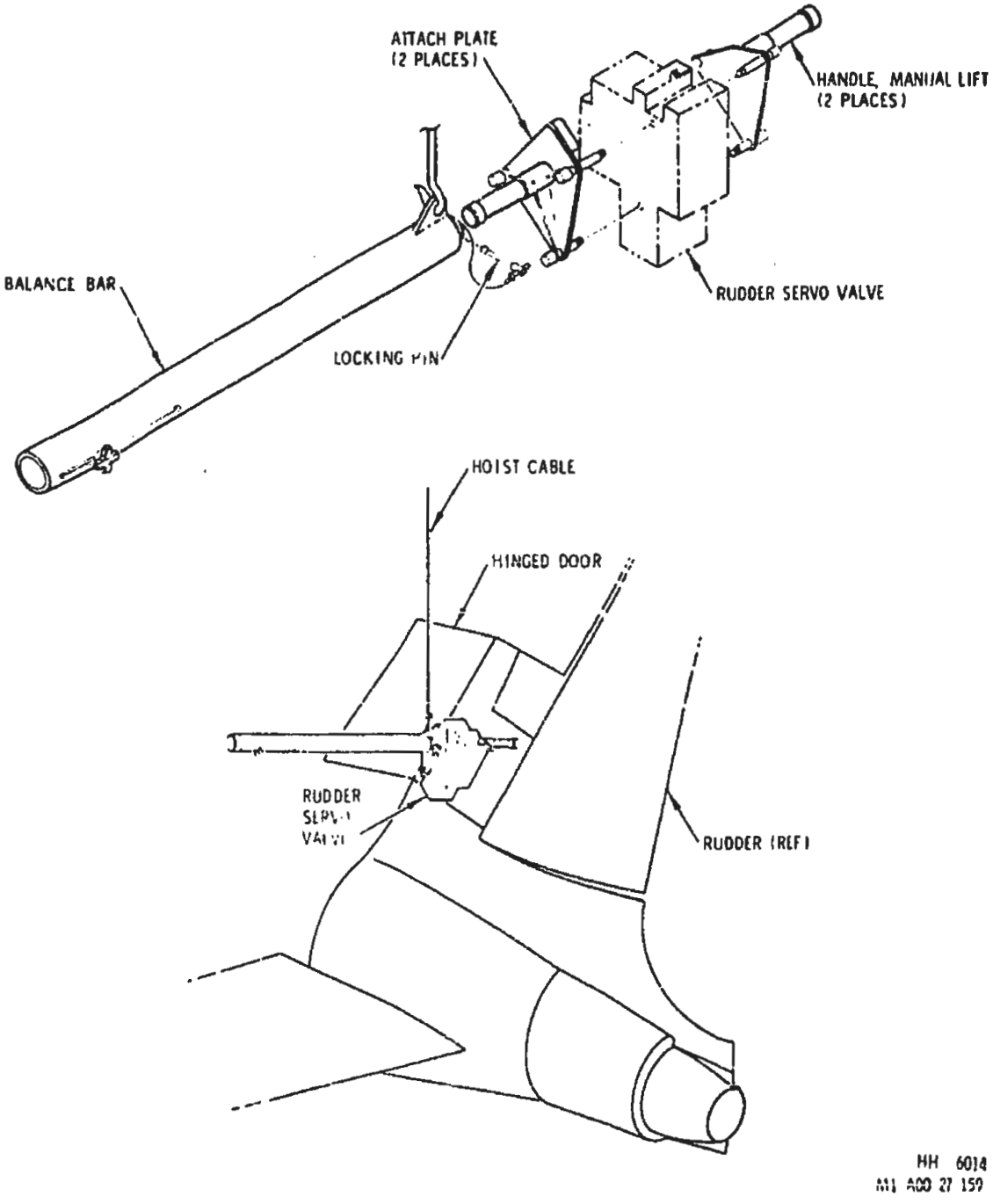
(13) Remove rudder holding blocks.



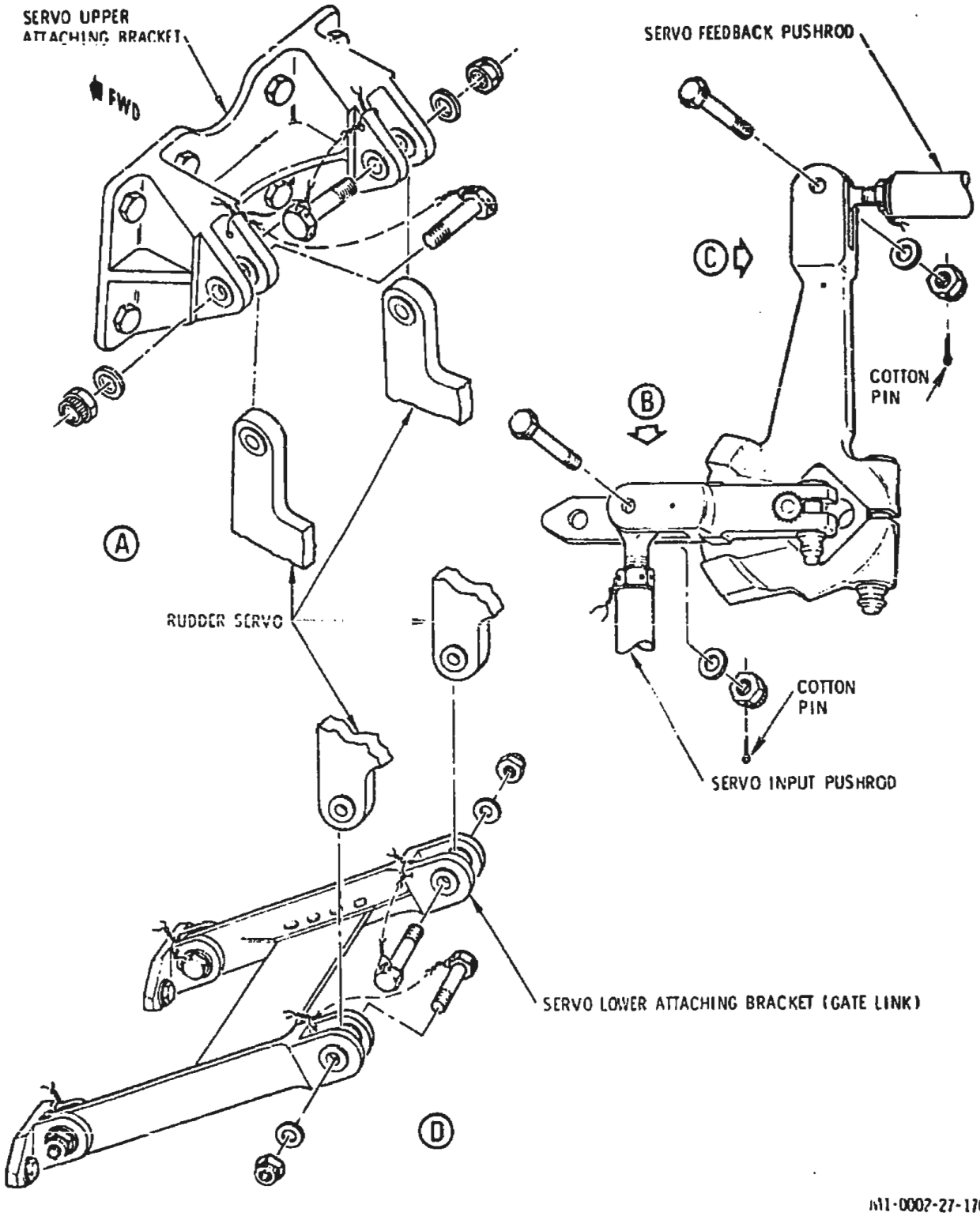


Rudder Servo Control Module - Removal and Installation
Figure 401 (Sheet 1)

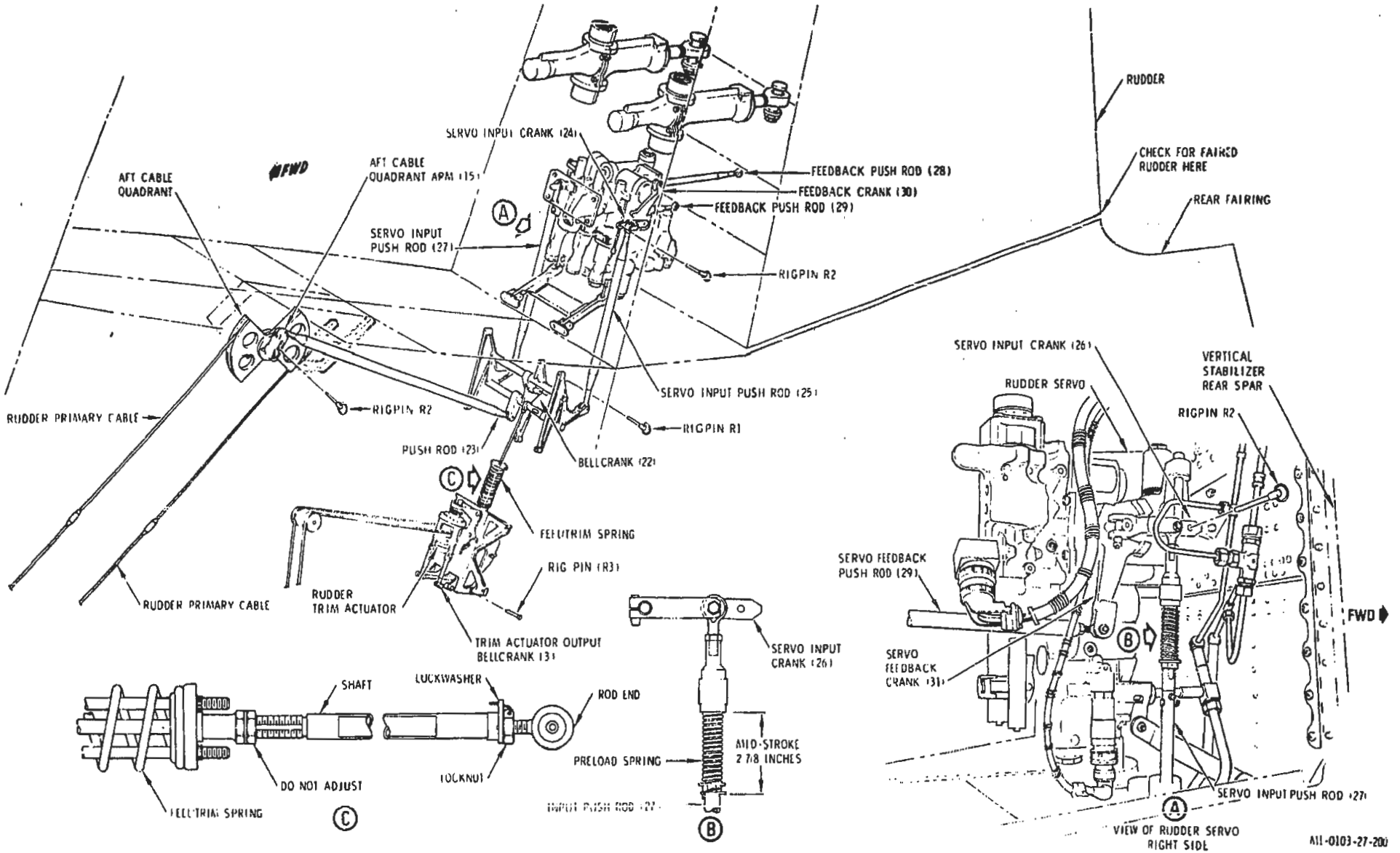
R EFFECTIVITY: ALL
R
001B



Rudder Servo Control Module - Removal and Installation
Figure 401 (Sheet 2)



Rudder Servo Control Module - Removal and Installation
Figure 401 (Sheet 3)



Rudder Servo Control - Rigging Check and Adjustment
Figure 402

R EFFECTIVITY: ALL
R
001B

(14) Connect servo input pushrods to their respective servo input arms. Connect pushrods by installing attaching bolts, washers, and nuts.

(15) Install and connect removed feedback pushrod to rudder fitting with attaching bolt, washer, and nut. Torque nut 30 to 40 lb in. and install cotter pin. (Pushrod adjustable rod-end must face forward.)

(16) Connect the two feedback pushrods to servo feedback arms.

(17) Connect hydraulic lines to servo. Torque hydraulic fittings (Ref. 20-12-00).

CR CR CR NOTE: It may be necessary to transfer hydraulic attach fittings from the removed unit to the installed unit.

NOTE: Access to hydraulic lines is limited. Success in connecting hydraulic lines depends on proper alignment of hydraulic lines to servo. Use care when connecting hydraulic lines in servo to prevent crossing hydraulic lines (Ref. Fig. 401).

(18) Install access door support.

(19) Install the three rudder leading edge shroud ribs.

(20) Install the shroud panels.

(21) Remove tags and close circuit breakers opened in Step A(1).

(22) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND MAIN GEAR DOORS SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(23) Turn on electrical power (Ref. 24-41-00).

(24) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

CAUTION: THE RUDDER SERVO INCORPORATES A STATIC CAVITY RELIEF VALVE ON THE FORWARD UPPER SECTION OF THE SERVO WHICH MUST BE OPEN TO ATMOSPHERE. DO NOT INSTALL A PRESSURE CAP ON THE RELIEF VALVE FITTING OR THE SERVO MAY BE DAMAGED.

(25) Bleed by slowly operating rudder pedals forward and aft through 10 full cycles until control feels smooth.

NOTE: Operating rudder at a high rate can damage the rudder damper seals. Operate rudder so that stop-to-stop travel takes at least 4 seconds.

After bleeding any hydraulic component, bleed associated hydraulic reservoir (Ref. 12-13-01).

(26) Check for leaks at servo module hydraulic fittings.

(27) Verify controls operate smoothly without binding or hesitation throughout control range.

(28) Verify A hydraulic system rudder fusing shutoff valve has not actuated closed due to air in system as follows:

(a) Gain access to forward electronic service center (FESC).

(b) Locate flight control auxiliary unit (FCAU) below bottom shelf of center rack.

(c) On FCAU, verify RUDDER HYDRAULIC LIMITER A light is off with hydraulic system A pressurized. If light is on, reset fusing system (Ref. 29-11-74). After resetting fusing system, verify that A light is off.

(29) Check rudder servo neutral rigging as follows (Ref. Fig. 402):

R (a) On aircraft 001,
R position YAW trim wheel to .5 mark NOSE L.

R NOTE: On aircraft 001,
R the adjustment of the YAW trim wheel has
R been biased to provide straight and level
R flight with the YAW trim wheel at zero. A
R decal located at the left underside of the

R alternate landing gear control cover
R specifies .5 mark R YAW for aircraft 001.
R It should be noted that for the .5 mark
R NOSE R bias specified, the YAW trim wheel
R is set to .5 mark NOSE L with the rig pin
R in the YAW cable drum. Removing the rig
R pin and positioning the YAW trim wheel to
R zero produces a NOSE R bias.

R (a) On aircraft 002-999,
R position YAW trim wheel to zero.

(b) On First Officers control column, remove screws attaching shield to control column and shroud to floor. Rotate shroud to expose rig pin hole in upper right corner to pin the rudder pedal interconnect lever.

(c) Insert rig pin R2 in First Officers rudder pedal interconnect lever to lock rudder control system in neutral. With rig pin in rudder pedal interconnect lever, rudder must be faired at lower trailing edge (±0.75 inch). If rudder fairs within above tolerance, remove rig pin, install shroud and shield, then proceed to Step 4B(30). If rudder does not fair within above tolerance, accomplish following Steps (d) through (t).

(d) Shut off all hydraulic power (Ref. 29-11-00).

(e) Disconnect servo left and right input pushrods (25) and (27) from the servo input cranks (24) and (26) (Ref. Fig. 402).

(f) Install rig pins R2 in servo left and right input cranks (24) and (26).

WARNING: WITH HYDRAULIC PRESSURE ON, RUDDER SERVO IS SENSITIVE AND DANGEROUS IF SERVO INPUT PUSHRODS ARE DISCONNECTED FROM SERVO (OR SERVO INPUT ARMS ARE NOT PINNED), OR IF BOTH FEEDBACK PUSHRODS ARE DISCONNECTED FROM SERVO.

(g) Disconnect right feedback pushrod (29) from servo feedback crank (31) (Ref. Fig. 402). Position pushrod outboard to provide clearance for rudder movement. Turn on hydraulic systems A, B, and C. If rudder moves to faired position (±0.75 inch), adjust and reconnect right feedback pushrod to servo feedback crank to hold rudder in faired position. Proceed to Step (m).

(h) If rudder does not move to faired (±0.75 inch) with right feedback pushrod disconnected, accomplish following Steps (i) through (l).

(i) Note direction rudder is out of faired. Adjust right feedback pushrod half the required correction (but not more than two turns). Reconnect right feedback pushrod to feedback crank.

NOTE: One turn of feedback pushrod changes rudder position approximately 0.75 inch at trailing edge. Lengthening right feedback pushrod moves rudder left; lengthening left feedback pushrod moves rudder right.

(j) Disconnect left feedback pushrod (28) from servo feedback crank (30).

(k) Note direction and amount rudder is out of faired. Adjust left feedback pushrod half the required correction (but not more than two turns). Reconnect left pushrod to servo.

(l) Repeat Step (g).

NOTE: If rudder is several inches out of faired, it may require several adjustments of feedback pushrods to safely "walk" rudder to faired position by adjusting one feedback pushrod at a time.

(m) Adjust right input pushrod (27) (containing preload spring) to 0.110 inch longer than required to install with no compression load applied to preload spring. Compress spring and connect to input crank.

(n) Adjust left input pushrod (25) so it can be connected to input crank (24), then shorten pushrod one turn.

(o) Remove rig pins from servo input cranks (24) and (26). Connect left input pushrod (25) to input crank.

NOTE: When installed, pushrod (27) preload spring should be in mid-stroke (Ref. Fig. 402).

(p) With right input pushrod (27) connected, verify rudder returns to faired (±0.75 inch). If not, disconnect left input pushrod (25) from input

crank (24); position left input crank to fair rudder, then adjust left pushrod (25) and reconnect.

(q) Verify rudder deflection with rig pin installed only in servo left input crank (24) is opposite and approximately equal to rudder deflection with rig pin installed only in servo right input crank (26).

(r) Verify rudder is faired (±0.75 inch) with all rig pins removed from servo.

(s) Verify preload spring is at approximately mid-stroke (Ref. Fig. 402).

(t) Remove all rig pins.

(u) Verify input and feedback pushrod bolts are correctly torqued and install cotter pins.

(v) Install First Officers control column shroud and shield.

(30) Perform following tests and checks:

CAUTION: REPLACEMENT OF RUDDER SERVO MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL USING INDIVIDUAL HYDRAULIC SYSTEMS. THIS IS REQUIRED TO ASSURE HYDRAULIC LINES ARE NOT CROSSED DURING INSTALLATION. RUDDER SERVO IS SUPPLIED BY HYDRAULIC SYSTEMS A, B, AND C. THIS CHECK IS MADE BY PERFORMING RUDDER SERVO HYDRAULIC INTEGRITY TEST.

(a) Rudder Servo Shutoff Valve Test (Ref. 27-21-00).

(b) Rudder Servo Hydraulic Integrity Test (Ref. 27-21-00).

(c) YAW SAS Engage Solenoid Shutoff Valves - Functional Test (Ref. 27-21-07).

(d) Rudder Dual Position Transducer Check (Ref. 22-15-03). (This test checks rudder autopilot function.)

(31) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(32) Turn off electrical power if no longer required (Ref. 24-41-00).

(33) Close all access panels (Ref. 6-40-00).

R RUDDER SERVO CONTROL MODULE - ADJUSTMENT AND TEST

1. General

The yaw SAS engage solenoid shutoff valves, on the rudder servo module, are dual coil assemblies with each coil controlled from one of the two yaw SAS channels. This test is provided to verify that the solenoid shutoff valves have not failed in the open (hydraulics on) position.

2. Referenced Procedures

21-20-00	Equipment Cooling - Maintenance Practices
24-41-00	External Power/Ground Service Systems - Maintenance Practices
R 29-11-00	Hydraulic Power System - Maintenance Practices

3. Adjustment/Test

A. Yaw SAS Engage Solenoid Shutoff Valves - Functional Test

(1) Turn on electrical power (Ref. 24-41-00).

(2) Verify that equipment cooling is on (Ref. 21-20-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

(4) Verify that hydraulic systems A, B and C indicate 3000 psi.

(5) On the pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

R YAW SAS (A5)

R FCES - COMPUTERS - AC & L AOA (B5)

R YAW SAS (A23)

R INSTR XFMR NO. 3 (D27)

R SURF POSN IND (J23)

R On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, verify that the following
R circuit breakers are closed:

R R AOA (F1)

R AFCS WARNING - CAPT and F/O (K18, K19)

R RUDDER SERVO - A, B, and C (K12, K13, K14)

R RUDDER FUSING SYS (L16)

R On Flight Engineer/Second Officers aft circuit breaker
R panel CB3, zone 215, verify that following circuit
R breakers are closed:

R PFCS ADS/DH (G8)

R FLT CONT ALT ALERT (G9)

R (6) On the FCES panel, verify that YAW SAS 1 switchlight is
R depressed (latched in) and the OFF light is off.
R Release (out) YAW SAS 2 switchlight, and verify that
R the OFF light comes on.

R (7) Rapidly rotate Captains control wheel fully clockwise.
R Verify that rudder deflects (approximately 8 degrees)
R (use position indicator). Return control wheel to
R neutral.

R (8) Release YAW SAS 1 switchlight and verify that the OFF
R light comes on.

R (9) Rapidly rotate Captains control wheel fully clockwise.
R Verify that rudder does not respond. Return control
R wheel to neutral.

R (10) Depress YAW SAS 2 switchlight. Verify that the OFF
R light goes off.

R (11) Rapidly rotate Captains control wheel fully clockwise.
R Verify that rudder deflects (approximately 8 degrees).
R Return control wheel to neutral.

R (12) Depress both YAW SAS 1 and 2 switchlights. Verify that
R both OFF lights go off.

R (13) Turn off hydraulic power (Ref. 29-11-00).

R (14) Turn off electrical power (Ref. 24-41-00).

RUDDER SERVO AND RUDDER DEFLECTION LIMITER SOLENOID SHUTOFF VALVE - REMOVAL AND INSTALLATION

1. General

The solenoid shutoff valve is normally replaced as an assembly, however, if the valve malfunction appears to be an electrical problem, the solenoid coil can be replaced separately without disturbing the hydraulic portion of the shutoff valve or the valve-to-servo interface.

The NO. 2 YAW SAS (hydraulic system A) solenoid shutoff valve installation is such that the solenoid coil cannot be removed separately.

NOTE: The rudder deflection limiter is installed on aircraft 001-017.

2. Equipment and Materials

Container, 1 quart (If replacing the entire valve assembly)

Gasket plate (Ref. Fig. 401) (If replacing the entire valve assembly)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

3. Referenced Procedures

6-40-00	External Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Preparation

WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open and tag applicable circuit breaker:

Power Servo:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, RUDDER SERVO - A, B, or C.

Autopilot Module (part of power servo):

On pilots overhead circuit breaker panel CB1, zone 210, AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS, or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS.

Rudder Limiter:

R On aircraft 001-017, on Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, RUDDER MECH LMTR - A or B.

(2) Open vertical stabilizer access door 324AL or 324AR (Ref. 6-40-00).

B. Removal of Solenoid Coil Assembly

NOTE: The NO. 2 YAW SAS (hydraulic system A) solenoid coil cannot be removed separately with solenoid shutoff valve installed on servo due to lack of accessibility.

(1) Remove lock-wire and remove screw on top of shutoff valve assembly (Ref. Fig. 401 or 402).

(2) Disassemble coil from valve assembly as follows:

(a) Remove stepped washer and spacer.

(b) Pull coil assembly to disengage electrical connector from servo and remove coil assembly from valve housing.

C. Installation of Solenoid Coil Assembly

(1) Verify spacer is installed on valve housing.

(2) Verify O-ring is installed on electrical connector.

(3) Slide coil assembly on valve housing while positioning coil assembly electrical connector through hole in

valve flange. Verify electrical connectors are properly engaged.

(4) Install spacer and stepped washer on valve housing.

(5) Install screw through stepped washer and into end of valve housing. Tighten screw and lock-wire.

(6) Check solenoid valve operation (Ref. Para. G).

D. Removal of Solenoid Shutoff Valve

(1) Place container under shutoff valve to catch oil spillage.

(2) Remove mount screws and remove valve from servo, (Ref. Fig. 401).

R E. On aircraft 001-017, removal of Rudder Deflection Limiter Solenoid Shutoff Valve.

(1) Place container under shutoff valve to catch oil spillage.

(2) Remove mount screws and remove valve from deflection limiter actuator (Ref. Fig. 402).

F. Installation of Solenoid Shutoff Valve

(1) Verify circuit breaker opened in Step 4A(1) is open and tagged.

(2) Verify O-ring is installed on valve electrical connection.

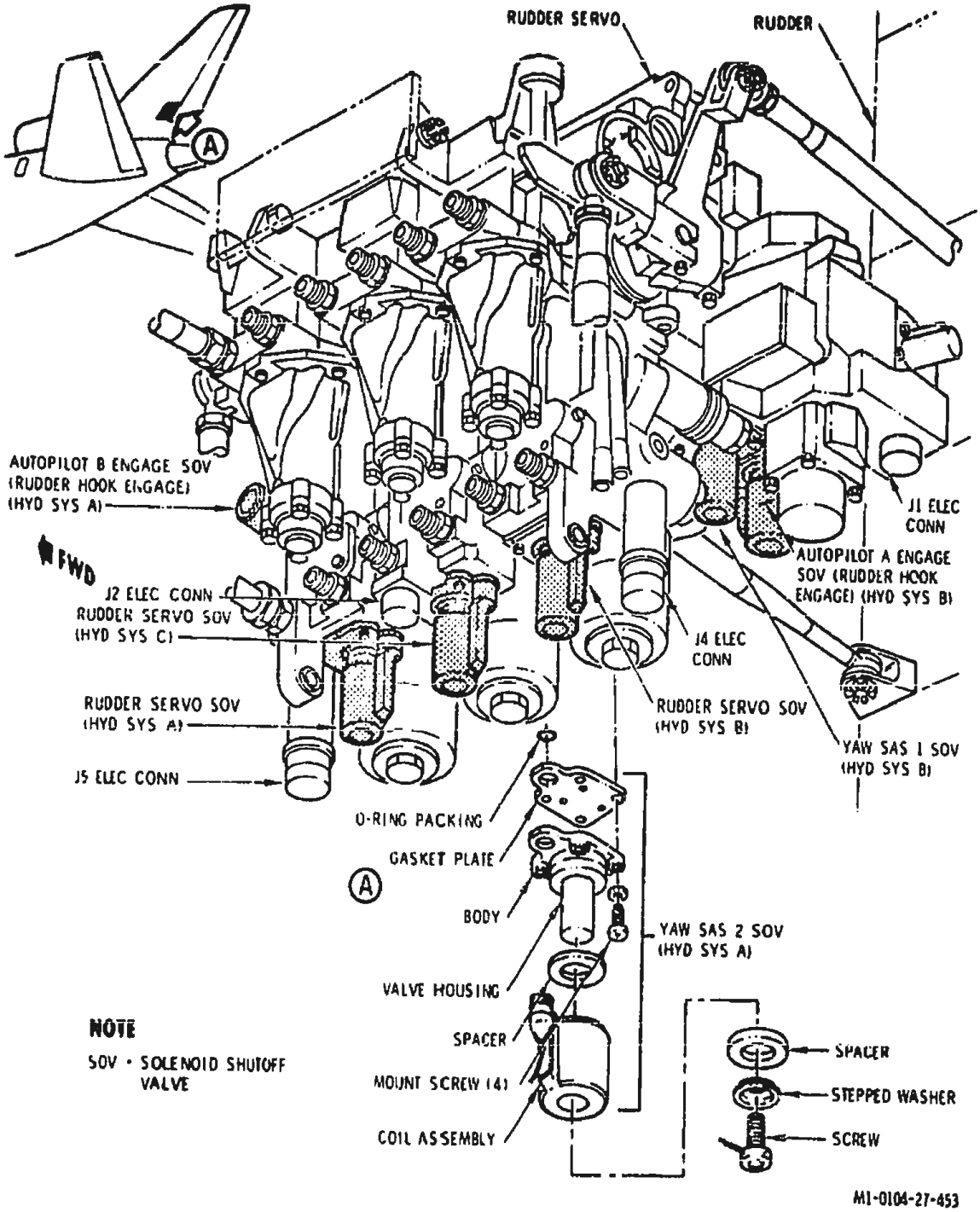
(3) Verify electrical connector is not contaminated with oil; if it is, clean with approved solvent

(4) Verify new gasket plate is installed on valve. Install shutoff valve and secure with mount screws and lock-wire.

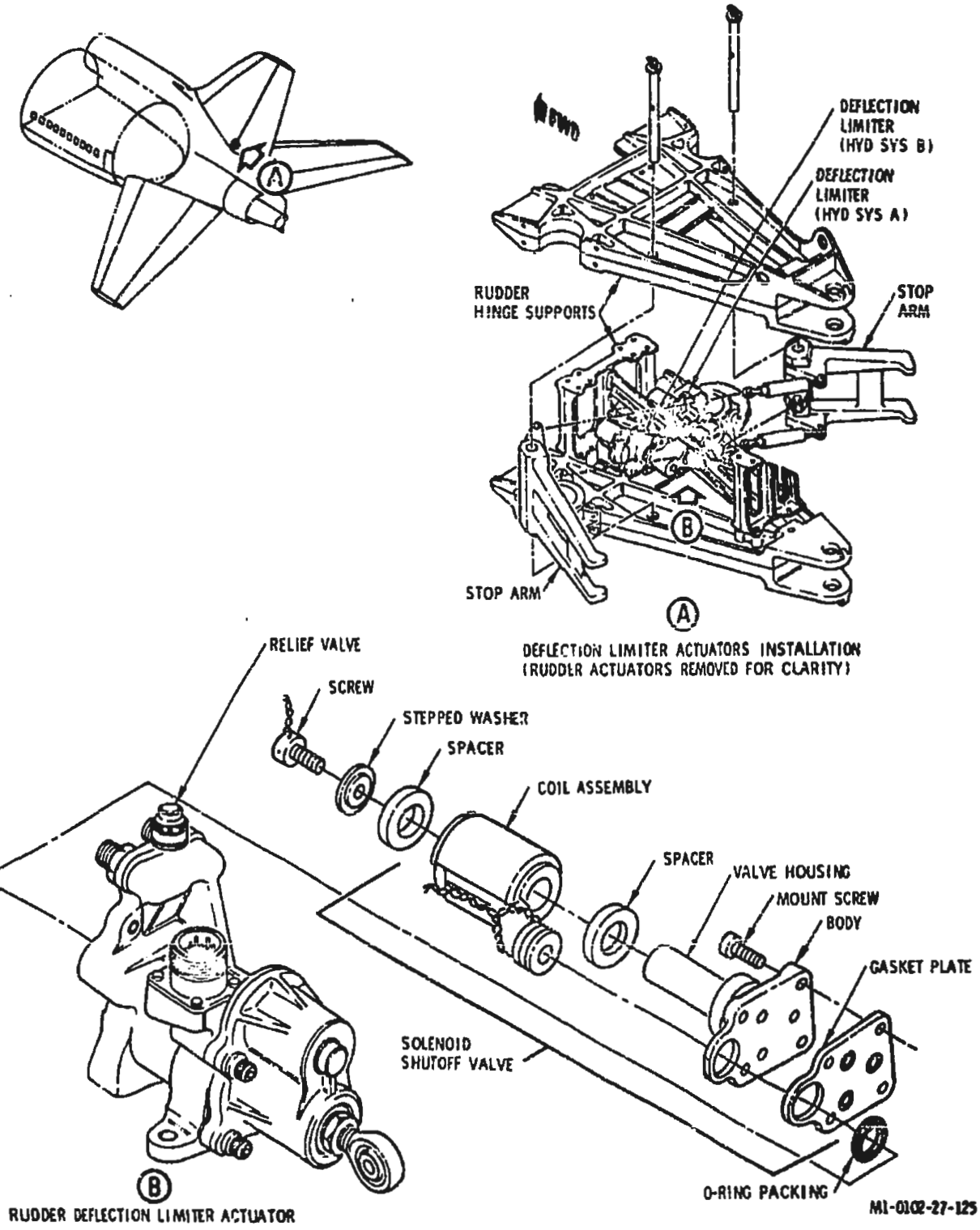
NOTE: When replacing the number 2 YAW SAS Solenoid valve it can be installed using longer screws (NAS1351-4H20P) and spacers (LS10020-4PP14) to raise the screw head for easier safetying.

NOTE: Tri-wing mount screws can be replaced by NAS 1351 socket-head cap screws.

(5) Check solenoid valve operation in accordance with Para. G.



R Rudder Servo Solenoid Shutoff Valve - Removal and Installation
R Figure 401



Rudder Deflection Limiter Solenoid Shutoff Valve
Removal and Installation
Figure 402

G. Checkout of Solenoid Shutoff Valve

(1) Remove tag and close circuit breaker opened in Step 4A(1).

(2) Turn on electrical power (Ref. 24-41-00).

(3) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on only hydraulic system supplying affected solenoid shutoff valve (Ref. 29-11-00). (See Fig. 401 or 402 to determine shutoff valve hydraulic supply.)

(5) Check rudder SAS shutoff valve: Accomplish 27-21-07, Adjustment and Test.

(6) Check rudder autopilot engage shutoff valve: Accomplish Rudder Dual Position Transducer Check (Ref. 22-15-03, Adjustment and Test).

R (7) Check rudder servo shutoff valve as follows:

R (a) On pilots overhead PFCS panel, verify RUDDER
R switchlight is latched.

R (b) Slowly cycle rudder and verify rudder responds to
R pedal movement (use the surface position indicator
R on main instrument panel to verify rudder
R movement).

R (c) On PFCS panel unlatch RUDDER switchlight to
R actuate rudder servo shutoff valves. Verify
R rudder does not respond to rudder pedal movement.

R (d) On PFCS panel latch RUDDER switchlight. Verify
R rudder responds to pedal movement.

R (e) If shutoff valve assembly was replaced, check
R shutoff valve for hydraulic leakage.

R (8) On aircraft 001-017,
R check the rudder deflection limiter actuator as
R follows:

R (a) On the RUDDER LIMITER panel (on the pilots
R overhead panel), unlatch MECHANICAL switchlight
R marked MNL/PUSH. The MNL light must come on.

R (b) Check limiter actuator operation by unlatching the
R ±8°/±30° switchlight. The actuator arms must
R extend and the±8° light must come on.

R (c) Latch ±8°/±30° switchlight. The actuator arms
R must retract and the ±30° light must come on.

R (d) Latch MNL/PUSH switchlight. The MNL light must go
R off.

(9) Check valve installation for signs of hydraulic leakage.

(10) Close access panel.

(11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(12) Turn off electrical power if no longer required (Ref. 24-41-00).

RUDDER SERVO ELECTROHYDRAULIC SERVO VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

   Container, 1 quart

   Gasket (Ref. Fig. 401)

   Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

   O-ring (Ref. Fig. 401)

2. Referenced Procedure

   29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

   A. Removal

      WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS, or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS.

      (2) Open access door 324AL or 324AR.

      (3) Place container under servo valve.

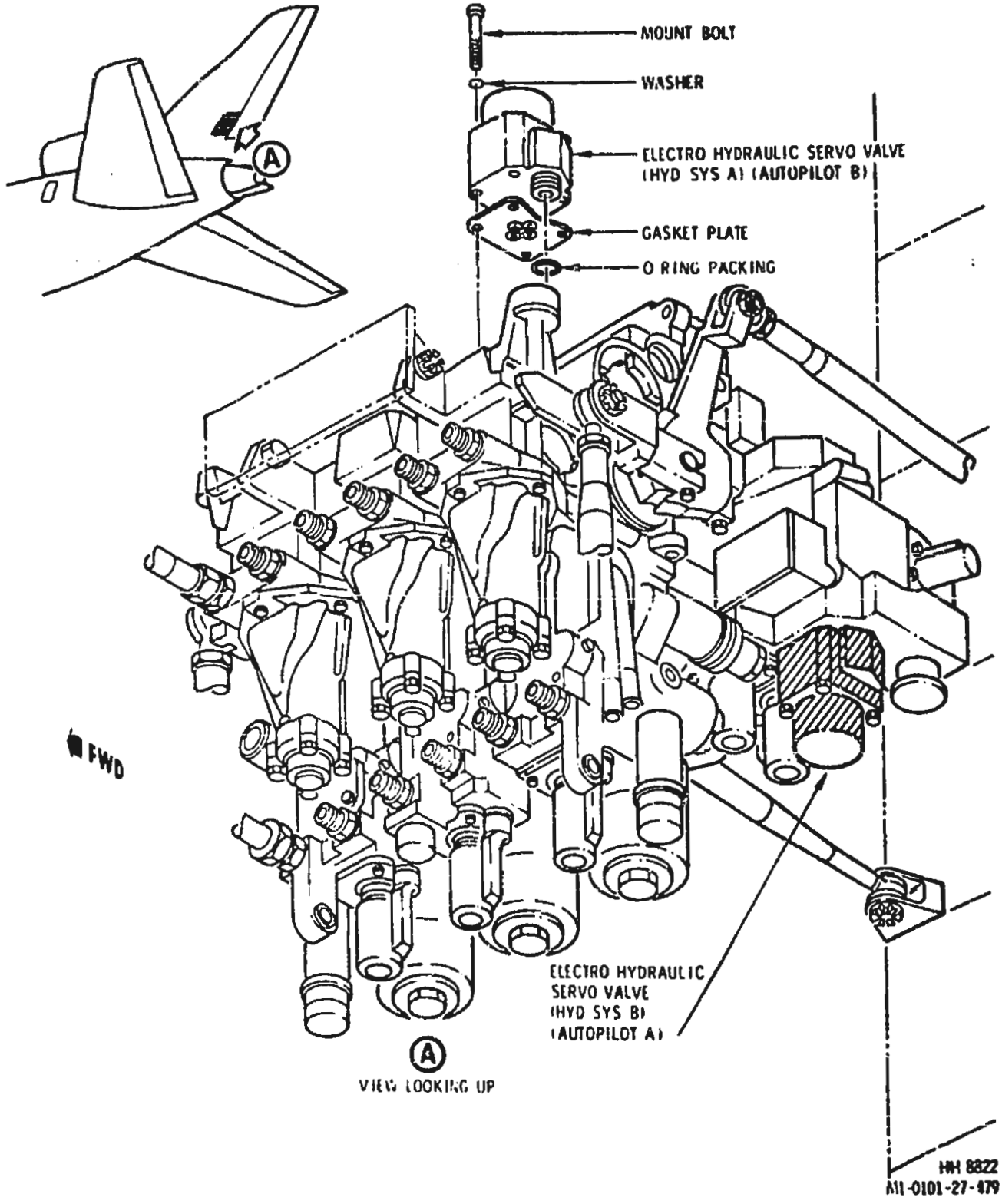
      (4) Remove mount bolts and remove valve (Ref. Fig. 401).

      (5) Remove and discard plate gasket.

      (6) Remove and discard preformed O-ring packing from valve electrical connection groove.

   B. Installation

      (1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.



R Rudder Servo Electrohydraulic Servo Valve
R Removal and Installation
R Figure 401

(2) Install new preformed O-ring packing on valve electrical connection groove.

R (3) Install new plate gasket and valve. Secure with mount
R screws and lock-wire.

R NOTE: Tri-wing screws can be replaced by NAS 1351
R socket-head cap screws.

R (4) Remove tag and close circuit breaker opened in Step
R 3A(1).

R (5) Remove tags from hydraulic control panels.

R (6) Check rudder servo electrohydraulic servo valve:
R Accomplish Rudder Dual Position Check (Ref. 22-15-03,
R Adjustment and Test).

R (7) Check valve installation for signs of hydraulic
R leakage.

R (8) Close access door.

R

RUDDER SERVO FILTER ELEMENT REMOVAL AND INSTALLATION

1. Equipment and Materials

Drip pan, 1-gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

2. Referenced Procedure

29-11-00 Hydraulic Power - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Open rudder hinge access doors 324AL and 324AR, for
R access to the rudder servo,

R (2) Place drip pan under rudder servo to catch hydraulic
R fluid.

R (3) Remove filter cover from rudder servo (Ref. Fig. 401).

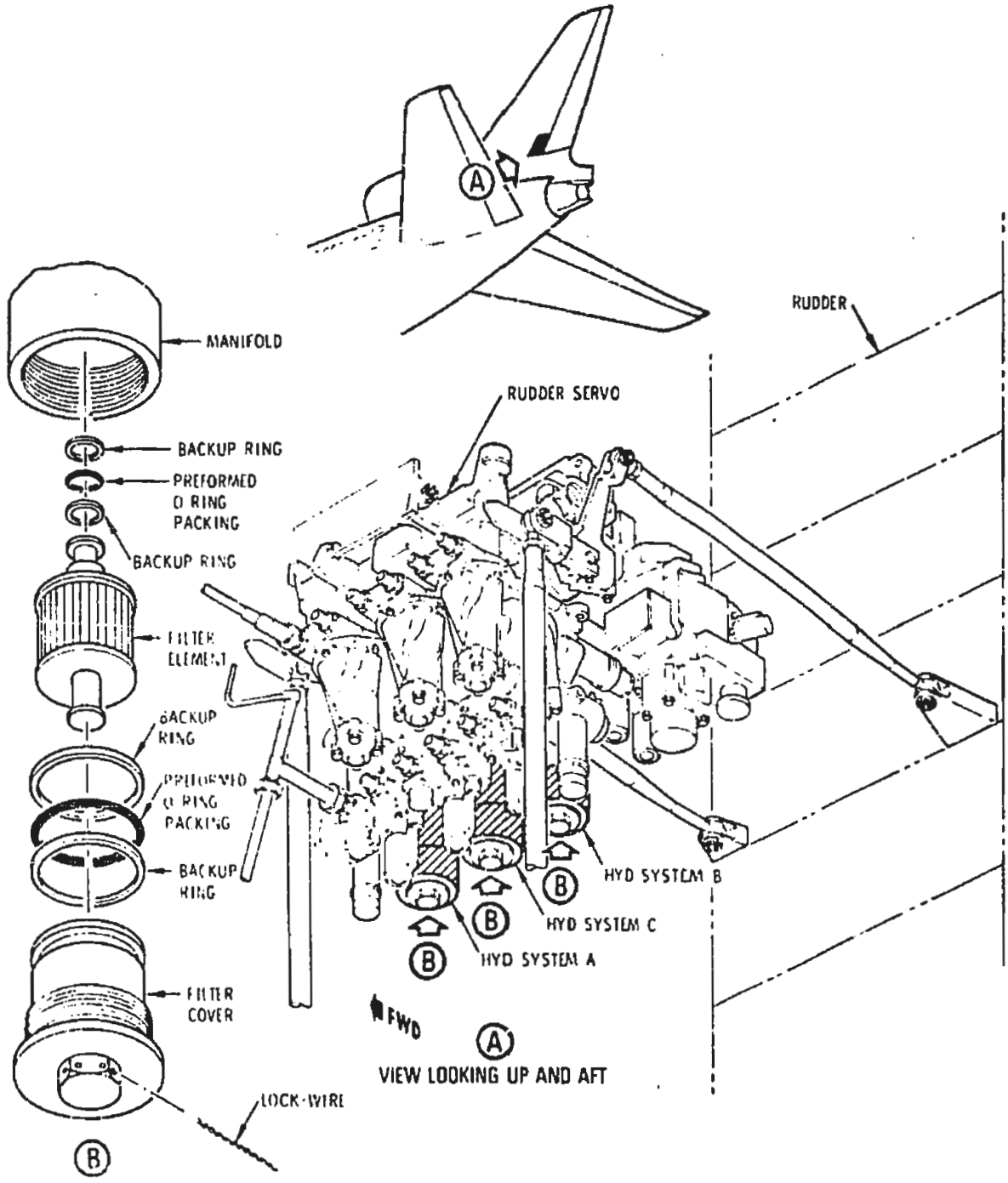
(4) Remove and discard backup ring, preformed packing, and backup ring from filter cover.

R (5) Pull filter element from the rudder servo. Remove and discard backup ring, preformed packing, and backup ring from filter element.

B. Installation

(1) Wet preformed packings and backup rings with hydraulic fluid before installation.

(2) Install backup ring, preformed packing, and backup ring on filter element.



HH 8824
M1-0101-27-457

R
R
R

Filter Element, Rudder Servo
Removal and Installation
Figure 401

EFFECTIVITY: ALL

0018

R (3) Install filter element in the rudder servo control module.

(4) Install backup ring, preformed packing, and backup ring in groove on filter cover.

R CAUTION: DO NOT EXCEED 55 LB FT WHEN TIGHTENING FILTER COVER.

(5) Install filter cover over filter element and torque 50 to 55 lb ft. Attach lock-wire to filter cover and manifold.

(6) Remove placards installed at beginning of Paragraph 3.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic system (Ref. 29-11-00) associated with filter element being installed (Ref. Fig. 401).

R (8) Bleed the rudder servo by cycling pilots rudder pedals in flight station, zone 210, from full left to full right position five times. Visually determine that filter cover is not leaking.

(9) Turn off hydraulic power (Ref. 29-11-00).

(10) Close and secure access doors opened in Step 2A(1).

R RUDDER DUAL TANDEM HYDRAULIC ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Container - one gallon

Actuator hydraulic pad protective cover

Hydraulic line fitting protective pressure plate

Lock-wire, Fed. Spec. QQ-W-423, Form I, Cond. A, 0.032 inch diameter or equivalent

Grease, Aircraft and Instrument - MIL-G-23827A, or equivalent

2. Referenced Procedures

12-23-00	Flight Controls Lubrication
24-41-00	External Power/Ground Service Systems - Maintenance Practices
29-11-00	Hydraulic Power System Maintenance Practices
29-11-74	Rudder Hydraulic Fusing Shutoff Valve - Adjustment and Test

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICING PANEL, ZONE 147.

A. Removal

(1) Open access door 324AL and remove access panel 325CL for the left actuator; open access door 324AR and remove access panel 325CR for right actuator (Ref. Fig. 401).

(2) Disconnect actuator rod end from hinge fitting by removing the connecting dual bolts (inner bolt and hollow sleeve bolt).

(3) Disconnect hydraulic manifold plate fitting by removing attaching bolts. Use container to catch oil.

(4) Install protective cover on actuator pad and protective pressure plate and plate seal on hydraulic line manifold.

(5) Disconnect the upper and lower actuator trunnion bearing caps by removing the cap attach bolts. Allow caps to hang on attach cable.

(6) Remove actuator from trunnion fitting by guiding actuator outboard and aft.

(7) Remove bearings from actuator trunnions and save.

B. Installation

(1) Install trunnion bearings on actuator trunnions with bearing flange against actuator (Ref. Fig. 401).

(2) Position actuator in installed position with hydraulic ports on top. Rotate trunnion bearings to align flat on bearing flange with anti-rotation clip on hinge fitting.

(3) Install both trunnion caps by installing cap attach bolts.

(4) Remove protective plates from actuator pad and hydraulic line manifold. Inspect mating surfaces for nicks, scratches, and cleanliness.

(5) Verify that gasket plates are installed on trunnion that mates with manifold plate.

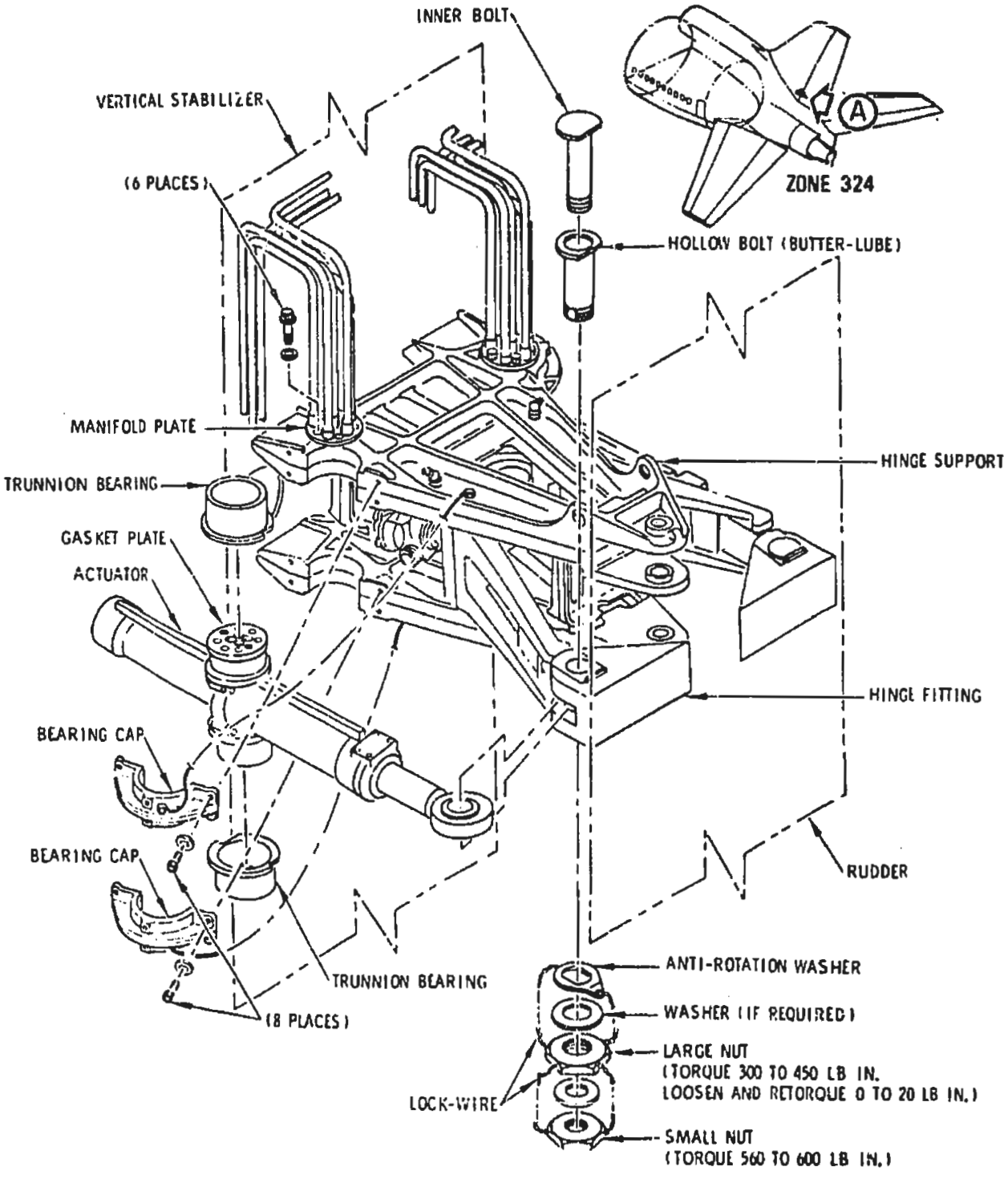
NOTE: Gasket plate assembly consists of two half moon-shaped gasket plates attached to trunnion with screws.

(6) Inspect gasket plates for condition of sealing surfaces and cleanness.

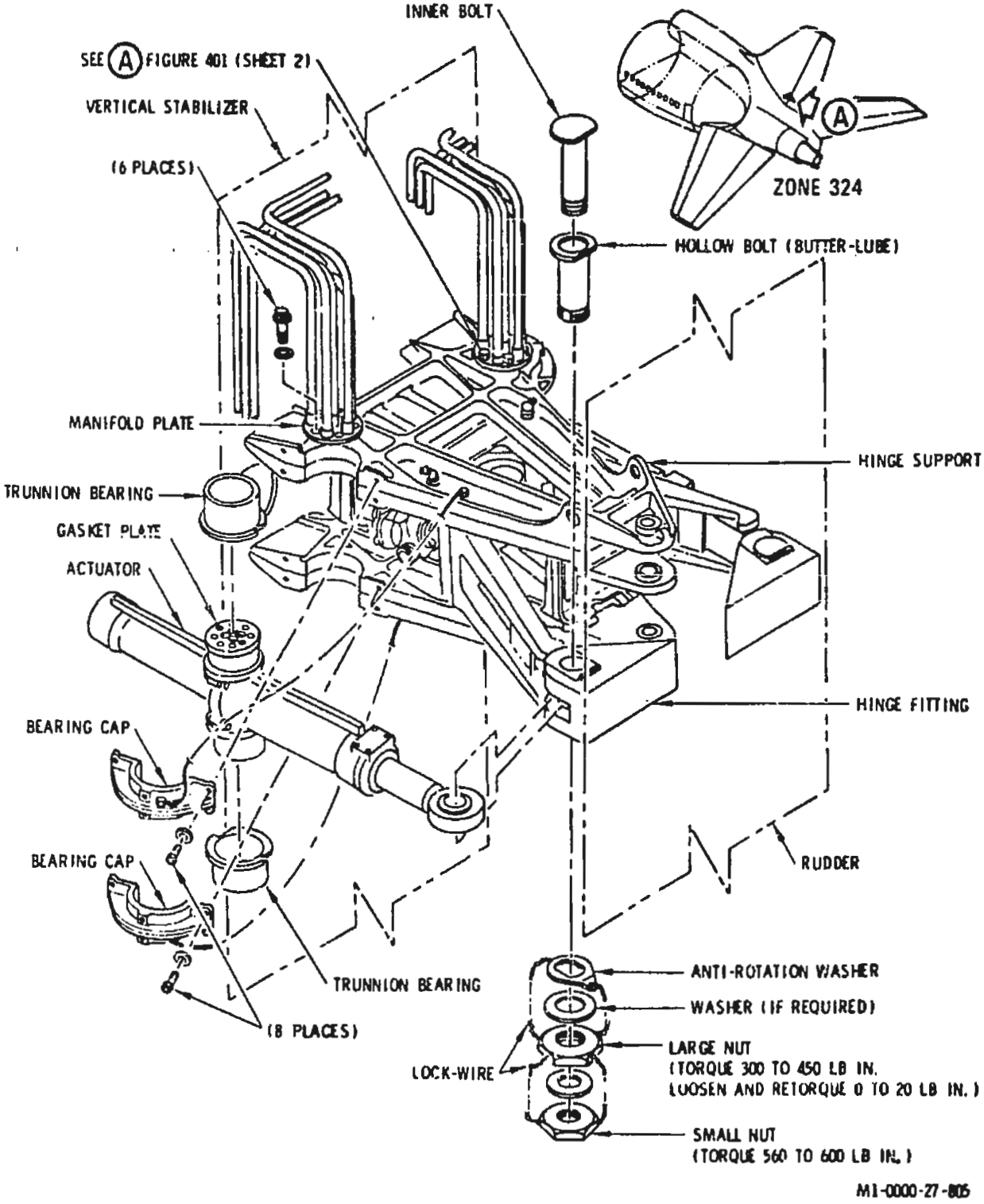
(7) Install hydraulic line manifold on actuator trunnion by installing attaching bolts. Torque bolts 95 (±5) lb in.

R NOTE: If a new tubing assy is installed on the R.H.
R Actuator, accomplish "Check for Visco Jet
R Restrictor Installation", 27-21-00, Adjustment
R and Test, 4D(1) thru (14) and accomplish
R correction if required.

(8) Extend or retract actuator piston rod end to align with hinge fitting.

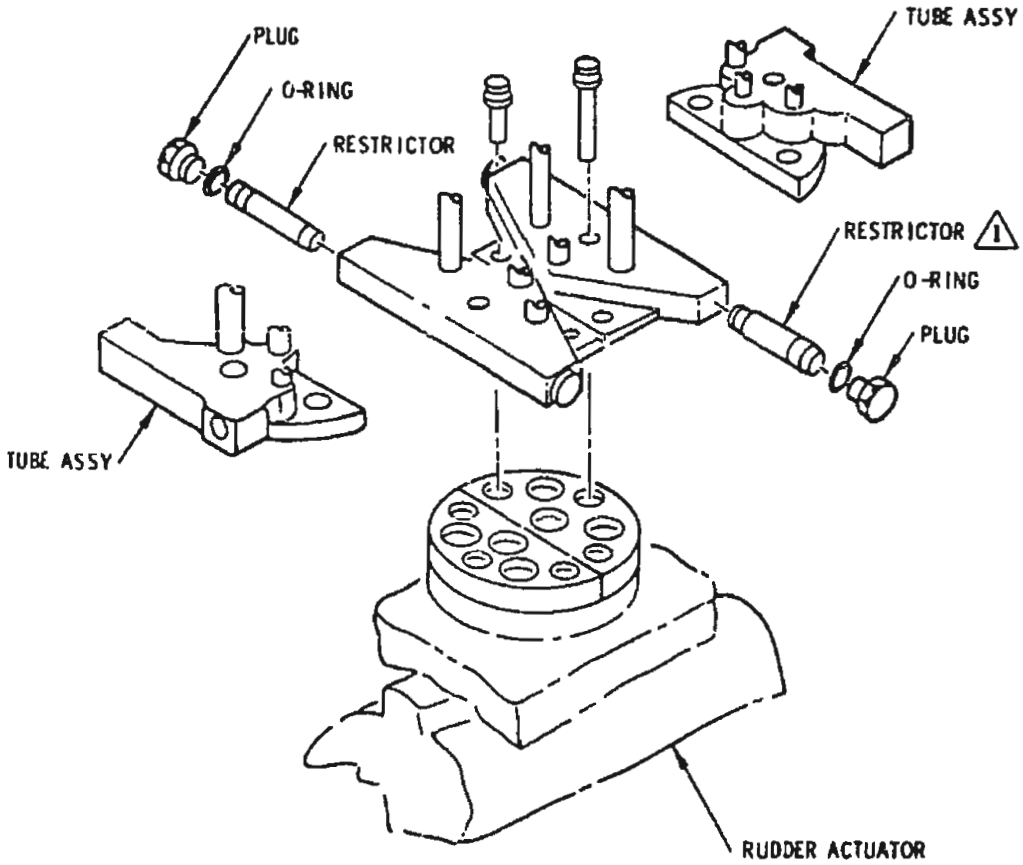


R R Rudder Dual Tandem Actuator - Removal and Installation
Figure 401



CR Rudder Dual Tandem Actuator - Removal and Installation
CR Figure 401 (Sheet 1)

EFFECTIVITY: ALL



NOTE

1 P/N 19XVC112DN1 OR VXCA2501112D RESTRICTORS REQUIRE SPECIAL TOOL P/N CUTA25001060CD FOR INSTALLATION.

M1-0000-27-806

CR CR Rudder Dual Tandem Actuator - Removal and Installation
Figure 401 (Sheet 2)

R R 001B EFFECTIVITY: ALL

(9) Butter-lube the outter surface of the rod-end hollow bolt with grease, MIL-G-23827A. Connect actuator piston rod to hinge fitting by installing both the hollow bolt and the inner bolt, anti-rotation washer, and large nut per Fig. 401.

(10) Torque large nut 300 to 450 lb in. then loosen nut and retorque to 0 to 20 lb in. If nut runs out of thread on bolt and bolt has vertical play, add thin washer under nut.

(11) Install washer and small nut. Torque small nut 560 to 600 lb in.

(12) Lock-wire both nuts to each other and to anti-rotation washer (under large nut) in two places.

NOTE: Clearance between the top and bottom of the piston rod-end and hinge fitting is normal.

(13) Lubricate actuator trunnions and rod end (Ref. 12-23-00).

(14) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(15) Turn on electrical power (Ref. 24-41-00).

(16) Turn on hydraulic system A, B, and C (Ref. 29-11-00).

R CAUTION: CYCLING RUDDER AT HIGH RATE CAN DAMAGE RUDDER DAMPER SEAL. OPERATE RUDDER PEDALS SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(17) Bleed actuator by slowly operating the rudder pedals through full left and right yaw throws (Ref. 27-21-00). Bleed until controls feel smooth with no roughness.

NOTE: After bleeding controls, perform hydraulic reservoir air bleed check (Ref. 12-13-01).

(18) Check actuator hydraulic connections and piston-rod seals for signs of leakage.

(19) Check that the A hydraulic system rudder fusing shutoff valve has not actuated closed due to air in system as follows:

(a) Gain access to forward electronic service center (FESC).

(b) Locate flight control auxiliary unit (FCAU) below bottom shelf of center rack.

(c) On FCAU, verify that RUDDER HYDRAULIC LIMITER A light is off with hydraulic system A pressurized. If A light is on, reset fusing system (Ref. 29-11-74, Adjustment/Test). After resetting fusing system, verify that A light is off.

(20) Check actuator installation during full-throw operation to ensure that actuator clears structure and operates smoothly without binding.

(21) Check clearance between top and bottom of piston rod-end and hinge fitting during full-throw operation. Clearance must be a minimum of 0.002 inch throughout rudder travel.

R CAUTION: REPLACEMENT OF RUDDER ACTUATORS MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL USING INDIVIDUAL HYDRAULIC SYSTEMS. THIS IS REQUIRED TO ASSURE THAT THE HYDRAULIC LINES TO THE RUDDER WERE NOT CROSSED DURING INSTALLATION. THIS IS CHECKED BY PERFORMING THE RUDDER SERVO HYDRAULIC INTEGRITY TEST.

(22) Check to verify that the rudder servo hydraulic lines were not crossed. Perform the Rudder Servo Hydraulic Integrity Test (Ref. 27-21-00, Adjustment and Test, Para. 4C).

(23) Turn off hydraulic power (Ref. 29-11-00).

(24) Turn off electrical power(Ref. 24-41-00).

(25) Close access doors and panels opened in Step 3A(1).

RUDDER DUAL TANDEM ACTUATOR - ADJUSTMENT AND TEST

1. General

This procedure provides an operational test of the individual rudder actuator channels.

2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Adjustment/Test

A. Operational Test

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that all three RUDDER SERVO circuit breakers (K12, K13, K14) are closed.

(2) Turn on electrical power (Ref. 24-41-00).

(3) On PFCS panel, open guard and release (out) RUDDER switchlight. Switchlight OFF light will come on. This action energizes the rudder servo solenoid shutoff valves to deactivate the servo.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic systems A, B, and C. System B and C AC pumps and B to A PTU (Power Transfer Unit) can be used (Ref. 29-11-00). Operate rudder pedals. Verify that rudder surface does not move. (Use surface position indicator.)

R
R
R

R (5) Open circuit breaker RUDDER SERVO A to deenergize
R system A solenoid valve and pressurize servo.

R (6) Operate rudder pedals. Verify that rudder responds to
R pedal movement. Use surface position indicator to
R verify rudder movement.

R (7) Close RUDDER SERVO A circuit breaker and open B circuit
R breaker.

R (8) Operate rudder pedals. Verify that rudder responds to
R pedal movement.

R (9) Close RUDDER SERVO B circuit breaker and open C circuit
R breaker.

R (10) Operate rudder pedals. Verify that rudder responds to
R pedal movement.

R (11) Close RUDDER SERVO C circuit breaker.

R (12) On PFCS panel, depress (latched in) RUDDER switchlight.
R Switchlight OFF light must go off.

R (13) Shut off hydraulic power (Ref. 29-11-00).

R (14) Shut off electrical power (Ref. 24-41-00).

RUDDER SURFACE DAMPER - MAINTENANCE PRACTICES

1. General

The following procedures specify the method used to deactivate one of the four rudder dampers. There are two damper conditions that will require action: lose of hydraulic fluid, or a sticking or jammed damper. Lose of hydraulic fluid will be confirmed by noting that the piston indicator is at or below the REFILL mark. A sticking damper could show up as a rough rudder. A jammed damper will obviously restrict rudder movement.

2. Deactivation

R NOTE: This deactivation procedure applies only when an
R aircraft is to be dispatched in accordance with the MEL.

A. Loss of Hydraulic Fluid

(1) A damper in this condition can be left installed until it can beserviced or replaced (Ref. 27-21-14, Servicing or Removal and Installation).

(2) Make appropriate entry in aircraft log book.

(3) Install rudder surface hydraulic damper inoperative placard in flight station.

(4) Service or replace damper as soon as possible.

B. Sticking or Jammed Damper

(1) Remove damper (Ref. 27-21-14, Removal and Installation). Aircraft can be dispatched with one damper removed.

(2) Make appropriate entry in aircraft log book.

(3) Install rudder surface hydraulic damper inoperative placard in flight station.

(4) Replace removed damper as soon as possible.

RUDDER SURFACE DAMPER - SERVICING

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-423, Cond A, 0.032-inch diameter, or equivalent

Cleaning Solvent, Fed Spec. P-P-560, Type 1 (Permatex 403-D, Glaze Cote by Michalan)

Hydraulic pressure source of 70 to 100 psi, supplied with either MIL-H-5606 or MIL-H-6083 hydraulic fluid, filtered to minimum allowable filtration of ten microns (Malabar Dispenser PN 54058 or 54124) (G/ITEL 27-11-78)

Container, one-gallon

Damper filler line with adapter fitting (5/16-24 UNF thread)

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power System - Maintenance Practices

3. Servicing (Ref. Fig. 301)

R Servicing of the rudder damper consists of adding fluid to the
R damper. On -101 through -105 and -111 dampers,Do not add fluid
R to damper if piston indicator is below REFILL mark; replace
R damper as there is a strong possibility that air is entrapped in
R damper. If damper piston indicator is not visible in sight
R window, and reservoir piston spring coils are visible, the
R reservoir is empty and damper should be replaced.

A. Rudder Surface Damper

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open associated access door and panel (Ref. 6-40-00).

No. 1 damper (on No. 3 hinge): access door 324 CL and access panel 325 DL

No. 2 damper (on No. 4 hinge): access door 324 EL and access panel 325 EL

No. 3 damper (on No. 5 hinge): access door 324 GL and access panel 325 FL

No. 4 damper (above No. 6 hinge): Access door 324 JR and access panel 325 GR

(2) Check damper piston rod seal area for leakage (area wet with fluid). Replace damper if hydraulic leakage is indicated.

(3) Check damper sight window for oil level. See Fig. 301 oil level chart for action to be taken.

(4) If fluid must be added to damper, proceed as follows:

(a) Remove filler plug.

NOTE: The filler and bleed plugs are similar. Do not remove bleed plug or air might be introduced into damper. The filler port contains a check valve similar to a tire air valve. The fill and bleed ports are identified on damper.

(b) Connect filler line to damper. (Verify that filler line is full of fluid before connecting to damper).

(c) Using hydraulic pressure source, apply pressurized fluid (70 to 100 psi) to damper and fill to the following level:

- On -101, -103, -105 and -111 dampers fill until indicator reaches the FULL level in the sight window (+0.00 to -0.10 inches).

- On -107 and -109 dampers, fill until intersection of blue- and red-stripped bands is opposite appropriate temperature arrow.

CAUTION: NEVER FILL PAST FULL MARK. OVERFILLED RESERVOIR CAN PRODUCE EXCESSIVE PRESSURES DURING OPERATION AND DAMAGE DAMPER.

NOTE: Damper indicator window is plexiglass. Use only approved cleaners or solvents to clean window (Fed Spec. P-P-560, Type 1).

(d) Remove filler line.

(e) Install filler plug and safety.

(f) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(g) Turn on hydraulic system B (Ref. 29-11-00).

CAUTION: CYCLING RUDDER AT A HIGH RATE CAN DAMAGE DAMPER SEALS. CYCLE RUDDER SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(h) Slowly cycle rudder from full left to full right several times. Verify that damper operation is smooth without any oscillation.

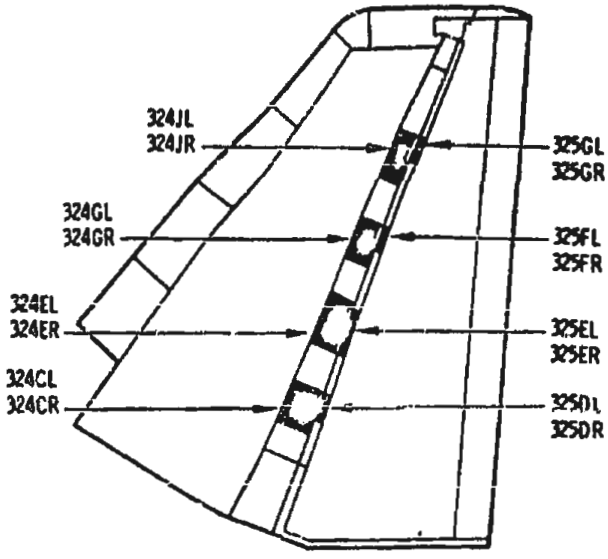
(i) Check damper sight window. Verify indicator still shows FULL.

NOTE: At high ambient temperatures, or after operating damper, indicator can show slightly above FULL and is acceptable.

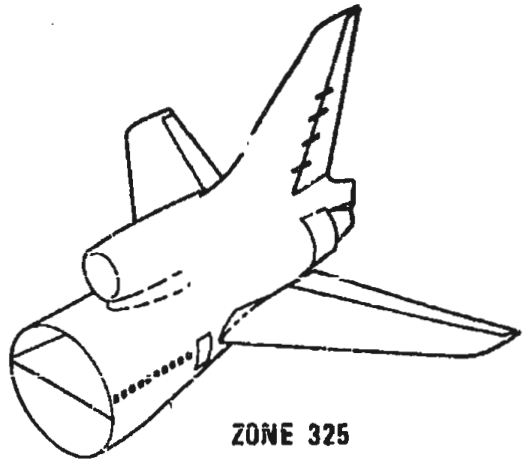
(j) If damper operation is suspect for any reason, remove damper and return to shop for functional test.

(k) Shut off hydraulic power if no longer required (Ref. 24-11-00).

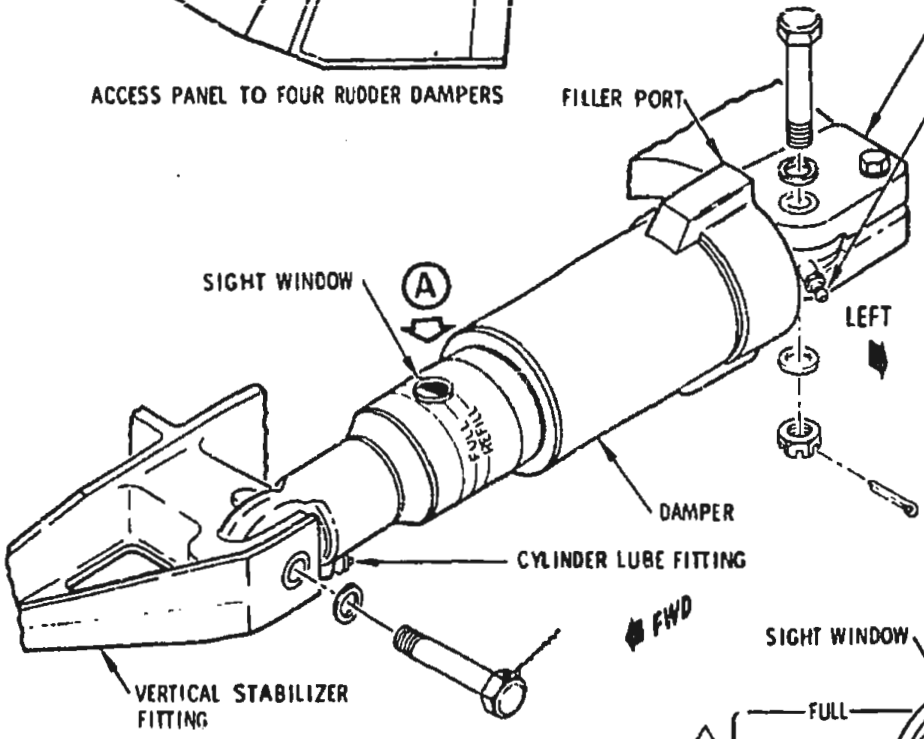
(5) Close access door and panel.



ACCESS PANEL TO FOUR RUDDER DAMPERS

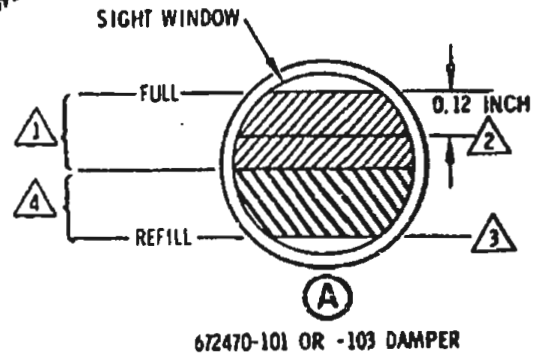


ZONE 325



CAUTION

RUDDER DAMPER MUST BE INSTALLED WITH DAMPER PISTON ROD LUBE FITTING POINTING LEFT. FAILURE TO INSTALL LUBE FITTING CORRECTLY WILL RESULT IN DAMAGE TO THE DAMPER PISTON ROD AND CAN HINDER RUDDER MOVEMENT



672470-101 OR -103 DAMPER

M1-0102-27-434

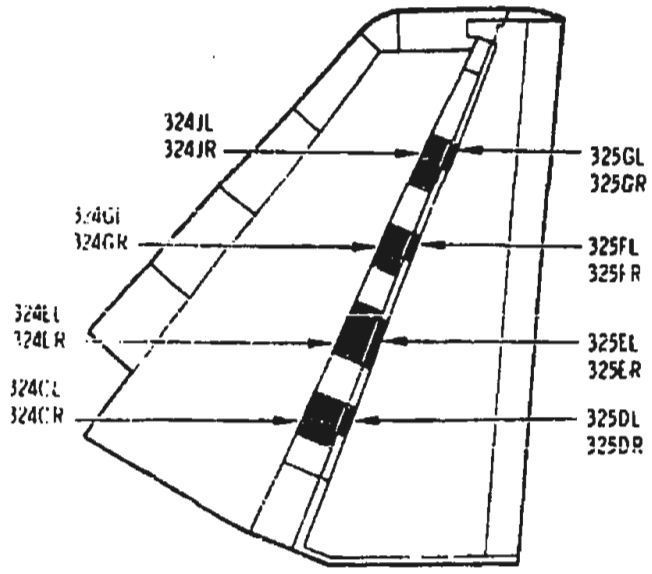
NOTE

1. IF INDICATOR IS IN THIS AREA DAMPER IS ACCEPTABLE
2. DO NOT FILL ABOVE THIS POINT
3. REMOVE DAMPER IF INDICATOR IS BELOW THIS MARK
4. FILL DAMPER IF INDICATOR IS IN THIS AREA

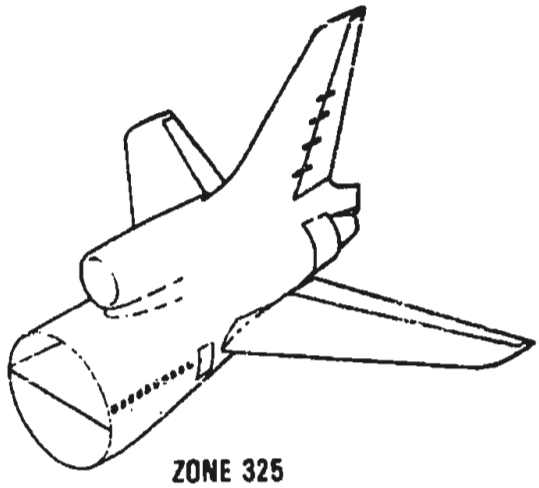
R Rudder Damper - Servicing
R Figure 301

EFFECTIVITY: 001-018 WITHOUT SB27-088 OR SB27-126

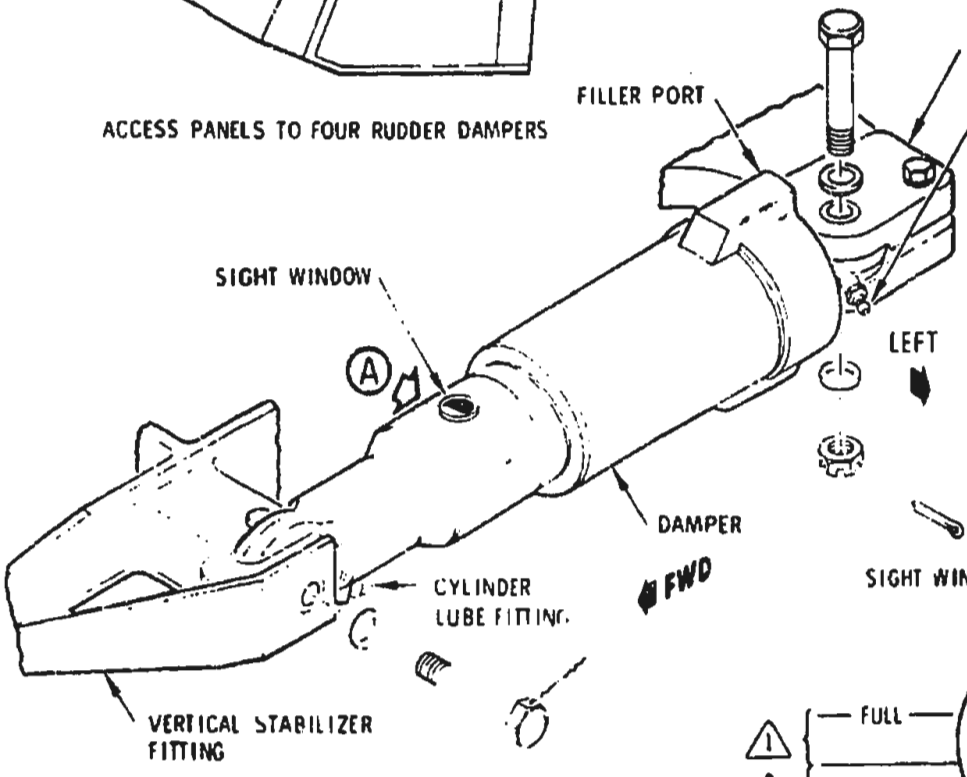
001B



ACCESS PANELS TO FOUR RUDDER DAMPERS

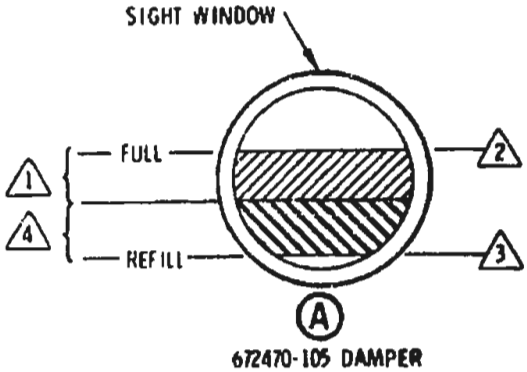


ZONE 325



CAUTION

RUDDER DAMPER MUST BE INSTALLED WITH DAMPER PISTON ROD LUBE FITTING POINTING LEFT. FAILURE TO INSTALL LUBE FITTING CORRECTLY WILL RESULT IN DAMAGE TO THE DAMPER PISTON ROD AND CAN HINDER RUDDER MOVEMENT



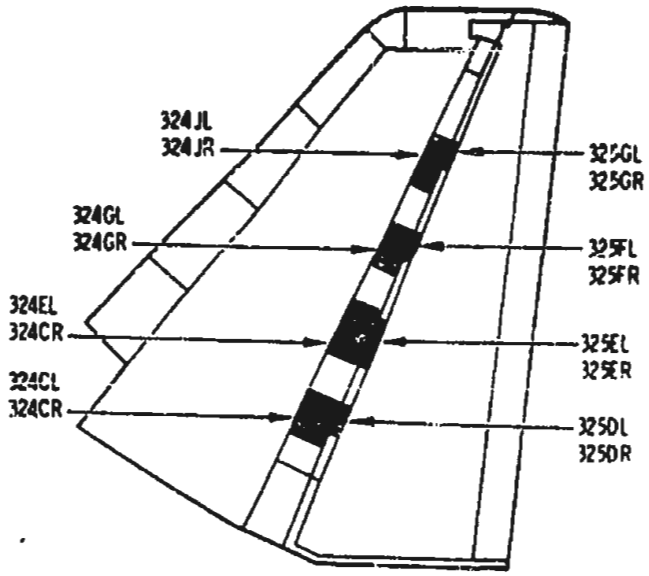
672470-105 DAMPER

NOTE

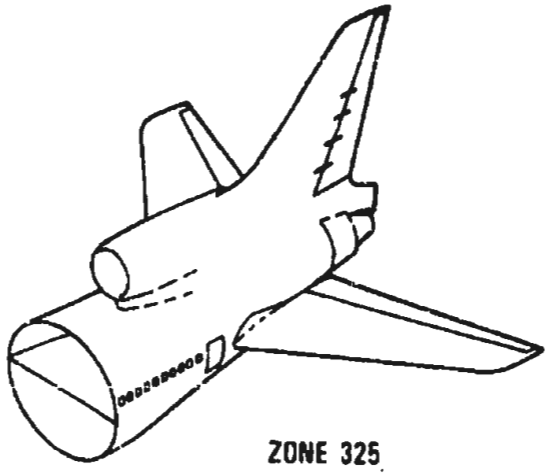
1. IF INDICATOR IS IN THIS AREA DAMPER IS ACCEPTABLE
2. DO NOT FILL ABOVE THIS POINT
3. REMOVE DAMPER IF INDICATOR IS BELOW THIS MARK
4. FILL DAMPER IF INDICATOR IS IN THIS AREA

M1-0102-27-430

Rudder Damper - Servicing
Figure 301

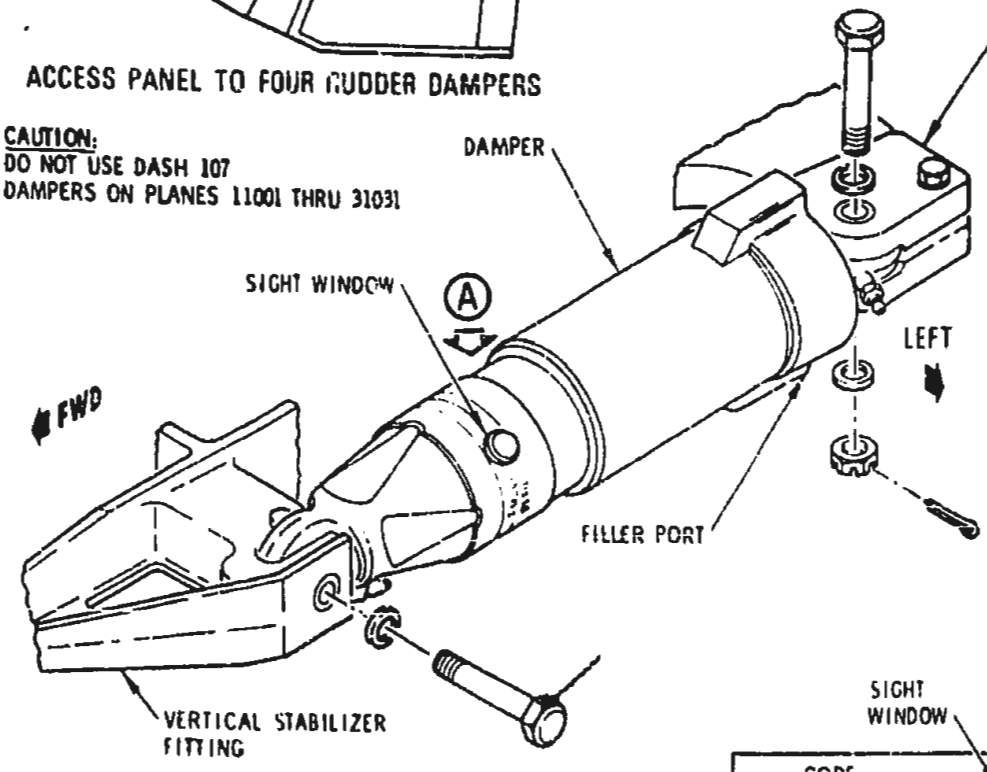


ACCESS PANEL TO FOUR RUDDER DAMPERS



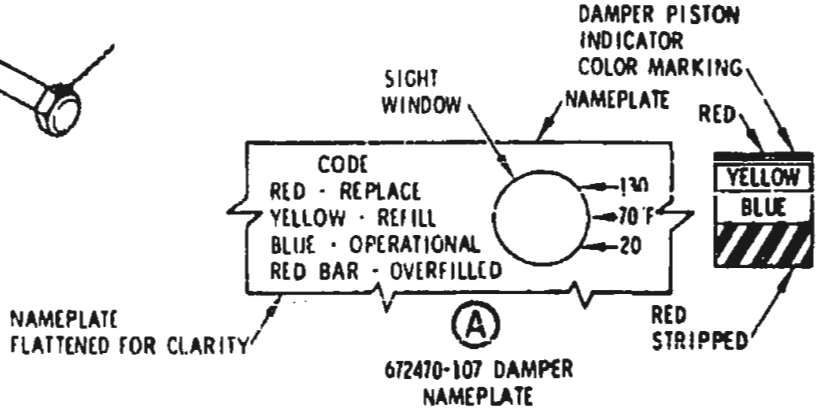
ZONE 325

CAUTION:
DO NOT USE DASH 107
DAMPERS ON PLANES 11001 THRU 31031



CAUTION
RUDDER DAMPER MUST BE INSTALLED WITH DAMPER ROD LUBE FITTING POINTING LEFT. FAILURE TO INSTALL LUBE FITTING CORRECTLY WILL RESULT IN DAMAGE TO THE DAMPER PISTON ROD AND CAN HINDER RUDDER MOVEMENT

NOTE
DO NOT ADD FLUID TO DAMPER IF FULL RED LINE IS IN VIEW; REPLACE DAMPER AS THERE IS STRONG POSSIBILITY OF AIR ENTRAPPED IN DAMPER. YELLOW TO RED LINE INDICATES MARGINAL, BLUE TO RED LINE INDICATES OPERATIONAL, AND RED STRIP INDICATES OVERFILLED. ALLOW TIME FOR TEMPERATURE TO STABILIZE BEFORE CHECKING POSITION OF LINES.



MI-0001-27-979

C
C

Rudder Damper - Servicing
Figure 301

R
R
001B

EFFECTIVITY: 032-999

RUDDER SURFACE DAMPER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-423, Form I, Cond A, 0.032 inch diameter, or equivalent

2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
	12-23-00	Flight Controls Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

A. Removal (Ref. Fig. 401)

R R (1) Open the following access panels as applicable (Ref. 6-40-00):

No. 1 damper (on No. 3 hinge); access door 324CL and access panel 325DL

No. 2 damper (on No. 4 hinge); access door 324EL and access panel 325EL

No. 3 damper (on No. 5 hinge); access door 324GL and access panel 325FL

No. 4 damper (above No. 6 hinge); access door 324JR and access panel 325GR

(2) Remove damper piston rod attaching bolt (Ref. Fig. 401).

(3) Remove damper cylinder attaching bolt. Remove damper.

B. Installation (Ref. Fig. 401)

C NOTE: Planes 31032 and on were delivered with dash 107
C dampers (large barrel). If dash 105 damper must be
C used to avoid flight delay, set up to replace with
CR dash 107 within 1500 flight hours. Dash 105 dampers
C are subject to A.D. 75-9-16 (SEE M11-AD-02). Dash
C 105 dampers are used on planes 11001 thru 31031.

(1) Verify that replacement damper is properly filled (On -101 through -105 dampers, indicator in sight window should be close to BUT SHOULD NOT BE PAST FULL MARK. On -107 damper, intersection of blue- and red-stripped bands should be opposite appropriate temperature arrow.)

(2) Attach damper cylinder to vertical stabilizer hinge fitting (with lube fitting on bottom) by installing washer and bolt. Lock-wire bolt.

(3) Attach damper piston rod to rudder fitting (with lube fitting on left side) by installing bolt, washers, and nut. Install cotter pin.

CAUTION: RUDDER DAMPER MUST BE INSTALLED WITH DAMPER PISTON ROD LUBE FITTING POINTING LEFT. FAILURE TO POSITION LUBE FITTING CORRECTLY WILL RESULT IN DAMAGE TO THE DAMPER PISTON ROD AND CAN HINDER RUDDER MOVEMENT.

(4) Lubricate damper lube fittings (Ref. 12-23-00).

(5) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on electrical power (Ref. 24-41-00).

(7) Turn on hydraulic systems A and B (Ref. 29-11-00).

CAUTION: CYCLING RUDDER AT A HIGH RATE CAN DAMAGE THE RUDDER DAMPER SEALS. CYCLE RUDDER SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

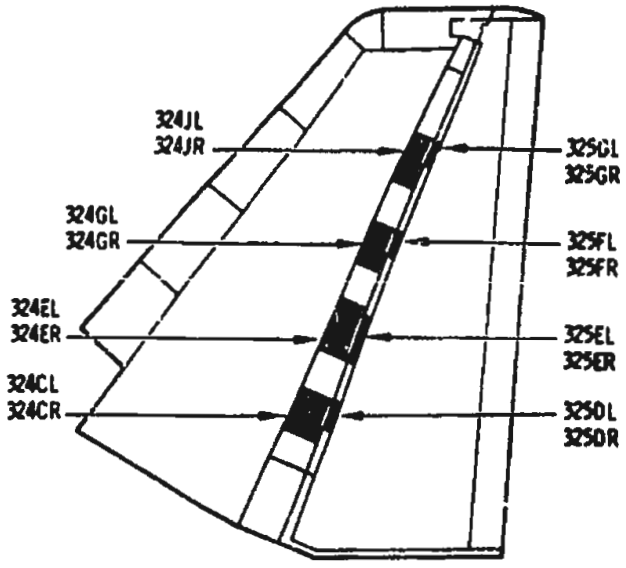
(8) Operate rudder pedals through five full left and right yaw applications. Check that damper operates smoothly without chatter.

(9) Check damper for signs of hydraulic leakage around piston rod seal.

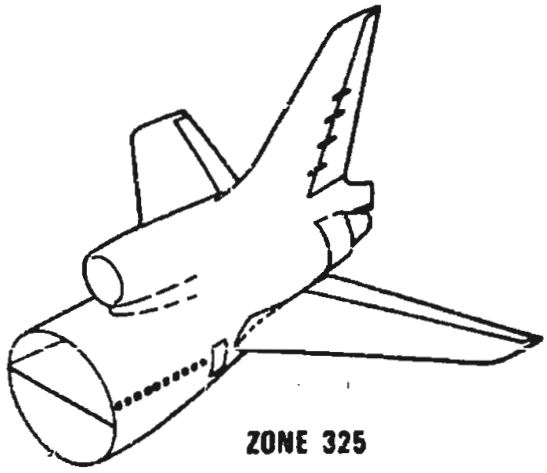
(10) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(11) Turn off electrical power if no longer required (Ref. 24-41-00).

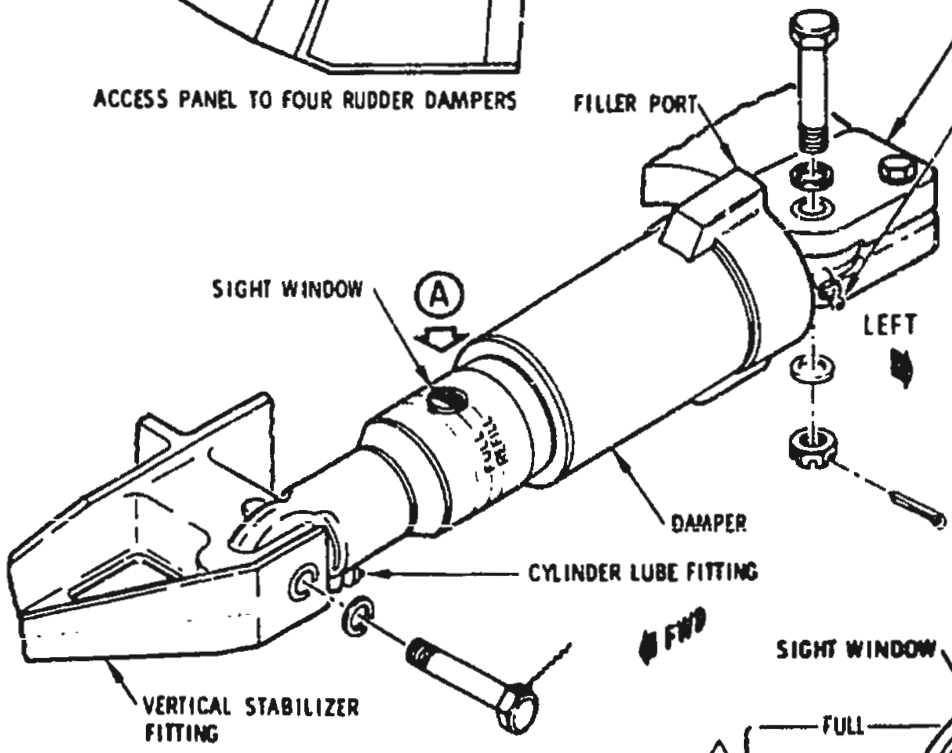
(12) Close access doors and panels opened in Step 3A(1).



ACCESS PANEL TO FOUR RUDDER DAMPERS

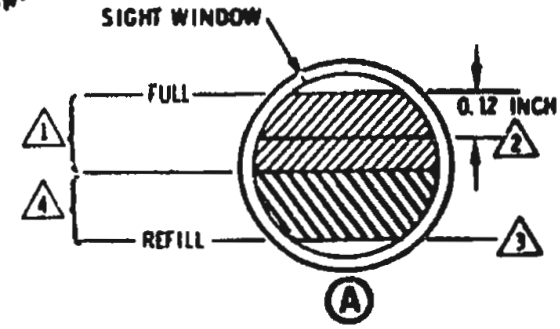


ZONE 325



CAUTION

RUDDER DAMPER MUST BE INSTALLED WITH DAMPER PISTON ROD LUBE FITTING POINTING LEFT. FAILURE TO INSTALL LUBE FITTING CORRECTLY WILL RESULT IN DAMAGE TO THE DAMPER PISTON ROD AND CAN HINDER RUDDER MOVEMENT



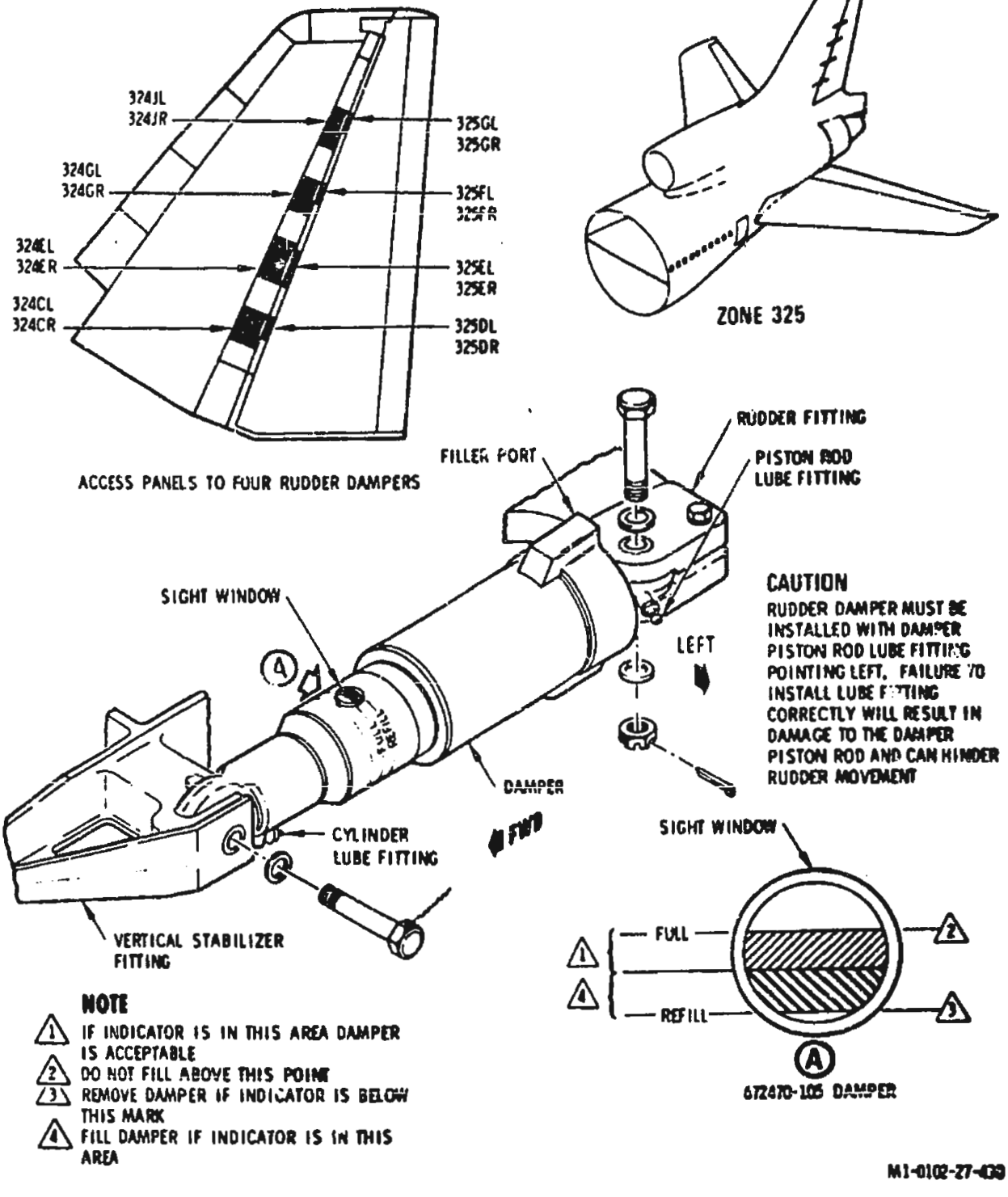
672470-101 OR -103 DAMPER

M1-0102-27-434

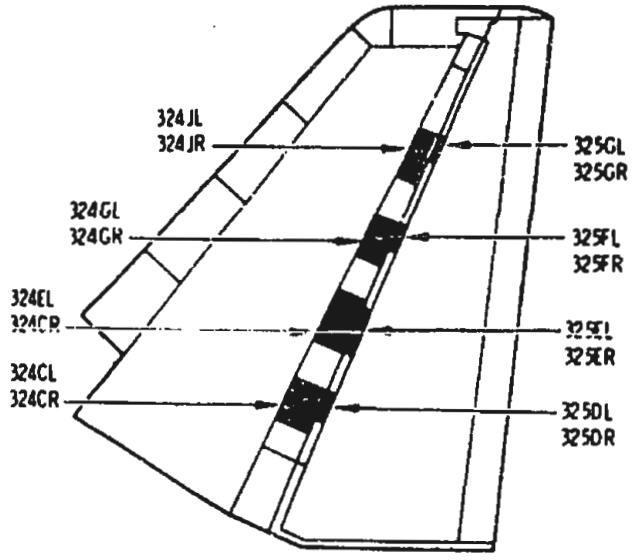
NOTE

1. IF INDICATOR IS IN THIS AREA DAMPER IS ACCEPTABLE
2. DO NOT FILL ABOVE THIS POINT
3. REMOVE DAMPER IF INDICATOR IS BELOW THIS MARK
4. FILL DAMPER IF INDICATOR IS IN THIS AREA

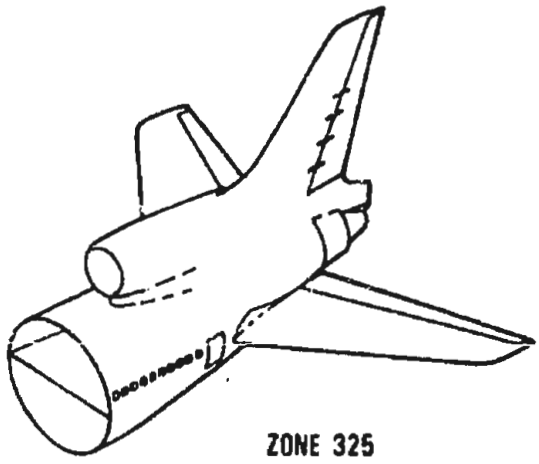
Rudder Damper - Removal and Installation
Figure 401



Rudder Damper - Removal and Installation
Figure 401

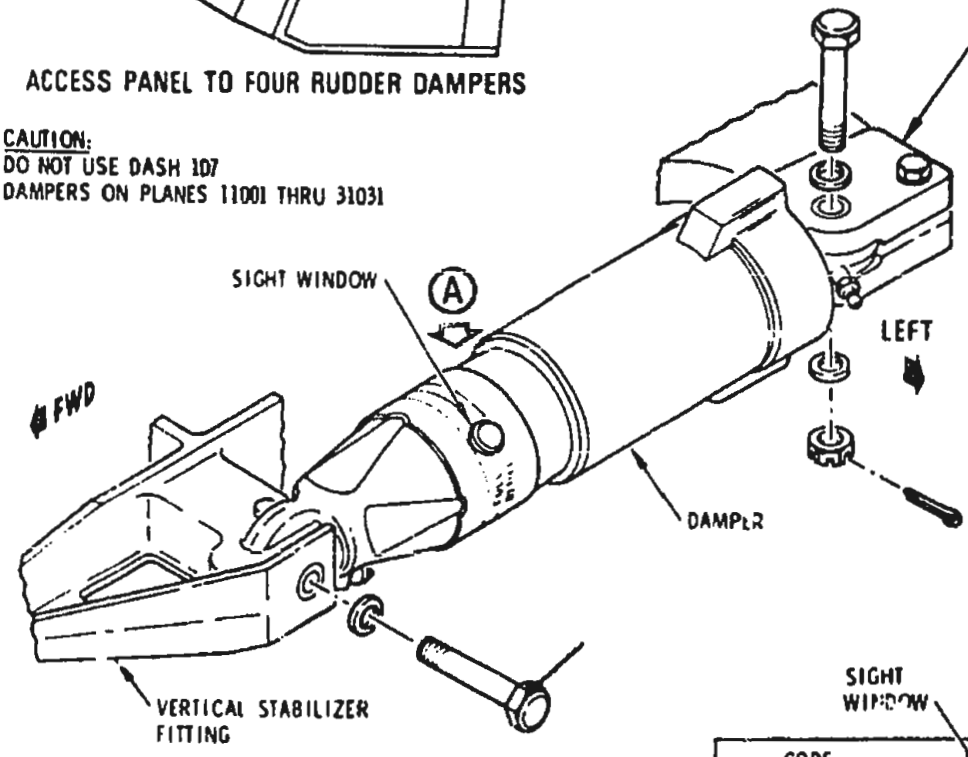


ACCESS PANEL TO FOUR RUDDER DAMPERS



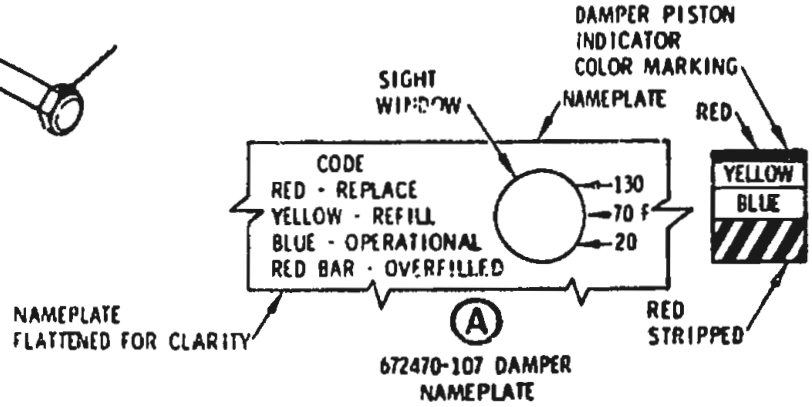
ZONE 325

CAUTION:
DO NOT USE DASH 107
DAMPERS ON PLANES 11001 THRU 31031



CAUTION
RUDDER DAMPER MUST BE INSTALLED WITH DAMPER ROD LUBE FITTING POINTING LEFT. FAILURE TO INSTALL LUBE FITTING CORRECTLY WILL RESULT IN DAMAGE TO THE DAMPER PISTON ROD AND CAN HINDER RUDDER MOVEMENT

NOTE:
DO NOT ADD FLUID TO DAMPER IF FULL RED LINE IS IN VIEW; REPLACE DAMPER AS THERE IS STRONG POSSIBILITY OF AIR ENTRAPPED IN DAMPER. YELLOW TO RED LINE INDICATES MARGINAL, BLUE TO RED LINE INDICATES OPERATIONAL, AND RED STRIP INDICATES OVERFILLED. ALLOW TIME FOR TEMPERATURE TO STABILIZE BEFORE CHECKING POSITION OF LINES.



M1-0000-27-979

CR Rudder Damper - Removal and Installation
CR Figure 401

R RUDDER SURFACE DAMPER - ADJUSTMENT AND TEST

R 1. Adjustment/Test

R A. Functional Test

R (1) The rudder surface damper must be removed and returned
R to the shop for functional testing.

RUDDER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rudder sling assembly, Lockheed P/N 1525171-903-MES, or equivalent

Lock-wire, Fed Spec QQ-W-423, Form 1, Cond A, 0.032-inch diameter, or equivalent

Grease, Aircraft and Instrument - MIL-G-23827A, or equivalent

2. Referenced Procedures

12-23-00	Flight Controls Lubrication
20-51-04	Environmental Sealing of Model L-1011 Airplane - PB75-24D
24-41-00	External Power/Ground Service Systems - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

A. Removal (Ref. Fig. 401)

(1) Position rudder to approximately the faired position.

(2) Open following access doors (Ref. Fig. 401): 324AL/AR, 324CL/CR, 324 EL/ER, 324GL/GR, 324JL/JR, and 324LL/LR.

(3) Remove the following access panels: 325CL/CR, 325DL/DR, 325EL/ER, 325FL/FR, 325GL/GR, and 325HL/HR (Ref. Fig. 401).

(4) Remove plugs from rudder hoist attach fittings. Install hoist attach plates (Ref. Fig. 401, Sheet 2).

NOTE: The six rudder hoist attach points (three on each side of rudder) incorporate 1/4-inch allen-socket headless setscrews installed in nut

plates. On each side of the rudder, the three attach points form a triangular pattern with two attach points on the front beam. The top attach point is 10 inches below the No. 5 hinge fitting. The lower attach point is 25 inches below the top attach point. The third attach point is 27 inches aft and centered between the forward attach points. The rudder weighs 561 pounds.

(5) Attach hoist straps to hoist plates. Take up slack on hoist cable, but do not apply lifting force to rudder.

(6) Disconnect the two rudder dual tandem actuator rod ends from their respective rudder fittings.

(7) Attach guide lines to the left and right actuator fittings.

(8) Disconnect the two rudder servo feedback pushrods from rudder fittings.

(9) On number 1 hinge, disconnect bonding jumpers, remove inner bolt, hollow bolt, and split cone bushings.

(10) On number 2 hinge, disconnect bonding jumper and remove inner bolt. Leave hollow bolt installed.

(11) Disconnect the dual transducer actuating rods from rudder clevis fitting located directly above the number 3 hinge fitting.

(12) Disconnect single transducer actuator rod from rudder clevis fitting located below number 3 hinge fitting.

(13) On number 3, 4, 5, and 6 hinges, disconnect bonding jumpers, remove bolts and split cone bushings.

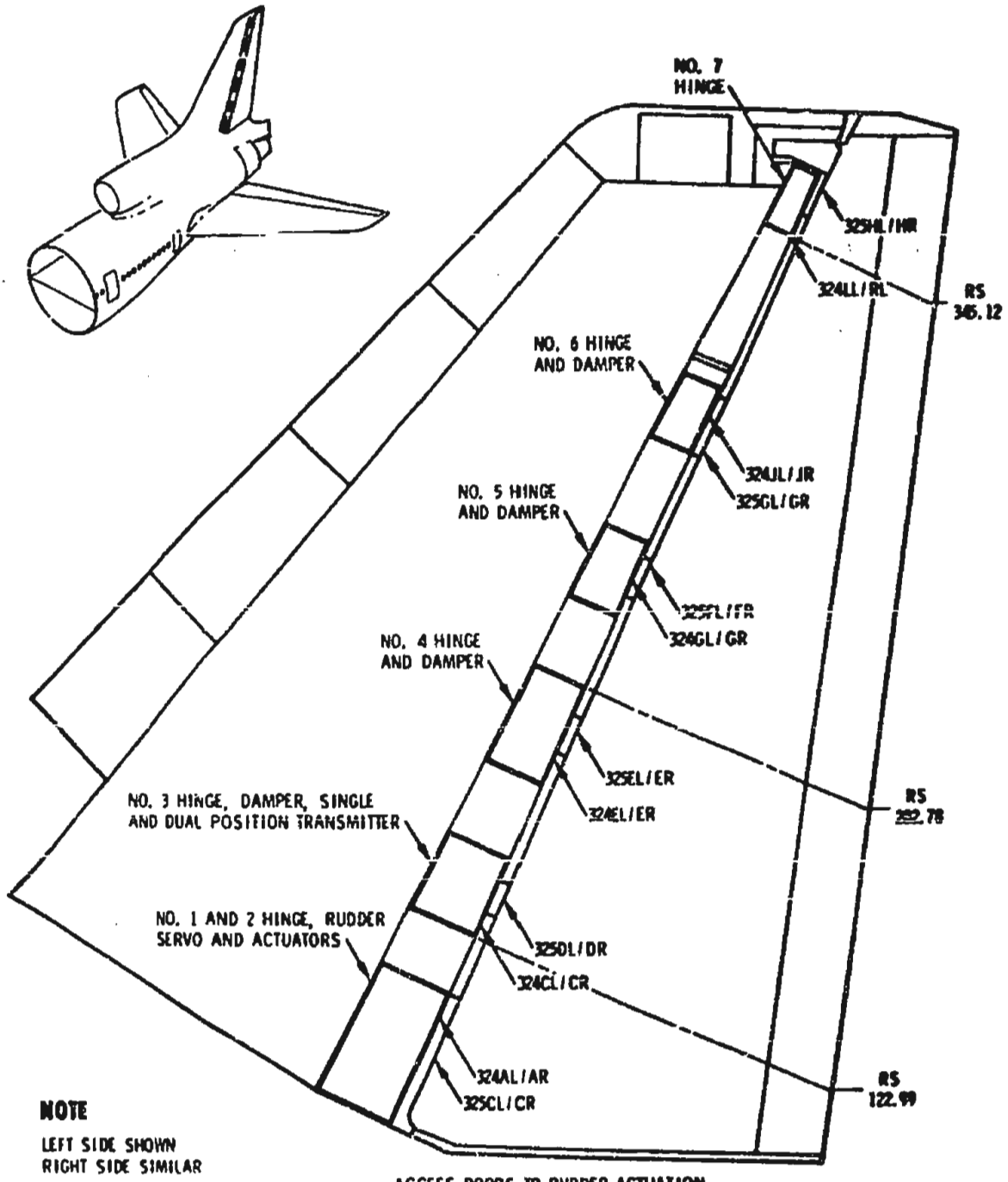
(14) Disconnect rudder dampers from rudder fittings at number 3, 4, and 5 hinges.

(15) Disconnect rudder damper from rudder fitting located above number 6 hinge.

(16) On number 7 hinge, disconnect bonding jumper, and remove inner bolt, hollow bolt, and split cone bushings.

(17) Remove hollow bolt from number 2 hinge.

(18) Using guide straps, guide rudder aft and then lower to dolly.

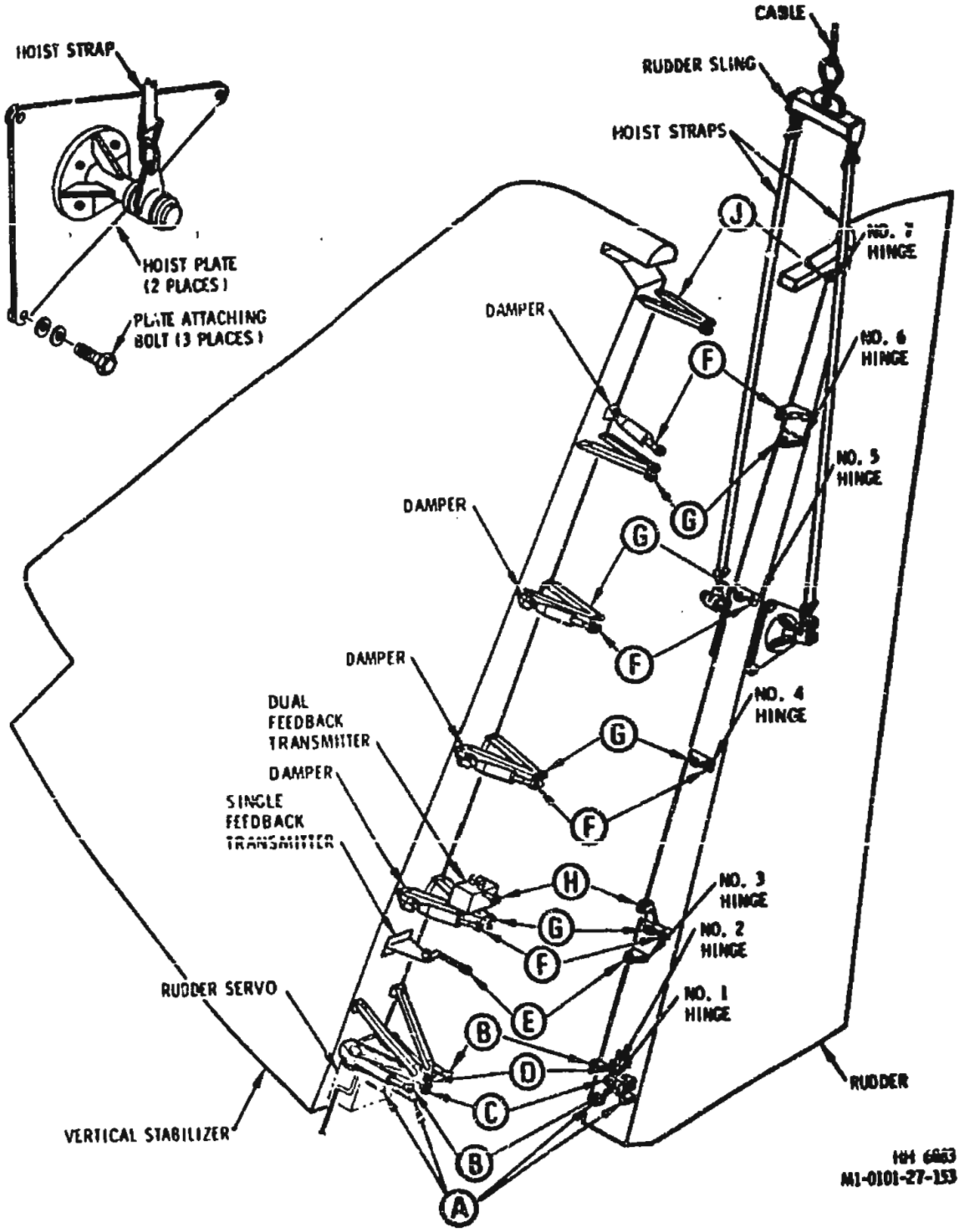


R
R

Rudder - Removal and Installation
Figure 401 (Sheet 1)

EFFECTIVITY: ALL

001B

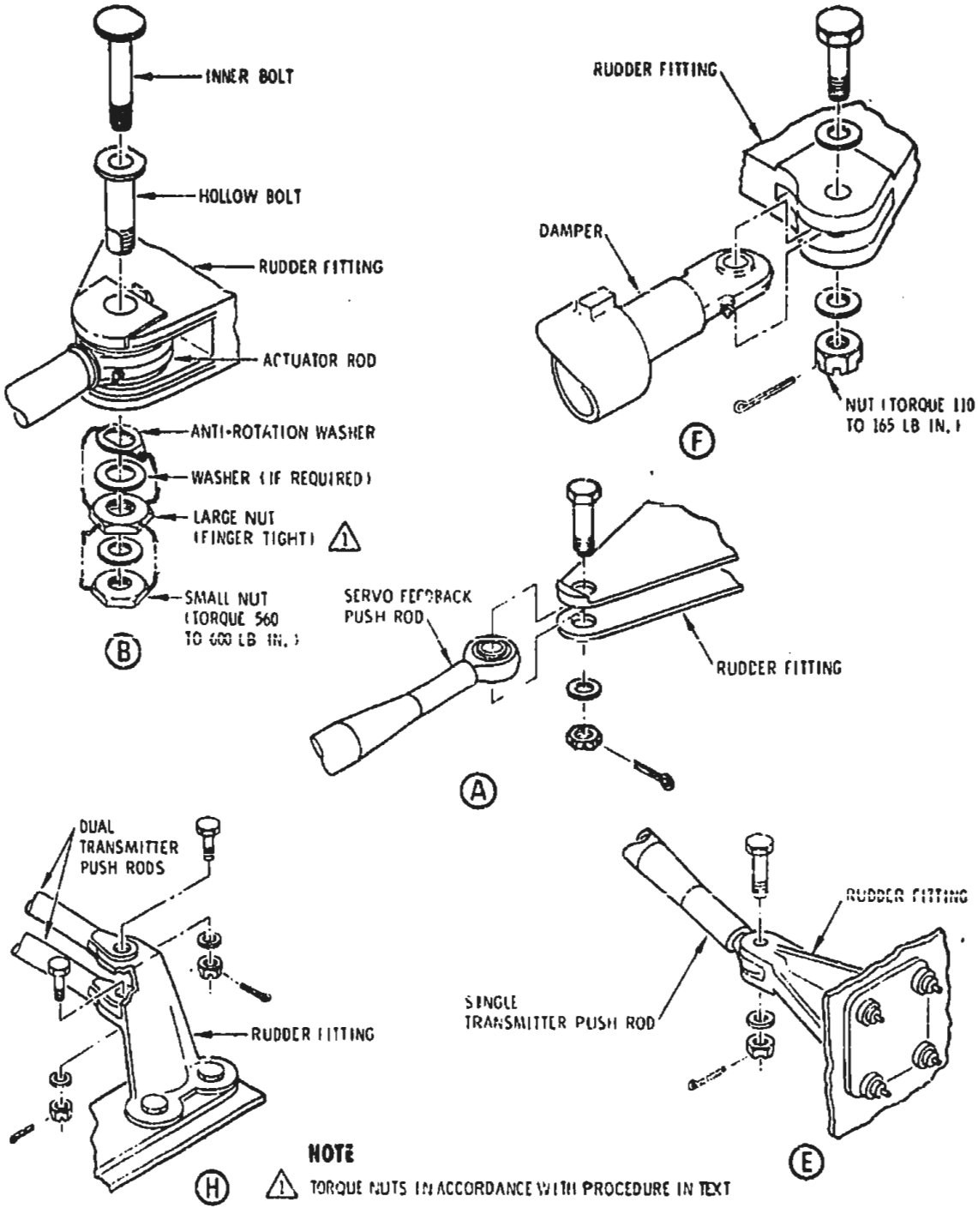


R
R

Rudder - Removal and Installation
Figure 401 (Sheet 2)

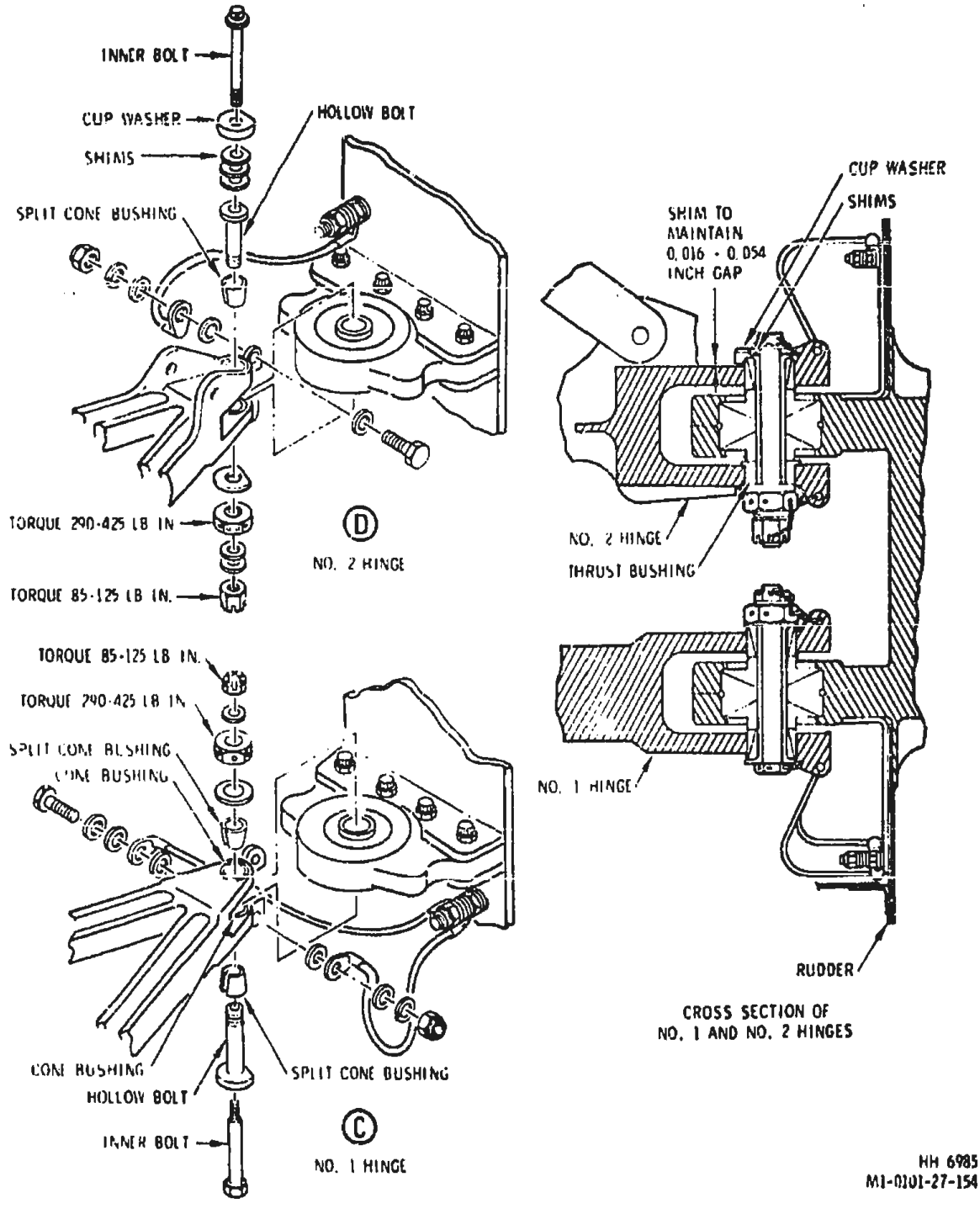
EFFECTIVITY: ALL

001B



A11-0002-27-171

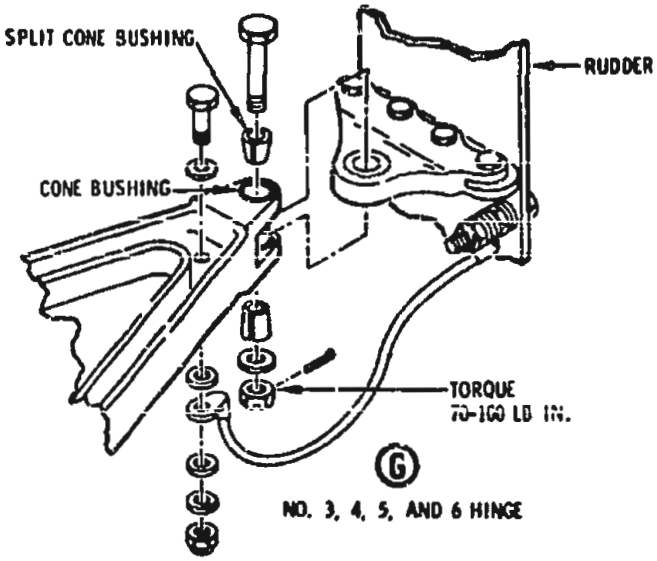
R Rudder - Removal and Installation
R Figure 401 (Sheet 3)

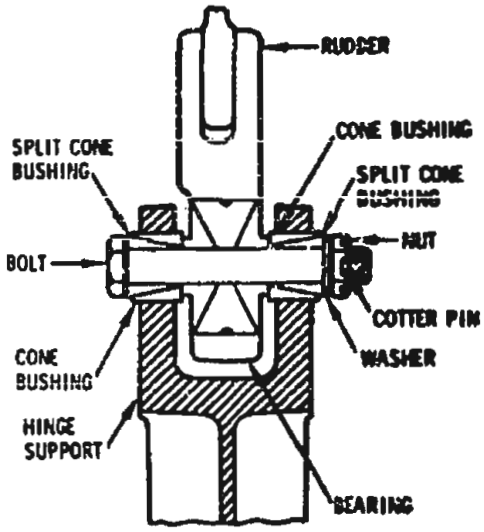


R Rudder - Removal and Installation
R Figure 401 (Sheet 4)

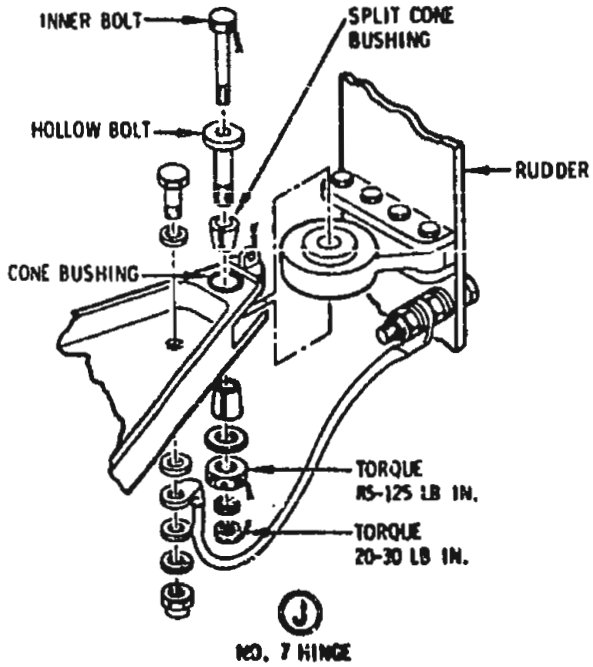
EFFECTIVITY: ALL

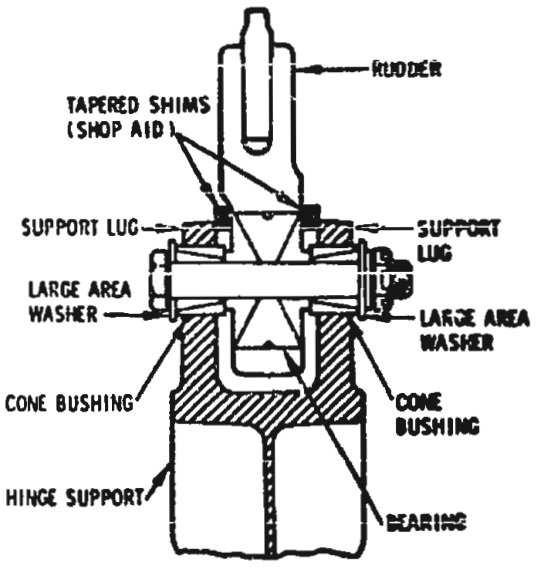
001B





TYPICAL HINGE INSTALLATION
FOR HINGE 3, 4, 5, AND 6





POSITIONING CONE BUSHINGS
AGAINST BEARING

HH 6469
M1-0101-27-155

R
R

Rudder - Removal and Installation
Figure 401 (Sheet 5)

EFFECTIVITY: ALL

001B

B. Installation

NOTE: Replacement rudder must be balanced (Ref. Structural Repair Manual, Section 51-90-00). Weight and balance information is provided on a data placard located on the lower end of the front spar at rudder station 62.

R WARNING: WEIGHTS CONTAIN DANGEROUS MATERIAL. HANDLE IN
R ACCORDANCE WITH ESTABLISHED PROCEDURES (REF.
R STRUCTURE REPAIR MANUAL 51-90-00).

(1) Verify that hydraulic power is turned off.

(2) Position the cone bushings on all hinges so that the cone bushing inner surface is flush with inside surface of hinge support lugs.

NOTE: Use soft aluminum or micarta to position cone bushings.

(3) Attach rudder sling attach plates to replacement rudder. Attach hoist strap to plates. Attach guide lines to rudder actuator fittings.

(4) Hoist rudder into positon. Engage rudder bearings between hinge rib lugs.

(5) Temporarily install hollow bolts in hinges number 2 and 7.

(6) Lower hoist to transfer rudder weight to number 2 hinge lower lug shoulder bushing. This bushing is the thrust bushing, and locates the vertical position of the rudder.

(7) Position the cone bushings on hinges 1, 3, 4, 5, and 6 as follows:

(a) Install shop aid tapered shim between lugs of rudder hinge and bearing to prevent bending lugs when pressing in the bushings.

(b) Install a bolt with large area washers under bolt head and nut.

(c) Tighten nut to press cone bushings against bearing.

(d) Remove bolt, washers, and nut.

(8) On hinge number 1, install hollow bolt, split cone bushings, washer and nut. Install inner bolt, washer

and nut. Torque large nut 290 to 425 pound inches. Torque smaller nut 85 to 125 pound inches. Lock-wire inner bolt head to hinge lug. Lock-wire both nuts to each other and to hinge lug.

(9) On hinges 3, 4, 5, and 6, install bolt, split cone bushings, washer, and nut. Torque nut 70 to 100 pound inches. Install cotter pin.

(10) On hinge number 2, remove temporary hollow bolt. Press upper hinge lug cone bushing against bearing per Step (7).

(11) On hinge number 2, install hollow bolt, split cone bushing, washer and nut. Install inner bolt, cup washer, shims, washers and nut. Torque large nut 290 to 425 pound inches. On inner bolt, shim between cup washer and hollow bolt to maintain 0.016 to 0.054 inch clearance between cup washer and hinge lug (Ref. Fig. 401). Torque small nut 85 to 125 pound inches. Lock-wire small bolt head to hinge lug. Lock-wire both nuts to each other and to hinge lug.

(12) Remove temporary bolt, washers, and nut from hinge number 7. Press cone bushings against bearing per Step (7).

(13) On hinge number 7, install hollow bolt, split cone bushings, washer and nut. Install inner bolt, washer, and nut. Torque large nut 85 to 125 pound inches. Torque smaller nut 20 to 30 pound inches. Lock-wire inner bolt to hinge lug. Lock-wire both nuts to each other.

(14) Remove sling attach plates from rudder. Remove sling. Install plugs in rudder sling attach fittings.

(15) At hinges number 3, 4, and 5, and above hinge number 6, connect the four dampers to the rudder by installing bolt, washers, and nut. Torque nut 110 to 165 pound inches and install cotter pin. Check each damper sight gage to verify that piston indicator is above REFILL line.

(16) Connect single and dual transmitter actuating rods to rudder clevis fittings located below and above number 3 hinge respectively.

(17) Remove guide lines from rudder actuator fittings.

(18) Connect left and right actuator rod ends to their corresponding rudder fittings as follows:

(a) Butter-lube outer surface of actuator rod end hollow bolt with grease, MIL-G-23827A.

(b) Install both the hollow bolt and inner bolt, anti-rotation washer, and large nut. Torque large nut 300 to 450 lb in. then loosen and retorque to 0 to 20 lb in. If nut runs out of thread on bolt and bolt has vertical play, add thin washer under nut.

(c) Install washer, and nut on inner bolt. Torque small nut 560 to 600 pound inches.

(d) Lock-wire nuts to each other and to anti-rotation washer in two places.

CAUTION: CLEARANCE BETWEEN ACTUATOR ROD END BEARING AND RUDDER FITTING IS NORMAL. DO NOT SHIM.

(19) Connect the two rudder servo feedback pushrods to rudder with bolt, washer, and nut. Torque nut 30 to 40 pound inches. Install cotter pin.

(20) Lubricate rudder hinges, dampers, and actuator rod ends (Ref. 12-23-00).

(21) Install access panels on rudder leading edge.

NOTE: Occasionally, after installation of the rudder, the rudder tip may not fair with the tip of the vertical stabilizer, resulting in a positive mismatch on one side.

In case of mismatch, alignment can be improved by removing aerodynamic sealant between rudder tip and rudder, loosening the tip mounting screws and repositioning the tip to an optimum faired position. The screws should be tightened while holding the tip in the new position. Reseal gap between rudder tip and rudder (Ref. 20-51-04).

(22) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(23) Turn on electrical power (Ref. 24-41-00).

(24) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

CAUTION: CYCLING RUDDER AT A HIGH RATE CAN DAMAGE THE RUDDER DAMPER SEALS. OPERATE RUDDER PEDALS SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(25) Cycle the rudder pedals through full left and right throws a minimum of three times. The rudder must operate smoothly without binding.

(26) Visually verify that rudder actuator, feedback pushrods, and transmitter pushrods, operate freely without structual interference.

(27) Check clearance between top and bottom of piston rod end and hinge fitting during full-throw operation. Clearance must be a minimum of 0.002 inch throughout rudder travel.

(28) Turn off hydraulic power.

(29) Turn off electrical power.

R (30) Close all access doors opened in Step 3A(2).

HYDRAULIC PRESSURE REGULATOR AND CONTROL MODULE REMOVAL AND INSTALLATION

1. Equipment and Materials

Control Column Lock, PN 8A80, or equivalent

Hydraulic line pressure plugs and caps

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
20-12-00	Hydraulic Tube Connections and Fittings
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 115, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers FLAP LOAD RELIEF - CHAN-1 (H12) and CHAN-2 (H20).

(2) Install control column lock (Ref. Fig. 401).

(3) Open access door 317BB and gain access to area above horizontal stabilizer center section (Ref. 6-40-00). Pressure regulator is located in righthand side of
R afterbody mid/lower section, zone 317, (Ref. Fig. 402).

(4) Disconnect hydraulic lines from pressure regulator.

(5) Disconnect electrical connectors from pressure regulator.

(6) Remove pressure regulator from bracket by removing attaching bolts.

(7) Install pressure plugs on hydraulic lines.

(8) Install caps on pressure regulator hydraulic fittings.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Verify that control column lock is installed (Ref. Fig. 401). R

(3) Install pressure regulator on bracket with bolts and washers.

(4) Remove caps from pressure regulator.

(5) Remove pressure plugs from hydraulic lines and connect hydraulic lines to their respective fittings. Torque hydraulic line fittings (Ref. 20-12-00).

(6) Install electrical connectors on pressure regulator.

(7) Remove tags from hydraulic control panels.

(8) Remove tags and close circuit breakers opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

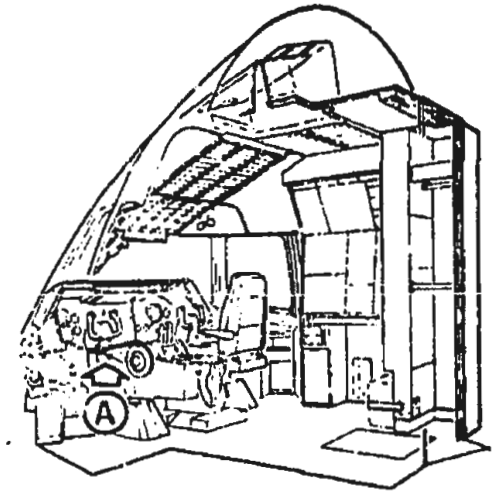
PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

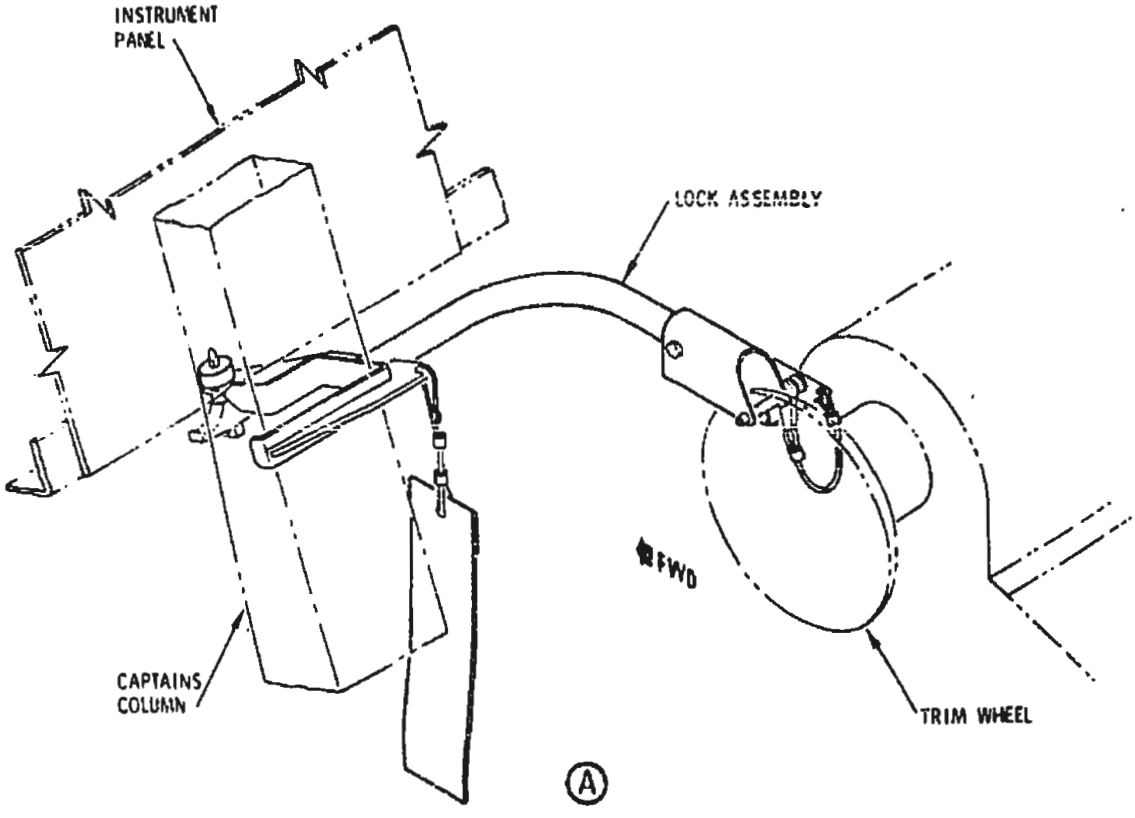
THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on electrical power (Ref. 24-41-00).

(10) Turn on hydraulic systems A, B, and C (Ref. MM29-11-00). C C

(11) Slowly cycle rudder pedals to bleed hydraulic system (Ref. 27-21-00). Operate pedals full left and full right until controls operate smoothly without roughness.





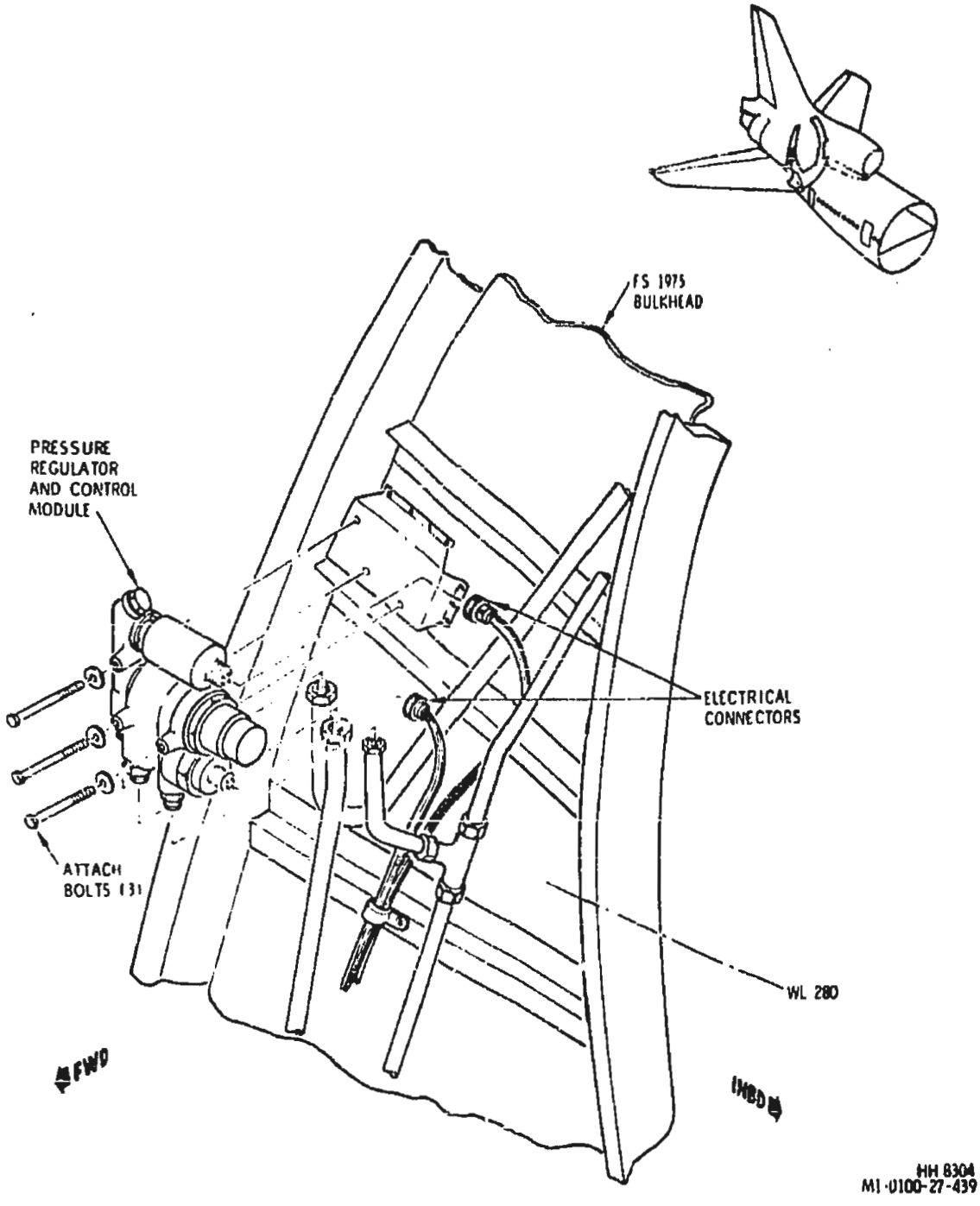
HH 6884
M1-0100-27-183

R
R

Control Column Lock Installation
Figure 401

EFFECTIVITY: ALL

001B



R Hydraulic Pressure Regulator and Control Module
R Removal and Installation
R Figure 402

EFFECTIVITY: ALL

001B

CAUTION: CYCLING RUDDER AT A HIGH RATE CAN DAMAGE RUDDER HYDRAULIC DAMPERS. CYCLE RUDDER PEDALS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(12) Check pressure regulator for hydraulic leakage.

(13) Open access door 112AB to gain access to forward electronic service center (Ref. 6-40-00).

(14) Locate the Flight Control Auxiliary Unit (FCAU) mounted below the bottom shelf of the center rack.

(15) On the FCAU control panel, verify that the C-REG ON light is off.

(16) Depress and hold C-REG ON switch; the following lights must come on:

(a) C-REG ON light on FCAU

(b) HYD LMTR FAULT light on FCAU

(c) RUDDER HYDR LMTR light on pilots annunciator panel

(17) Release C-REG ON switch; the lights that came on in Step (16) must go off.

NOTE: If lights do not operate correctly, refer to fault isolation procedure (Ref. 27-21-00, Fault 1).

(18) Turn off hydraulic power (Ref. 29-11-00).

(19) Turn off electrical power (Ref. 24-41-00).

(20) Close and secure access doors 112AB and 317BB.

(21) Remove control column lock.

RUDDER MECHANICAL LIMITER - MAINTENANCE PRACTICES

1. General

The rudder mechanical limiter system will automatically limit rudder deflection to ±8 degrees when airspeed exceeds 164 knots and flaps are retracted. (Below 164 knots, normal rudder deflection is ±30 degrees.)

If the automatic function of the rudder mechanical limiter system is inoperative, the aircraft may be dispatched if the automatic function of the rudder mechanical limiter is deactivated and the mechanical limiter is in the ±30 degree position.

NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MMEL.

2. Deactivation

A. Rudder Mechanical Limiter

(1) Turn on electrical power (Ref. 24-41-00).

(2) On RUDDER LIMITER panel, release (out) the MECHANICAL MNL/PUSH switchlight. Verify MNL light comes on.

(3) On RUDDER LIMITER panel, verify +8°/±30° switchlight is depressed (latched in) and the ±30° light is on.

(4) Verify rudder deflection of 30 degrees, as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on hydraulic system A or B (Ref. 29-11-00).

(b) Slowly operate rudder pedals left and right. Verify rudder displaces 30 degrees left and right (use the surface position indicator).

(c) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(5) Turn off electrical power if no longer required (Ref. 24-41-00).

(6) Install rudder mechanical limiter inoperative placard on RUDDER LIMITER MECHANICAL panel.

(7) Make appropriate entry in aircraft log book.

C 3. Removal of Rudder Mechanical Limiter System

C A. During the current base visit of plane 31029 the Rudder
C Mechanical Limiter System will be completely removed by MO
C 99885 (Lockheed Service Bulletin 27-169 R2). MO 99885 also
C removes the Rudder Mechanical Limiter on the remainder of
C the existing dash 100 aircraft (planes 31025, 31026, 31028,
C 31030, 31031).

C B. The 5 new dash 100 aircraft to be delivered in late 1981 and
C 1982 will not have the limiter installed.

C C. In the final configuration all the domestic (L1011-1)
C aircraft will have the system installed and all the
C international (L1011-50/-100) aircraft will have the system
C removed.

C D. All L1011-50 aircraft already have had the system removed.

C E. Plane 11021, now operating with the system removed, will
C have the system reinstalled at its base visit in 1982.

RUDDER MECHANICAL LIMITER - REMOVAL AND INSTALLATION

1. General

The left and right rudder mechanical limiter actuators are bolted together and mounted on the rudder hinge brace structure.

R The left and right rudder mechanical limiter arms are pinned to
R the rudder hinge brace structure. One or both rudder dual
R tandem actuators must be removed to gain access to the rudder
R limiter actuator arms. This procedure assumes that only one
R actuator or arm is being replaced. If both actuators or arms
R must be replaced, repeat procedural steps for remaining actuator
R or arm.

2. Equipment and Materials

Hydraulic line plugs and dust caps

Electrical connector dust caps

Lock-wire, Fed Spec QQ-W-423, Form I, Cond A, 0.020 and 0.032-inch diameter, or equivalent

Cotter Pin MS24665-151

R Shim LS5940-3, two per actuator may be required

R Washer AN960D10, two per actuator may be required

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	12-23-10	Rudder Lubrication
	20-12-00	Hydraulic Tube Connections and Fittings
	24-41-00	External Power/Ground Service Systems - Maintenance Practices
	27-21-12	Rudder Dual Tandem Actuator - Removal and Installation
	29-11-00	Hydraulic Power - Maintenance Practices

4. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICING PANEL, ZONE 147.

R A. Removal of Limiter Arm (Ref. Fig. 401)

R (1) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, open and tag circuit
R breakers RUDDER MECH LMTR A (K15) and B (K16).

R (2) Tag hydraulic system control panels against operation.

R (3) Remove either left or right dual tandem actuator (Ref.
R 27-21-12) as required.

R (4) Disconnect both interconnecting links from limiter arm
R that is to be removed.

R (5) Disconnect rudder limiter actuator rod end from rudder
R limiter arm that is to be removed.

R (6) Remove cotter pin, washer and flathead pin from limiter
R arm.

R (7) Remove limiter arm pivot pin.

R (8) Remove limiter arm complete with washers, spacers and
R bearings. Retain washers, spacers and bearings for
R reuse.

R NOTE: Washers, spacers and bearings are installed
R above and below the limiter arm.

R B. Removal of Limiter Actuator (Ref. Fig. 401)

R (1) On Flight Engineer/Second Offecers overhead circuit
R breaker panel CB2, zone 215, open and tag circuit
R breakers RUDDER MECH LMTR A (K15) and B (K16).

R (2) Tag hydraulic system control panels against operation.

R (3) Remove left and right rudder dual tandem actuators
R (Ref. 27-21-12).

R (4) Disconnect electrical connector from rudder limiter
R actuator and install dust caps on connectors.

R (5) Disconnect hydraulic lines from rudder limiter actuator
R and install dust caps on actuator fittings and pressure
R plugs in hydraulic lines.

R (6) Disconnect rudder limiter actuator rod end from rudder
R limiter arm.

R (7) Remove actuator forward dual mounting bolts.

R NOTE: Rudder limiter mounting bolts extend transversly
R through the aircraft centerline and are used to
R attach both rudder mechanical limiter actuators
R to the hinge assembly. The forward mounting
R bolt is a dual bolt and is made up of a hollow
R outer bolt and a standard inner bolt.

R (8) Support both limiter actuators and remove rudder
R limiter actuator rear mounting bolts, washers, shims,
R and nuts. Retain hardware for reuse and note number
R and location of shims.

R (9) Remove rudder limiter actuator.

R (10) If actuator will not be replaced promptly and only one
R actuator is removed, temporarily reinstall mounting
R bolts to support remaining actuator.

R C. Installation of Limiter Arm (Ref. Fig. 401)

R (1) Verify on Flight Engineer/Second Officers overhead
R circuit breaker panel CB2, zone 215, circuit breakers
R RUDDER MECH LMTR A (K15) and B (K16) are open and
R tagged.

R (2) Verify hydraulic system control panels are tagged
R against operation.

R (3) Install bearings in upper and lower hinge supports.
R Insert the following stack in the indicated order
R between the bearings:

R (a) Spacer

R (b) Washer

R (c) Limiter arm

R (d) Washer

R (e) Spacer

R (4) Insert limiter arm pivot pin from top through the
R bearing in the upper hinge support, spacer, washer,
R limiter arm, washer, spacer and the bearing in the
R lower hinge support.

R (5) Rotate pivot pin to align hole in pin with hole in
R limiter arm and insert flathead pin.

R (6) Install washer on projecting end of flathead pin and
R install cotter pin.

R (7) If either or both limiter actuators are not installed,
R skip following steps in paragraph 4C and install
R actuators in accordance with Paragraph 4D.

R (8) If both limiter arms were removed,
R check alignment of limiter arms as follows:

R (a) Extemd right limiter arm and swing rudder right to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and
R rudder hinge fitting bumper coincide within 0.03
R inch.

R (b) Fully extend right limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R NOTE: Piston rod end locking key must be fully
R disengaged before adjusting rod end.

R (c) Connect right limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (d) Extend left limiter arm and swing rudder left to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and
R rudder hinge fitting bumper coincide within 0.03
R inch.

R (e) Fully extend left limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R (f) Connect left limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (g) With limiter arms fully extended, adjust length of
R interconnecting links and connect to left and
R right limiter arms using bolts, washers, nuts and
R cotter pins.

R (8) If only the right limiter arm was removed,
R check alignment of limiter arms as follows:

R (a) Extend left limiter arm. Verify left limiter
R actuator rod is fully extended.

R (b) Swing rudder left and verify alignment marks on
R limiter arm and rudder hinge fitting bumper
R coincide within 0.030 inch.

R (c) If alignment marks do not coincide, disconnect
R actuator rod end and adjust left limiter arm so
R that alignment marks coincide. Fully extend left
R limiter actuator piston and adjust rod end to
R match fitting on limiter arm. Reconnect limiter
R actuator rod end to limiter arm using bolt,
R washer, nut and cotter pin.

R NOTE: Rod end locking key must be fully
R disengaged before adjusting rod end.

R (d) Extend right limiter arm and swing rudder right to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and
R rudder hinge fitting bumper coincide within 0.03
R inch.

R (e) Fully extend right limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R (f) Connect right limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (g) With limiter arms fully extended, adjust length of
R interconnecting links and connect to right limiter
R arm using bolts, washers, nuts and cotter pins.

R (8) If only the left limiter arm was removed,
R check alignment of limiter arms as follows:

R (a) Extend right limiter arm. Verify right limiter
R actuator rod is fully extended.

R (b) Swing rudder right and verify alignment marks on
R limiter arm and rudder hinge fitting bumper
R coincide within 0.03 inch.

R (c) If alignment marks do not coincide, disconnect
R actuator rod end and adjust right limiter arm so
R that alignment marks coincide. Fully extend right
R limiter actuator piston and adjust rod end to
R match fitting on limiter arm. Reconnect limiter
R actuator rod end to limiter arm using bolt,
R washer, nut and cotter pin.

R NOTE: Rod end locking key must be fully
R disengaged before adjusting rod end.

R (d) Extend left limiter arm and swing rudder left to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and
R rudder hinge fitting bumper coincide within 0.03
R inch.

R (e) Fully extend left limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R (f) Connect left limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (g) With limiter arms fully extended, adjust length of
R interconnecting links and connect to left limiter
R arms using bolts, washers, nuts and cotter pins.

R (9) Install dual tandem actuator (Ref. 27-21-12).

R (10) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, close RUDDER MECH LMTR A
R (K15) and B (K16) circuit breakers.

R (11) Remove tags from hydraulic control panels.

R (12) Lubricate Limiter/Actuator (Ref. 12-23-10).

R (13) Perform Test procedure (Paragraph E).

R D. Installation of Limiter Actuator (Ref. Fig. 401)

R (1) Verify on Flight Engineer/Second Officers circuit
R breaker panel CB2, zone 215, circuit breakers RUDDER
R MECH LMTR A (K15) and B (K16) are open and tagged.

R (2) Verify hydraulic system control panels are tagged
R against operation.

R NOTE: If only the left actuator is being replaced,
R components installed in Steps 4D(3) through (8)
R may already be in place.

R (3) Insert rear mounting bolts through lugs on right
R actuator.

R (4) Install shims, if required, on rear mounting bolts.

R NOTE: Up to two shims may be used to align actuator
R rod end with lug on limiter arm.

R (5) Install washers on rear mounting bolts.

R (6) Install right actuator on hinge brace with rear
R mounting bolts extending through brace.

R (7) Install washers on rear mounting bolts.

R (8) Install shim, if required, on rear mounting bolts.

R NOTE: Up to two shims may be used to align actuator
R rod end with lug on limiter arm.

R (9) Install left actuator on hinge brace and secure with
R washers and nuts.

R (10) Install forward dual mounting bolt which consists of a
R hollow outer bolt and a standard inner bolt.

R NOTE: Up to two washers may be added between hollow
R outer bolt and nut to ensure proper bolt grip.

R (11) Verify actuator rod ends align with lugs on limiter
R arms. If not add or remove shims on the rear mounting
R bolts to align rod ends.

R (12) If both limiter actuators were removed,
R check alignment of limiter arms as follows:

R (a) Disconnect both interconnecting links from left or
R right limiter arm.

R NOTE: Interconnecting links may already be
R disconnected/not installed.

R (b) Extend right limiter arm and swing rudder right to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and
R rudder hinge fitting bumper coincide within 0.03
R inch.

R (c) Fully extend right limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R NOTE: Rod end locking key must be fully
R disengaged before adjusting rod end.

R (d) Connect right limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (e) Extend left limiter arm and swing rudder left to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and

R rudder hinge fitting bumper coincide within 0.03
R inch.

R (f) Fully extend left limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R (g) Connect left limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (h) With limiter arms fully extended, adjust length of
R interconnecting links and connect to left and
R right limiter arms using bolts, washers and cotter
R pins.

R (12) If only the right limiter actuator was removed,
R check alignment of limiter arms as follows:

R (a) Disconnect both interconnecting links from left or
R right limiter arm.

R NOTE: Interconnecting links may already be
R disconnected/not installed.

R (b) Extend left limiter arm. Verify the left limiter
R actuator rod is fully extended.

R (c) Swing rudder left and verify alignment marks on
R limiter arm and rudder hinge fitting bumper
R coincide within 0.03 inch.

R (d) If alignment marks do not coincide, disconnect
R actuator rod end and adjust left limiter arm so
R that alignment marks coincide. Fully extend left
R limiter actuator piston and adjust rod end to
R match fitting on limiter arm. Reconnect limiter
R actuator rod end to limiter arm using bolt,
R washer, nut and cotter pin.

R NOTE: Rod end locking key must be fully
R disengaged before adjusting rod end.

R (e) Extend right limiter arm and swing rudder right to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and
R rudder hinge fitting bumper coincide within 0.03
R inch.

R (f) Fully extend right limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R (g) Connect right limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (h) With limiter arms fully extended, adjust length of
R interconnecting links and connect to limiter arms
R using bolts, washers, nuts and cotter pins.

R (12) If only the left limiter actuator was removed,
R check alignment of limiter arms as follows:

R (a) Disconnect both interconnecting links from left or
R right limiter arm.

R NOTE: Interconnecting links may already be
R disconnected/not installed.

R (b) Extend right limiter arm. Verify the right
R limiter actuator rod is fully extended.

R (c) Swing rudder right and verify alignment marks on
R limiter arm and rudder hinge fitting bumper
R coincide within 0.03 inch.

R (d) If alignment marks do not coincide, disconnect
R actuator rod end and adjust right limiter arm so
R that alignment marks coincide. Fully extend right
R limiter actuator piston and adjust rod end to
R match fitting on limiter arm. Reconnect limiter
R actuator rod end to limiter arm using bolt,
R washer, nut and cotter pin.

R NOTE: Rod end locking key must be fully
R disengaged before adjusting rod end.

R (e) Extend left limiter arm and swing rudder left to
R contact limiter arm. Adjust limiter arm and
R rudder so that alignment marks on limiter arm and
R rudder hinge fitting bumper coincide within 0.03
R inch.

R (f) Fully extend left limiter actuator piston rod.
R Adjust rod end to match fitting on limiter arm.

R (g) Connect left limiter actuator rod end to limiter
R arm using bolt, washer, nut and cotter pin.

R (h) With limiter arms fully extended, adjust length of
R interconnecting links and connect to limiter arms
R using bolts, washers, nuts and cotter pins.

R (13) Remove dust caps and plugs from limiter actuator
R hydraulic lines and fittings. Install hydraulic lines
R to limiter actuator and torque fittings (Ref.
R 20-12-00).

R (14) Clean electrical connector with approved solvent if it
R is contaminated with hydraulic fluid.

R (15) Install electrical connector and lock-wire.

R (16) Install left and right rudder dual tandem actuators
R (Ref. 27-21-12).

R (17) Lubricate limiter/actuator (Ref. 12-23-10).

R (18) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, close RUDDER MECH LMTR A
R (K15) and B (K16) circuit breakers.

R (19) Remove tags from hydraulic control panels.

R (20) Perform test procedure (paragraph E).

R E. Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, ensure circuit breakers RUDDER MECH LMTR A (K15) and B (K16) are closed.

(2) Turn on electrical power (Ref. 24-41-00).

(3) Turn on hydraulic system B if left limiter actuator was replaced or system A if right limiter was replaced and turn off other hydraulic systems (Ref. 29-11-00).

(4) Check limiter actuator hydraulic connections for signs of leakage.

(5) On RUDDER LIMITER panel located on pilots overhead panel, zone 210, unlatch MECHANICAL MNL/PUSH switchlight and MNL light must come on.

(6) Check limiter actuator operation by unlatching ±8°/±30° switchlight, actuator arms must extend and ±8° light must come on.

C (6A) For the actuator replaced, check that the actuator rod
C end jam nut clears the limiter arm attach lug. If
C actuator does not clear, shim adjustment on the two aft
C mounting bolts may be required (Ref. para. B.(1)).

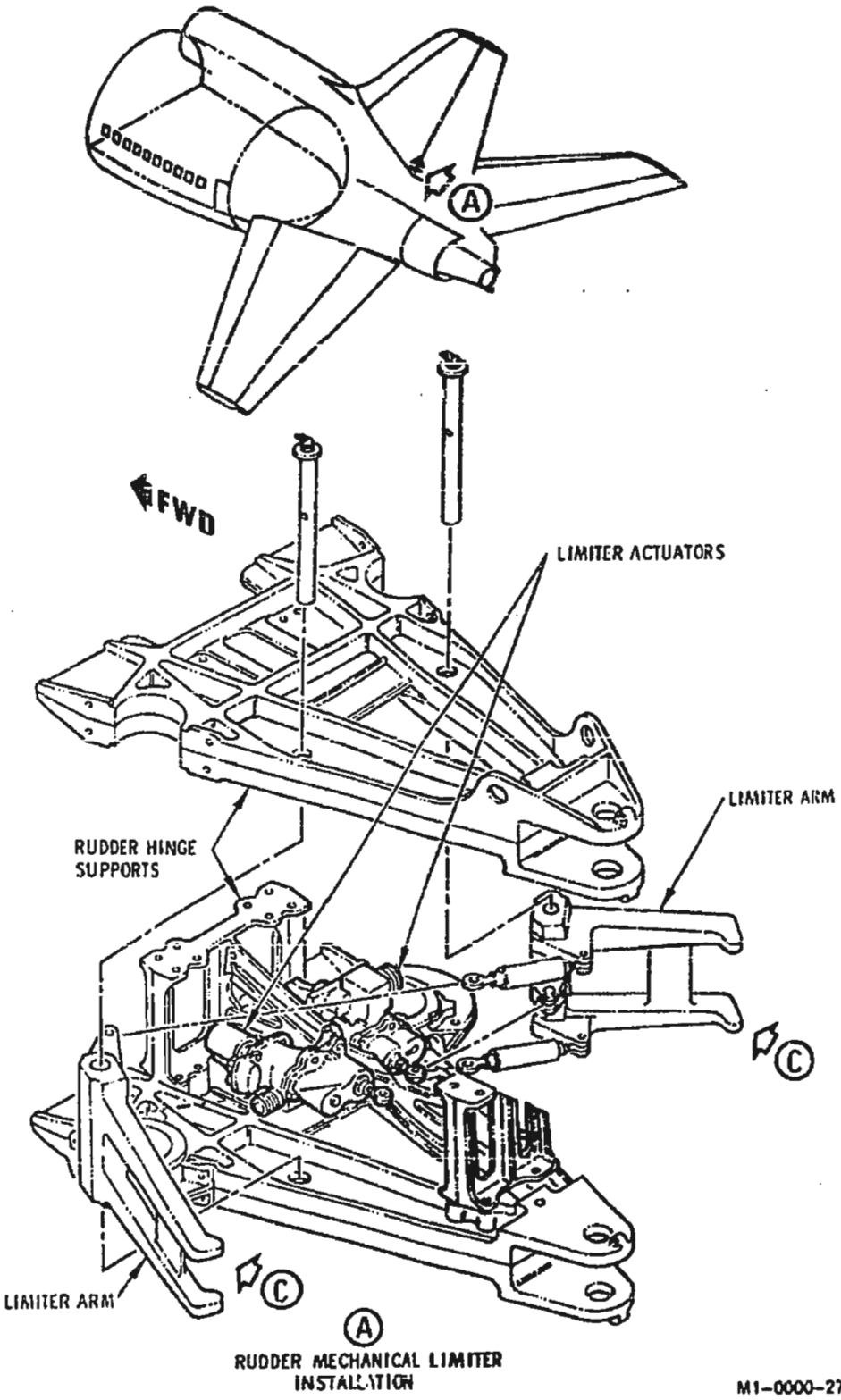
(7) Latch ±8°/±30° switchlight, actuator arms must retract and ±30° light must come on.

(8) Latch MNL/PUSH switchlight, MNL light must go off.

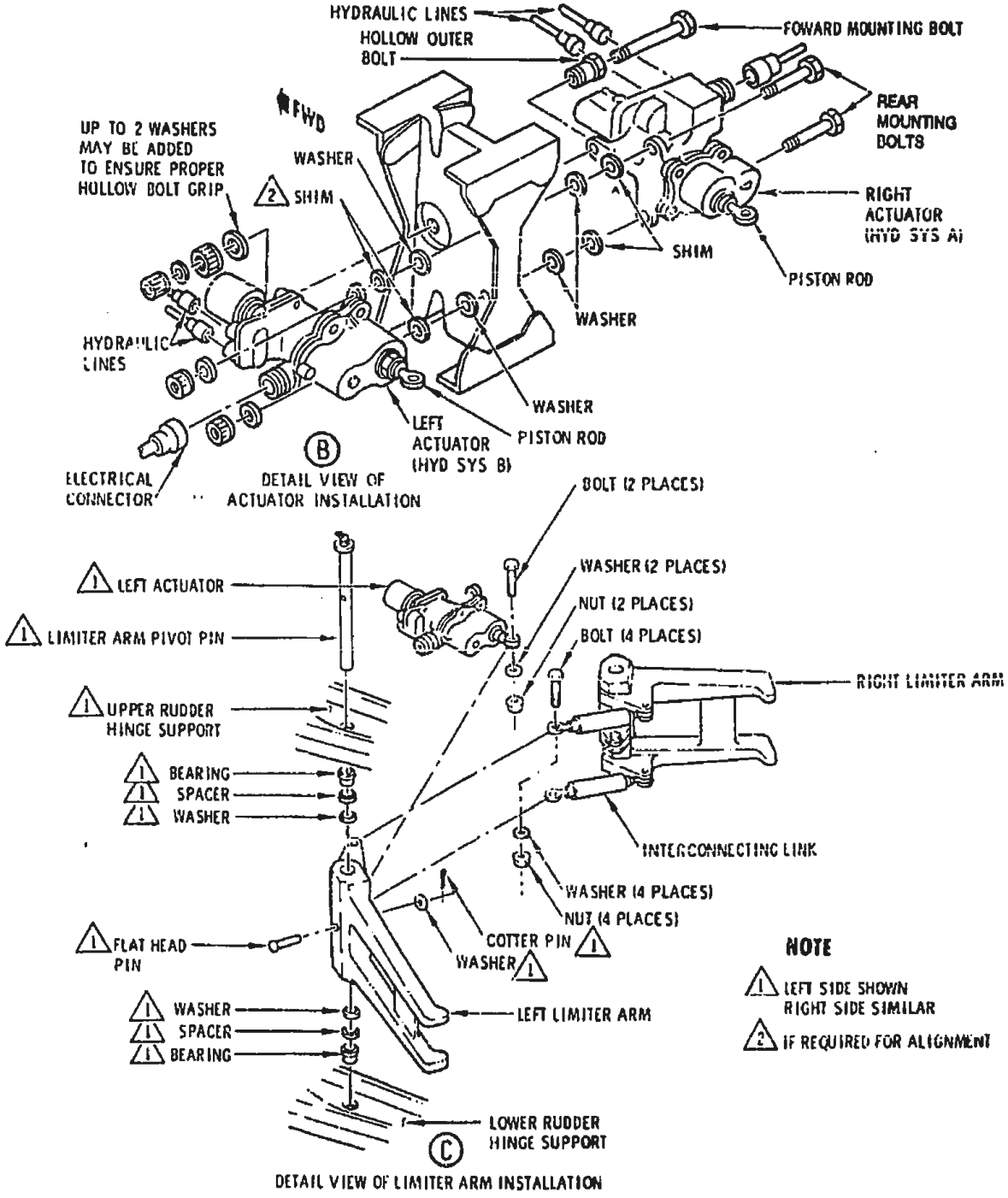
(9) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(10) Turn off electrical power if no longer required (Ref. 24-41-00).

(11) Close all access panels and doors.



Rudder Deflection Limiter Actuator - Removal and Installation
Figure 401 (Sheet 1)



M1-0004-27-435

Rudder Deflection Limiter Actuator - Removal and Installation
Figure 401 (Sheet 2)

RUDDER MECHANICAL LIMITER - ADJUSTMENT AND TEST

1. Referenced Procedures

   24-41-00 External Power/Ground Service System - Maintenance Practices

   29-11-00 Hydraulic Power - Maintenance Practices

2. Adjustment/Test

   A. Rudder Deflection Limiter Operational Check

      (1) Verify following circuit breakers are closed:

         (a) On pilots overhead circuit breaker panel CB1, zone 210:

         SPOILER DWELL - DC (B7)

         NO. 1 NAVIGATION - AIR DATA CMPTR (G8)

         NO. 2 NAVIGATION - AIR DATA CMPTR (G27)

         NO. 1 INSTRUMENT - CAPT - IAS/MACH (F1)

         NO. 2 INSTRUMENT - F/O - IAS/MACH (F19)

         (b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

         FLAP LOAD RELIEF - CHAN 1 (H12), and IND H13)

         FLAP LOAD RELIEF - CHAN 2 (H20)

         RUDDER MECH LMTR - A and B (K15, K16)

         RUDDER SERVO - A, B, and C (K12, K13, and K14)

         INDICATOR - T/O AURAL WRNG (H7)

         (c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

         IND LT - PFCS/ADS/DH (G8)

         FLT CONT ALT ALERT (G9)

(2) On pilots overhead PFCS panel, verify RUDDER switchlight is latched and OFF light is off.

(3) On pilots overhead RUDDER LIMITER panel, verify MECHANICAL MNL/PUSH and ±8°/±30°switchlights are latched.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Verify ±30° light on RUDDER LIMITER panel is on.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on hydraulic system A and B (Ref. 29-11-00).

(7) On RUDDER LIMITER panel unlatch MNL/PUSH switchlight. The MNL light must come on.

(8) Unlatch ±8°/±30° switchlight. The ±30° light must go off and ±8° light must come on.

(9) Verify rudder throw is limited: SLOWLY position rudder pedal left or right and verify rudder is limited to 8 degrees (use surface position indicator on pilots instrument panel). Allow rudder pedals to return to neutral.

(10) Latch both RUDDER LIMITER MECHANICAL ±8°/±30° and MNL/PUSH switchlights. The ±8° light must go off, ±30° light should come on, and MNL light must go off.

(11) In forward electronic service center, locate CADC 1 and 2 on rear avionics rack, shelf 5. Simultaneously press and hold self-test button on both CADC's.

NOTE: If RUDDER HYDR LMTR light on caution and warning panel comes on, release self-test buttons on CADC's, rotate LRS computer BITE selector switch

to RESET for 5 seconds, then back to RUN. Repeat Step (10).

(12) After pilots airspeed indicator exceeds 164 knots, verify MECHANICAL ±8°/±30°switchlight indication changes from ±30° to ±8°.

(13) Release both CADC's self-test button. When pilots airspeed indicator drops below 164 knots, verify MECHANICAL ±8°/±30° switchlight indication changes from ±8° to ±30°.

(14) Turn off hydraulic power if no longer required (29-11-00).

(15) Turn off electrical power if no longer required (24-41-00).

RUDDER PEDAL ADJUSTMENT SHAFT ASSEMBLY REMOVAL AND INSTALLATION

1. Equipment and Materials

Grease, Aircraft and Instrument, MIL-G-23827A, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

2. Referenced Procedures

29-11-00 Hydraulic Power Systems - Maintenance Practices

3. Removal/Installation

R CAUTION: THE FOLLOWING MUST BE OBSERVED WHEN OPERATING THE
R RUDDER PEDAL ADJUSTMENT SYSTEM.

R DO NOT DRIVE THE SYSTEM FORCIBLY INTO EITHER THE
R FORWARD AFT EXTREMES.

R OPERATE THE SYSTEM FROM 5 FWD TO 5 AFT ONLY AND DO NOT
R EXCEED 80 INCH POUNDS AT THE CRANK.

R DO NOT ATTEMPT TO FREE A SYSTEM JAM BY FORCING THE
R HAND CRANK.

R THIS CAN ONLY RESULT IN A FAILURE OF ONE OR BOTH OF
R THE FLEXIBLE DRIVE SHAFTS.

R DISCONNECT THE SHAFTS, FREE THE JAM, THEN RECONNECT
R AND CHECK FOR PROPER OPERATION.

A. Removal (Ref. Fig. 401)

(1) In the flight station, zone 210, remove both side panels from rudder pedal trim cover (Ref. Fig. 401).

(2) Remove bolt attaching pedal adjustment shaft clamp to top of rudder pedal trim cover.

(3) Rotate pedal adjustment crank handle to align arrow with mid position.

NOTE: Verify that rudder and rudder pedals are centered before removing shaft assembly.

(4) Remove three screws attaching the rudder pedal adjustment crank to the rudder pedal trim cover. Pull crank assembly from the trim cover for access and remove retaining hex nut attaching shaft assembly to adjustment crank.

(5) Open access door 112AB to gain access to the forward electronic service center.

(6) In the forward electronic service center, zone 112, remove retaining hex nut attaching lower end of shaft assembly to the rudder pedal adjustment worm gear and remove shaft assembly.

B. Installation (Ref. Fig. 401)

(1) In the flight station, verify that the pedal adjustment crank handle arrow is aligned with mid position.

(2) Install shaft assembly square drive to adjustment crank with hex nut; tighten and lock-wire.

. C (3) With rudder pedal worm gear in mid-position, connect adjustment shaft hex nut to the rudder pedal adjustment worm gear. Hex nut should be finger-tight, then backed off 1/4 to 1/2 turn and lock-wired to prevent rotation in either direction.

(4) If mid position of the rudder pedal adjustment is lost or is suspect, accomplish following:

(a) From the forward electronic service center, rotate worm gear shaft square drive until center of the pedal lever is 1.58 (±0.060) inches forward of the center of the pedal output lever bolt (Ref. Fig. 401). This is the rudder pedal adjustment mid position.

NOTE: If crank handle and worm gear are not in their mid positions when shaft assembly is connected, the worm gear can run off the segment gar at full FWD or AFT position.

(5) Install rudder pedal adjustment crank to trim cover with three screws, washers, and nuts.

(6) Install bolt, washer, and nut to secure shaft assembly clamp to top of trim cover.

(7) Install both side trim panels to trim cover.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on any one of the three hydraulic systems supplying the rudder, A, B, or C.

R (9) On aircraft 001,
R position YAW trim control to .5 mark NOSE L.

R NOTE: On aircraft 001,
R the adjustment of the YAW trim wheel has been
R biased to provide straight and level flight with
R the YAW trim wheel at zero. A decal located at
R the left underside of the alternate landing gear
R control cover specifies .5 mark R YAW for
R aircraft 001. It should be noted that for the
R .5 mark NOSE R bias specified, the YAW trim
R wheel is set to .5 mark NOSE L with the rig pin
R in the YAW cable drum. Removing the rig pin and
R positioning the YAW trim wheel to zero produces
R a NOSE R bias.

R (9) On aircraft 002-999,
R position YAW trim control to zero.

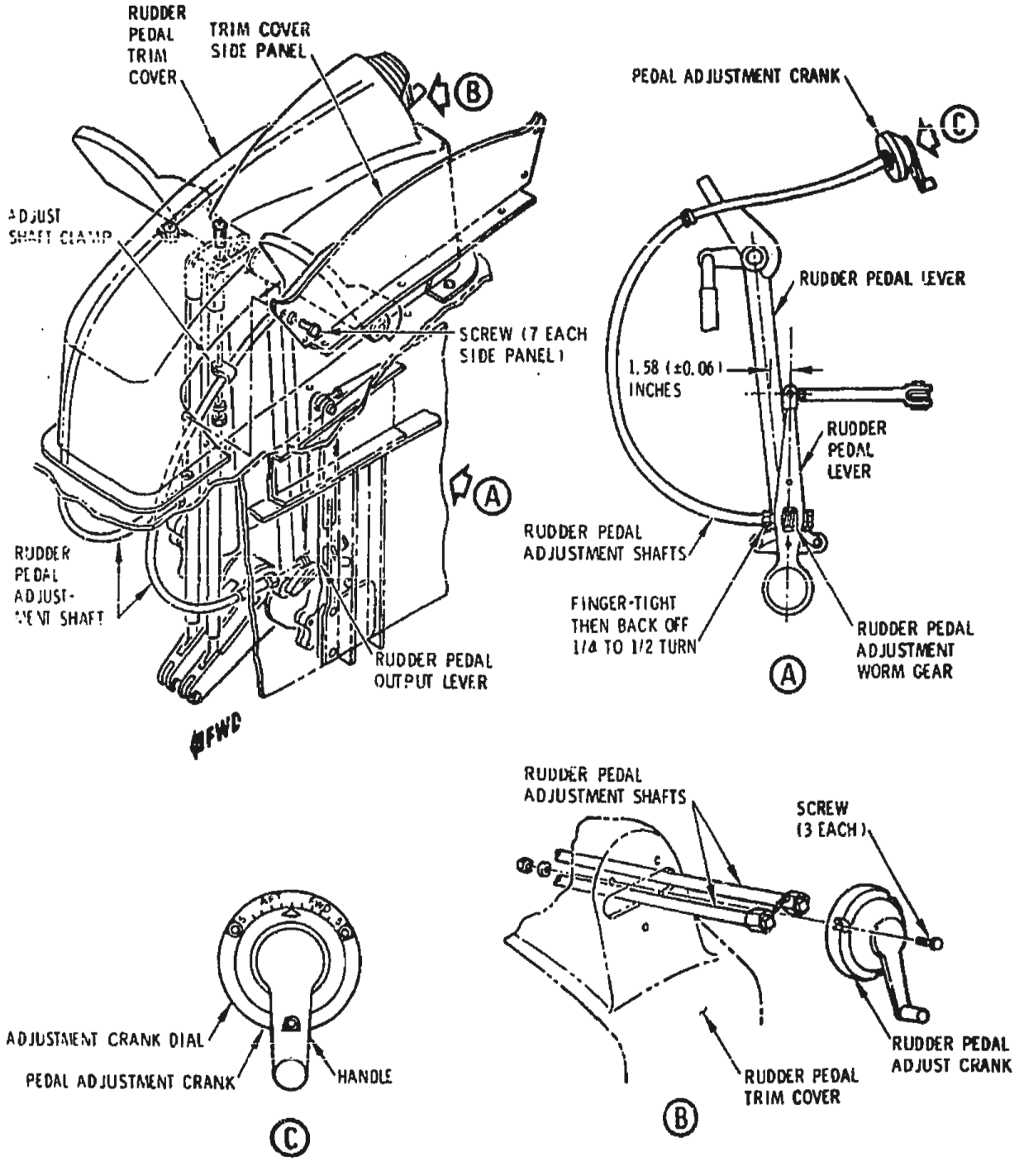
(10) Verify that rudder pedals are even. If not, recheck adjustment shaft rigging per Steps B(1) through (4).

(11) Cycle crank handle to 5 AFT, reverse to 5 FWD, and return to align arrow with mid position. Rudder pedals should move forward and aft and operate smoothly without binding.

NOTE: If rudder pedal adjustment does not operate smoothly, it is permissible to butter-lube the worm and sector gear with grease MIL-G-23827A. (SB27-089 reworks the worm and sector gear installation to improve rudder pedal adjustment operation.)

(12) Turn off hydraulic power.

(13) Close access door to forward electronic service center.



M1-0101-27-482

Rudder Pedal Adjustment Shaft - Removal and Installation
Figure 401

RUDDER HINGE BEARING - REMOVAL AND INSTALLATION

1. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
	12-23-00	Flight Controls Lubrication
	24-41-00	External Power/Ground Service Systems - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

R 2. Removal/Installation

A. Removal

R WARNING: PRIOR TO MAINTENANCE OPERATIONS IN THE VICINITY OF THE RUDDER, VERIFY HYDRAULIC POWER IS OFF AND HYDRAULIC CONTROL PANELS ARE TAGGED AGAINST OPERATION.

R (1) Turn off hydraulic power (Ref. 29-11-00). Tag Flight Engineer/Second Officers hydraulic control panel and hydraulic service center servicing panel against operation.

R (2) Gain access to rudder hinge bearings through access panels as follows (Ref. 6-40-00):

R Hinges No. 1 and 2; 324AL/AR, 325 CL/CR

R Hinge No. 3; 324CL/CR, 325DL/DR

R Hinge No. 4; 324EL/ER, 325EL/ER

R Hinge No. 5; 324GL/GR, 325FL/FR

R Hinge No. 6; 324JL/JR, 325GL/GR

R Hinge No. 7; 324LL/LR, 325HL/HR

R (3) Disconnect applicable bonding jumper by removing attaching bolt, washers and nut (Ref. Fig. 401).

R (4) For hinge No. 3 through No. 5, disconnect rudder damper rod from hinge bracket by removing attaching bolt, washers and nut.

R (5) Remove all lockwire, cotter pins, nuts, split cone
R bushings, shims and bolts, as applicable, from hinge
R fitting.

(6) Disconnect the hinge bracket from the rudder structure
R by removing attaching bolts, washers and nuts and
R remove hinge fitting from the mounting position.

B. Installation

R (1) Verify cone bushings are installed in hinge support.
R If not, install cone bushings with bushing inner
R surface flush with inside surface of hinge support lugs
R (Ref. Fig. 401).

R NOTE: Use soft aluminum or micarta to position cone
R bushings.

R (2) Install hinge fittings as follows:

R (a) Place hinge fitting in mounting position.

R (b) For hinge No. 1 and No. 2,
R install shims as required to reduce gap between
R hinge fitting and bracket to 0.00 to 0.002 inch.

R (c) For hinge No. 1 and No. 2,
R install hinge fitting attaching bolts, washers and
R nuts. Torque to 155 to 180 lb-in.

R (c) For hinges No. 3 through No. 7,
R install hinge fitting attaching bolts, washers and
R nuts. Torque to 70 to 85 lb-in.

R (3) Position cone bushings in hinge support as follows:

R (a) Install shop aid tapered shim between lugs of
R rudder hinge and bearing to prevent bending lugs
R when pressing in the bushings.

R (b) Install a bolt with large area washers under bolt
R head and nut.

R (c) Tighten nut to press cone bushings against
R bearing.

R (d) Remove bolt, washers and nut.

R (4) For hinge No. 1,
R install hollow bolt, split cone bushings, washer and
R nut. Install inner bolt, washer and nut. Torque
R larger nut to 290 to 425 lb-in. Torque smaller nut to

R 85 to 125 lb-in. Lockwire inner bolt head to hinge
R lug. Lockwire nuts together and to hinge lug.

R (4) For hinge No. 2,
R install hollow bolt, split cone bushing, washer and
R nut. Install inner bolt, cup washer, shims, washers
R and nut. Torque larger nut to 290 to 425 lb-in. On
R inner bolt, shim between cup washer and hollow bolt to
R maintain 0.016 to 0.054 inch clearance between cup
R washer and hinge lug. Torque smaller nut to 85 to 125
R lb-in. Lockwire inner bolt head to hinge lug.
R Lockwire nuts together and to hinge lug.

R (4) For hinge No. 3 through No. 6,
R install bolt, split cone bushings, washer, and nut.
R Torque nut to 70 to 100 lb-in. Install cotter pin.

R (4) For hinge No. 7,
R install hollow bolt, split cone bushings, washer and
R nut. Install inner bolt, washer and nut. Torque
R larger nut to 85 to 125 lb-in. Torque smaller nut to
R 20 to 30 lb-in. Lockwire inner bolt head to hinge lug.
R Lockwire nuts together and to hinge lug.

R (5) For hinge No. 3 through No. 5,
R connect dampers to rudder by installing bolt, washer
R and nut. Torque nut to 110 to 165 lb-in. Install
R cotter pin.

R (6) Connect bonding jumper by installing attaching bolt,
R washers and nut. Torque not tu 20 to 30 lb-in.

R NOTE: Hinge No. 1 has dual bonding jumpers.

R (7) Lubricate the rudder hinge bearing (Ref. 12-23-00).

R (8) Remove tags from Flight Engineer/Second Officers
R hydraulic control panel and hydraulic service center
R servicing panel.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (9) Turn on electrical power (Ref. 24-41-00).

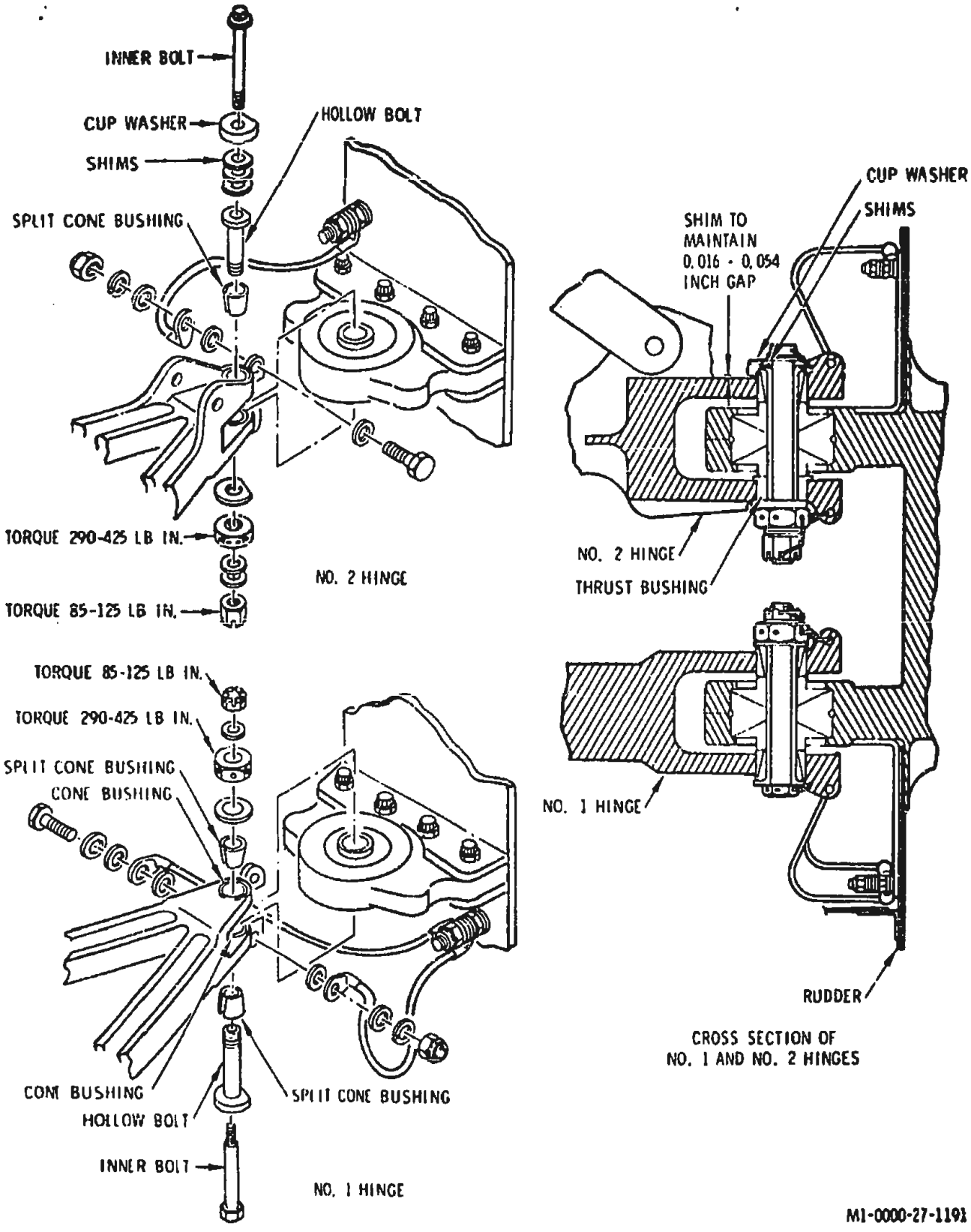
R (10) Turn on hydraulic systems A and C (Ref. 29-11-00).

R (11) Actuate the rudder by depressing each rudder pedal to travel limits, first the left and then the right, through three complete cycles. The rudder must move smoothly without binding or hesitation.

R (12) Turn off hydraulic power.

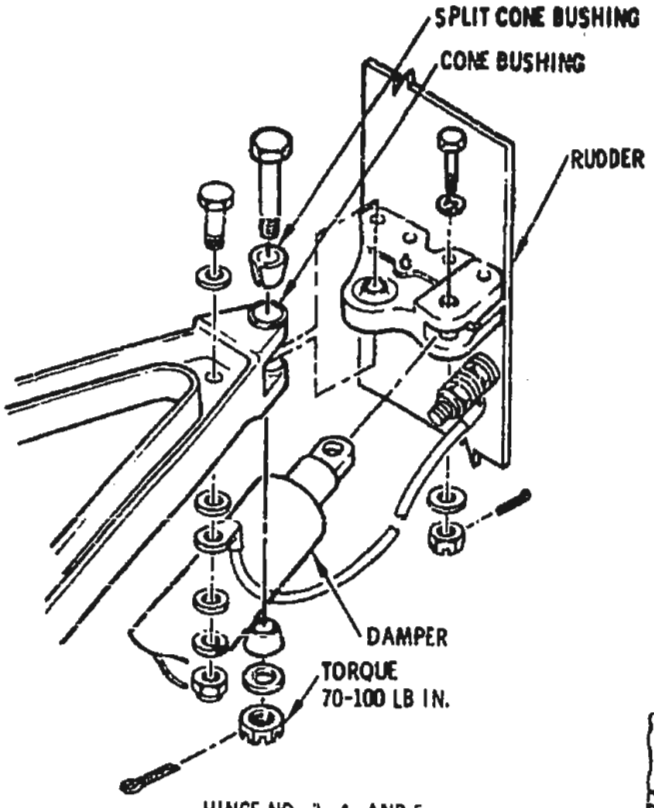
R (13) Turn off electrical power.

R (14) Close all access openings.

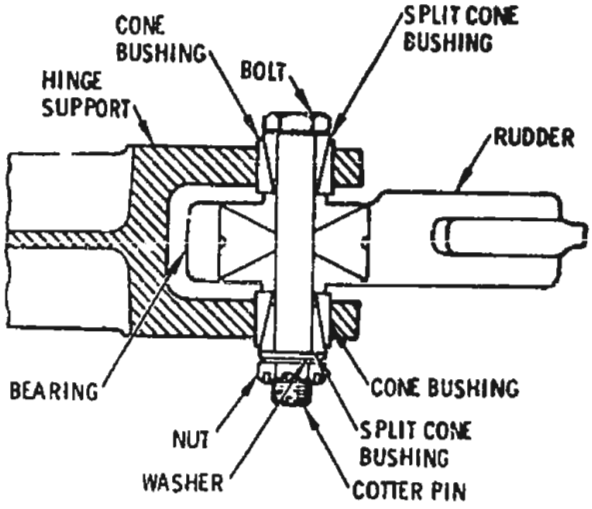


R Rudder Hinge Bearing - Removal and Installation
R Figure 401 (Sheet 1)

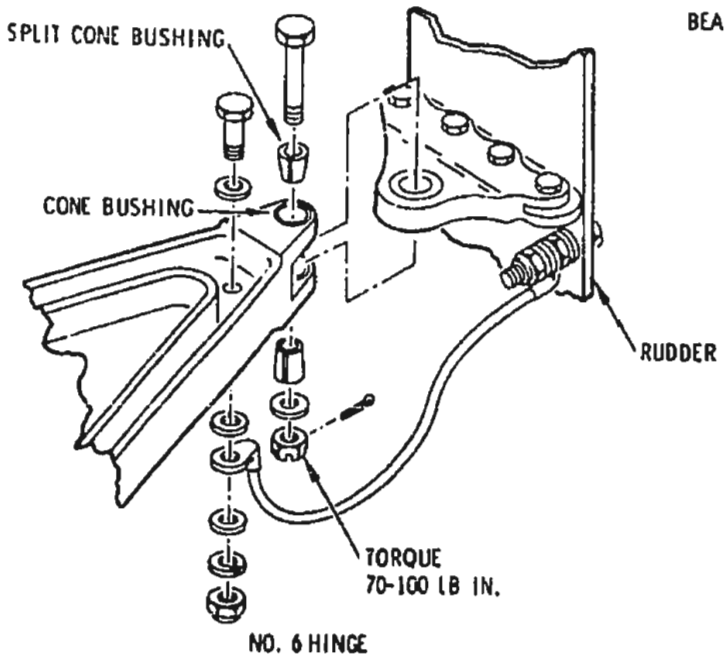
EFFECTIVITY: ALL



HINGE NO. 3, 4, AND 5



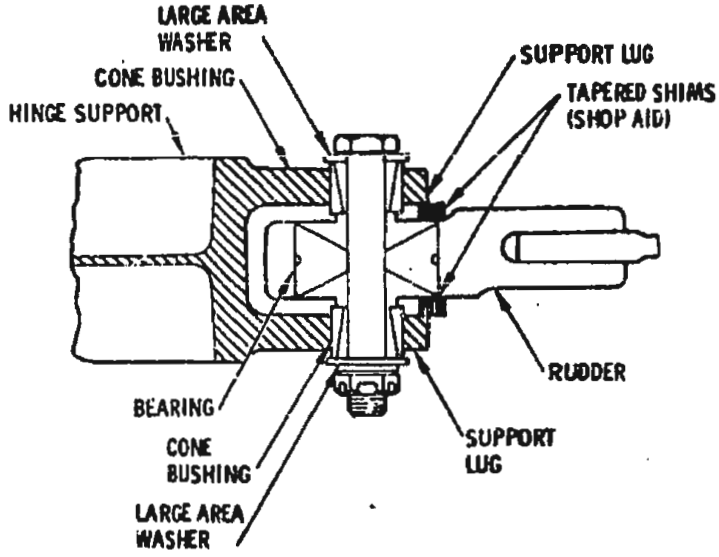
CROSS SECTION OF HINGE 3, 4, 5, AND 6
(DAMPER OMITTED FOR CLARITY)



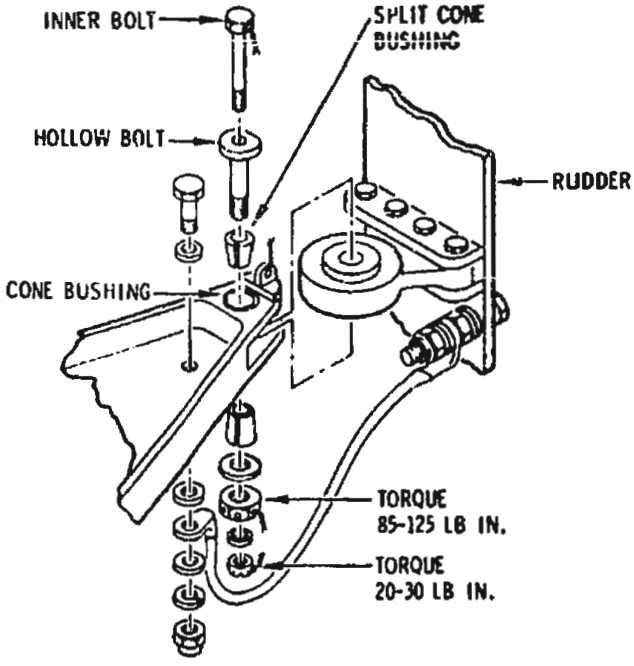
NO. 6 HINGE

M1-0000-27-1192

R Rudder Hinge Bearing - Removal and Installation
R Figure 401 (Sheet 2)



CROSS SECTION OF NO. 7 HINGE



NO. 7 HINGE

M1-0000-27-1193

R Rudder Hinge Bearing - Removal and Installation
R Figure 401 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

RUDDER PEDAL POSITION DFDR POTENTIOMETER REMOVAL AND INSTALLATION

1. Equipment and Materials

Rivet, LS13971AD4

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

Cotter Pin, MS24665-149

Rig Pin Kit, PN B734, or equivalent

Sealant, RR1422A2 (MIL-S-8802, CL A-2), or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
31-31-00	Digital Flight Data Recorder (DFDR) System - Adjustment and Test

3. Removal/Installation

A. Removal

R (1) Verify that all four hydraulic systems are shut off (Ref. 29-11-00), zone 215, and hydraulic control panels tagged, zone 147.

R (2) Verify following circuit breakers are opened and tagged:

(a) On Flight Engineer/Second Officers circuit breaker panel CB2, zone 215: RUDDER SERVO A(K12), B(K13), C(K14).

(b) On Flight Engineer/Second Officers vertical circuit breaker panel CB3, zone 215:

AIDS/FLT RCDR - DC(H10), A(H11), B(H12), C(H13)

(3) Open access door 112AB to gain access to forward electronic service center (Ref. 6-40-00).

(4) Install rudder pedal linkage rig pin(s) (Ref. Fig. 401).

(5) Remove the Captains control column stick shaker guard box to gain access to rudder pedal potentiometer.

(6) Locate potentiometer on floor web structure just to left of Captains left rudder pedal (Ref. Fig. 401).

R R (7) Disconnect potentiometer wires from terminal board TB10.

R (8) Remove nut holding link to arm (Ref. Fig. 401).

(9) Remove nut holding arm to potentiometer, and disengage arm from shaft (Ref. Fig. 401).

(10) On aircraft 001-031 without SB27-185, remove potentiometer assembly as follows:

(a) Remove rivet attaching alignment plate to floor web structure (Ref. Fig. 401).

(b) Remove nut and lockwasher attaching potentiometer to floor web structure (Ref. Fig. 401).

(c) Remove potentiometer with alignment plate.

(10) On aircraft 001-031 with SB27-185 and 032-036, remove potentiometer assembly as follows:

(a) At potentiometer arm, cotter pin, nut and washer and disconnect link from potentiometer arm.

(b) Remove nut and washer and remove arm from potentiometer shaft.

NOTE: Save all linkage components for reinstallation.

(c) Loosen clamp screws and rotate clamps from flange.

(d) Remove nut and lockwasher and remove potentiometer.

B. Installation

(1) Verify all four hydraulic systems are turned off (Ref. 29-11-00), zone 215 and hydraulic control panels tagged, zone 147.

(2) Verify circuit breakers opened in Step 3A(2) are opened and tagged.

(3) On aircraft 001-031 without SB27-185, install potentiometer as follows:

(a) Apply sealant inside both mounting hole and index pin hole of alignment plate.

(b) Place alignment plate over potentiometer shaft and seat firmly, engaging index pin on potentiometer to index hole on alignment plate (Ref. Fig. 401).

(c) Insert potentiometer shaft through web mounting hole and install lockwasher and nut on threaded shoulder.

NOTE: Do not fully tighten nut.

(d) Rotate potentiometer shaft so flat on shaft engages "D" slot in arm (Ref. Fig. 401).

NOTE: Flat on potentiometer shaft must be facing aft and arm must point up.

(e) Install washer, nut, and tighten nut to lock arm to potentiometer shaft (Ref. Fig. 401).

(f) Clamp alignment plate to floor web, tighten nut and install rivet (Ref. Fig. 401).

(g) Lock-wire arm locking nut to arm (Ref. Fig. 401).

R (3) On aircraft 001-031 with SB27-185 and 032-999, install potentiometer assembly as follows:

(a) Install flange on ring platform with index hole located at 3 o'clock position and tighten all clamps to secure flange.

(b) Brushcoat inside surface of index hole and mounting hole of flange with sealant.

(c) Insert potentiometer shaft through ring platform and mounting flange hole, enough to install lockwasher and nut on threaded shoulder (Ref. Fig. 401).

NOTE: Do not fully tighten nut.

(d) Rotate potentiometer shaft so flat on shaft engages "D" slot in arm (Ref. Fig. 401).

NOTE: Flat on potentiometer shaft must be facing aft and arm must point up and shoulder at base of potentiometer must engage index hole on mounting flange (Ref. Fig. 401).

(e) Install washer, nut and tighten nut to lock arm to potentiometer shaft (Ref. Fig. 401).

(f) Tighten nut to lock potentiometer against mounting flange (Ref. Fig. 401).

(4) Connect potentiometer wires to terminal board TB10 (Ref. Fig. 401).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Remove tags and close circuit breakers opened in Step 3A(2).

R (6) Remove tags from hydraulic control panels.

R (7) Turn on electrical power (Ref. 24-41-00).

R (8) Turn on any one of three hydraulic systems: A, B, or C (Ref 29-11-00).

CAUTION: TO PREVENT DAMAGE TO RUDDER SURFACE DAMPERS, CYCLE RUDDERS SLOWLY, AT LEAST 4 SECONDS STOP TO STOP.

(9) Cycle rudder pedals from full left rudder to full right rudder and back to neutral, and visually verify normal operation of potentiometer arm linkage.

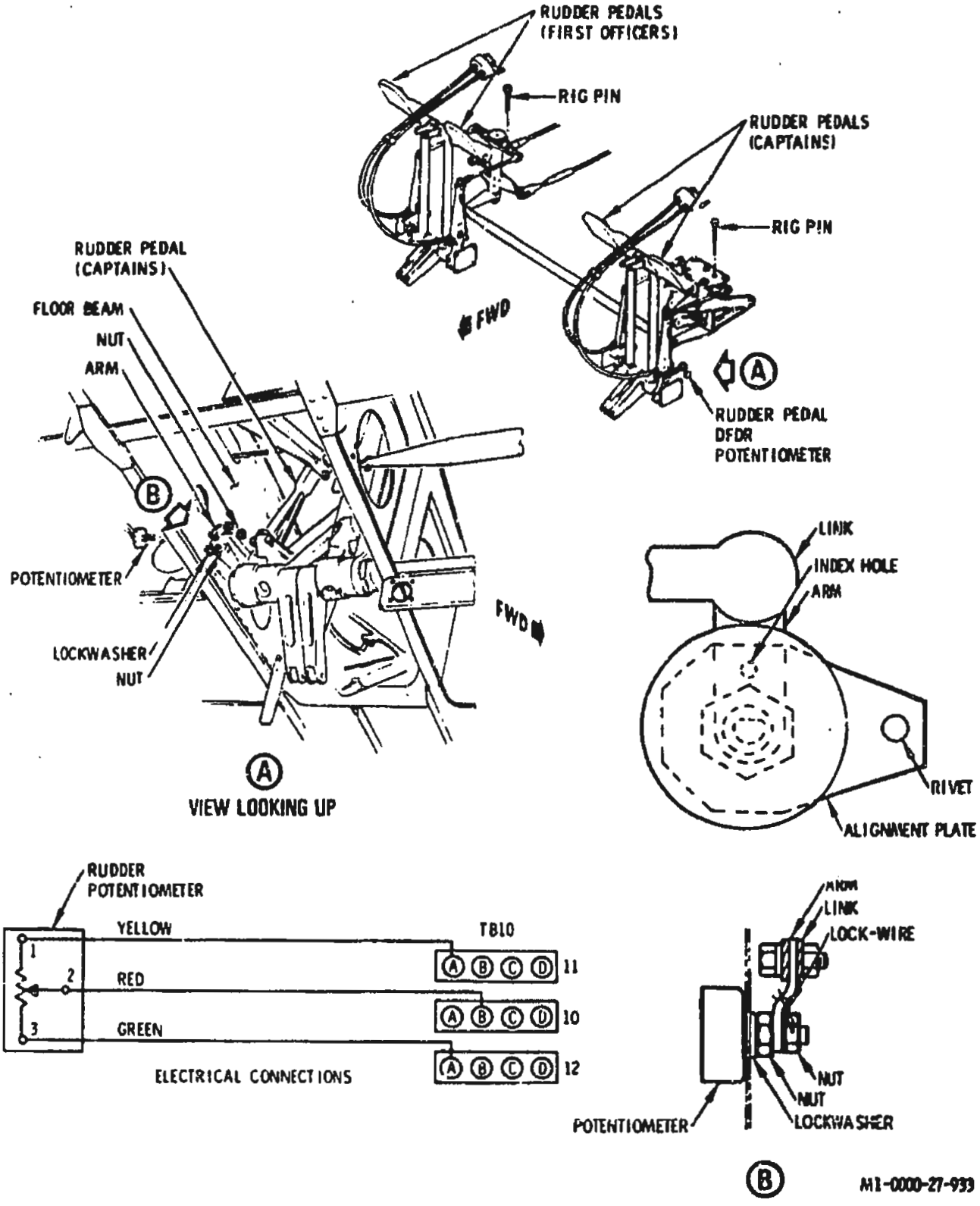
(10) Check rudder potentiometer for proper voltage and phase output (Ref. 31-31-00, Adjustment and Test, Table 501, signal code 112-1).

(11) Install control column stick shaker guard.

(12) Turn off hydraulic power (Ref. 29-11-00).

(13) Turn off electrical power (Ref. 24-41-00).

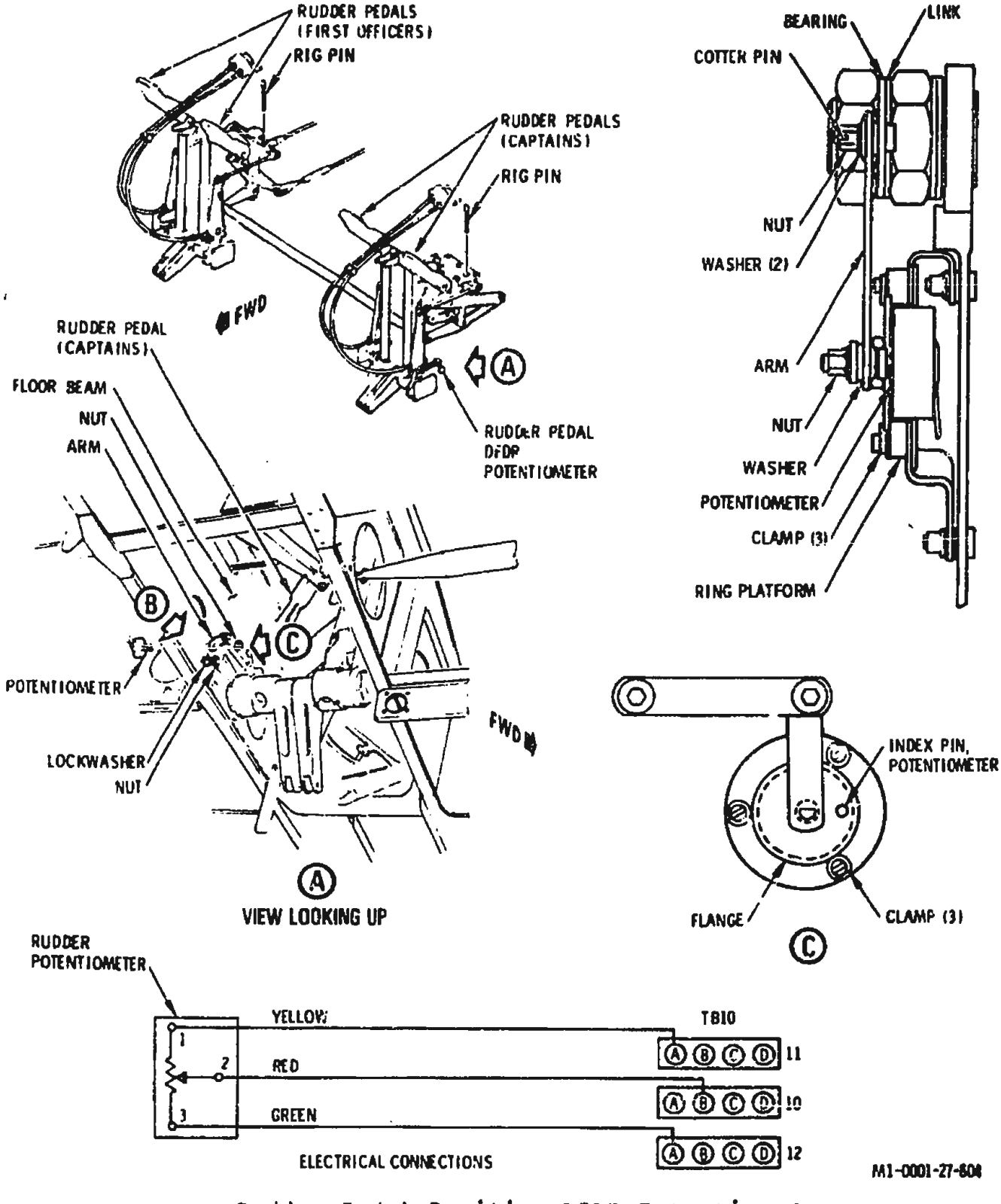
(14) Close access door (Ref. 6-40-00).



R Rudder Pedal Position DFDR Potentiometer
R Removal and Installation
R Figure 401

EFFECTIVITY: 001-031 WITHOUT SB27-185

001B



Rudder Pedal Position DFDR Potentiometer
Removal and Installation
Figure 401

R EFFECTIVITY: 001-031 WITH SB27-185 AND 032-036
R
001B

R RUDDER SERVO AUTOPILOT PRESSURE SWITCH - REMOVAL AND INSTALLATION

1. Equipment and Materials

Gasket (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

Gasket Plate Seal (Ref. Fig. 401)

2. Reference Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS, or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS.

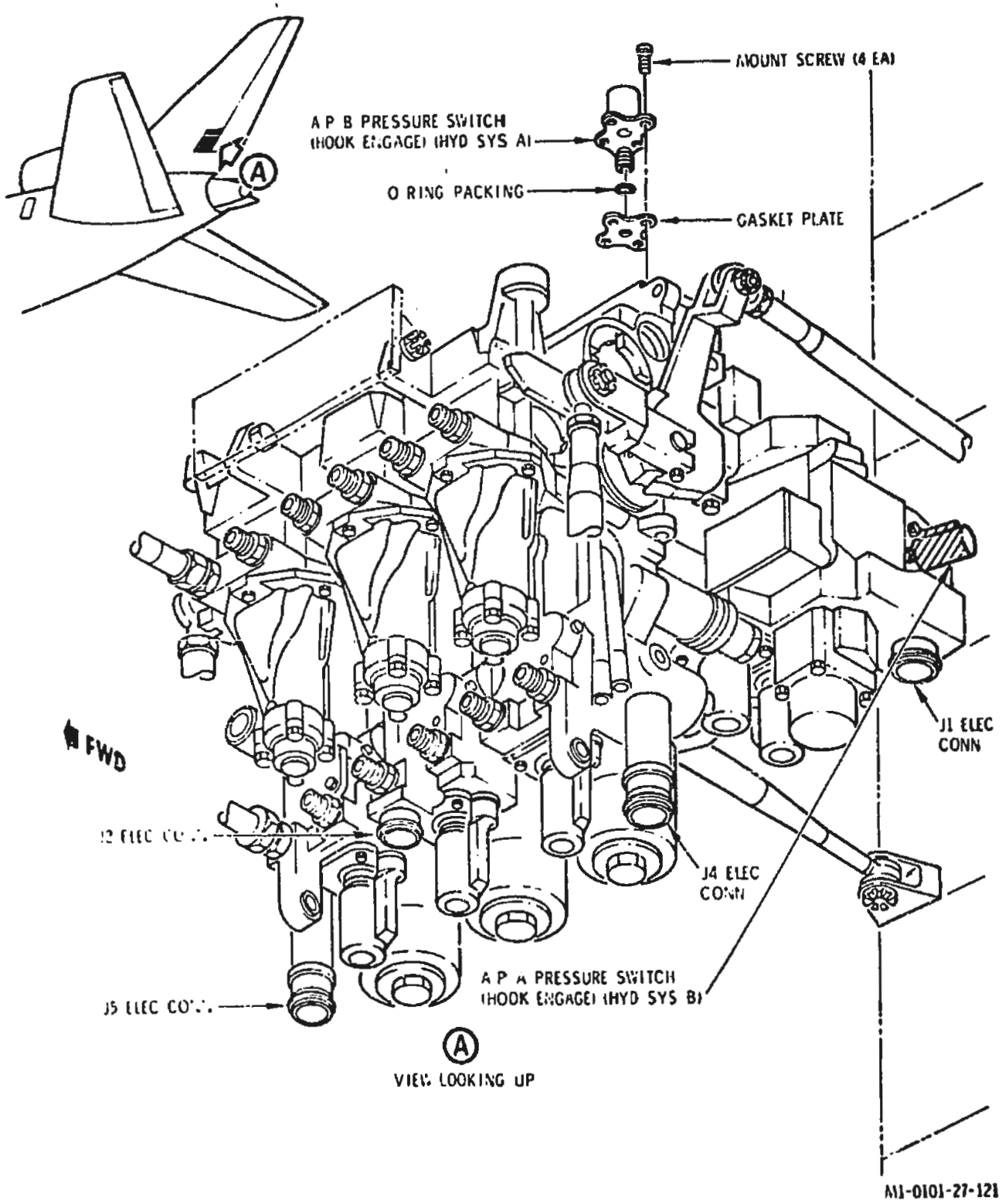
(2) Open access door 324AL to gain access to rudder servo (Ref. 6-40-00).

R (3) Remove mount screws and remove pressure switch (Ref. Fig. 401).

(4) Remove and discard plate gasket.

(5) Remove and discard preformed O-ring packing from switch electrical connection groove.

B. Installation



R Rudder Servo Autopilot Pressure Switch - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

(2) Install new preformed O-ring packing on pressure switch electrical connection groove.

(3) Install new plate gasket and pressure switch on servo. Secure with mount screws and lock-wire.

NOTE: Tri-wing mount screws can be replaced with NAS 1351 socket-head cap screws.

(4) Remove tag and close circuit breaker opened in Step 3A(1).

(5) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on hydraulic system A and B (29-11-00).

(7) Slowly operate rudder through several left and right rudder cycles to bleed rudder.

CAUTION: OPERATING RUDDER AT HIGH RATE CAN DAMAGE RUDDER DAMPER SEALS. OPERATE RUDDER SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(8) Check pressure switch by accomplishing Rudder Dual Position Transducer Check (Ref. 22-15-03, Adjustment/Test).

(9) Close access door.

R (10) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

R (11) Turn off electrical power if no longer required (Ref. 29-11-00).

RUDDER SERVO PRESSURE SWITCH (SYSTEMS A AND B) REMOVAL AND INSTALLATION

1. Equipment and Materials

   O-ring (Ref. Fig. 401)

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or
R equivalent

2. Referenced Procedure

R	6-40-00	External Access Doors and Panels
R R	24-41-00	External Power/Ground Service Systems - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

   A. Removal

      WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

      (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker RUDDER SERVO - A, B.

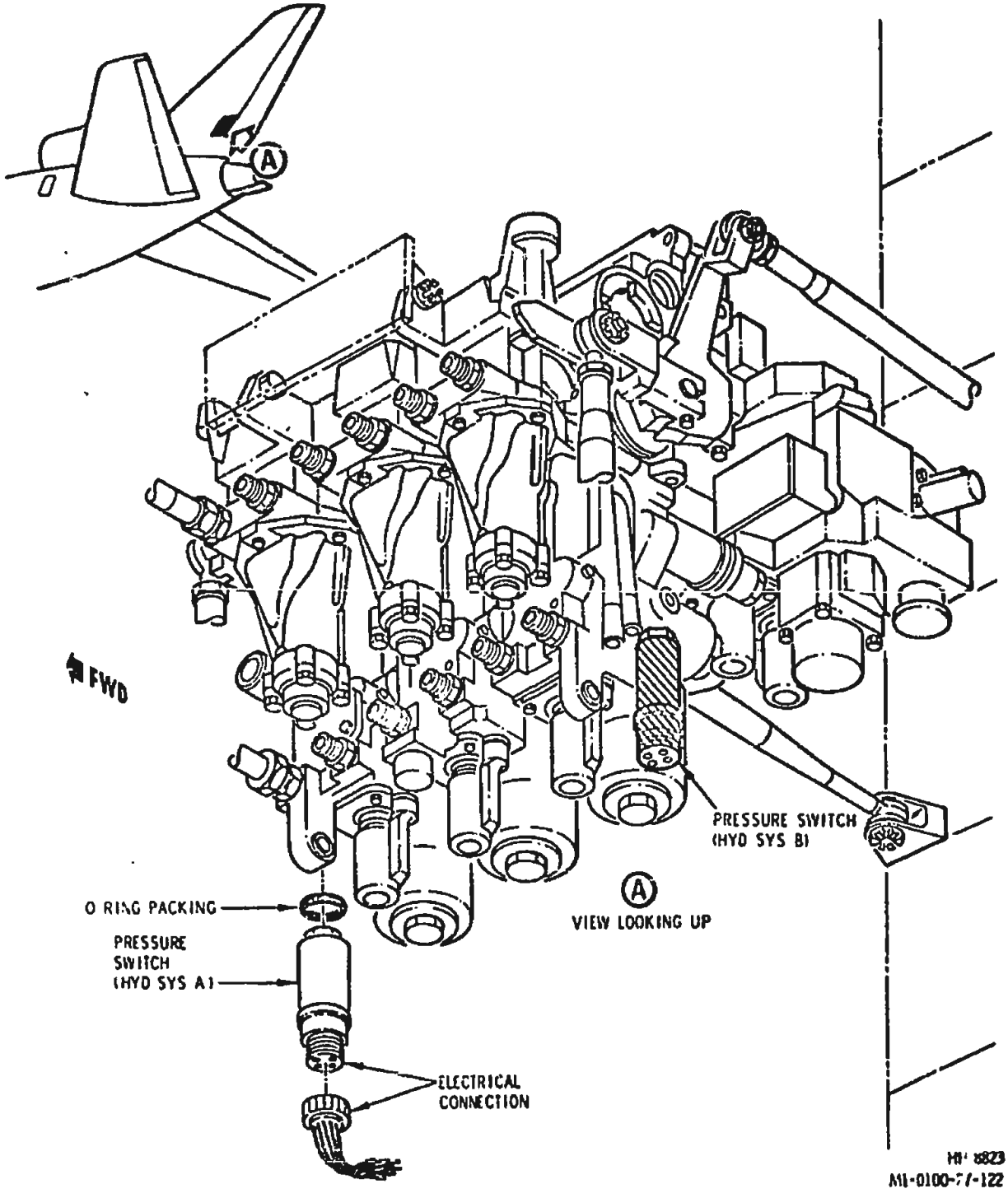
R R (2) Open access door 324AL (system B) or 324AR (system A) to gain access to rudder servo (Ref. 6-40-00).

R R (3) Disconnect electrical connection from pressure switch (Ref. Fig. 401).

R R (4) Remove lock-wire and unscrew pressure switch from servo.

      (5) Remove and discard preformed O-ring packing from groove on thread base.

   B. Installation



R Rudder Servo Pressure Switch (Systems A and B)
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

0508

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

R (2) Install new preformed O-ring packing on thread base groove of replacement pressure switch. Lubricate O-ring with hydraulic oil.

R (3) Install pressure switch by threading into servo boss. Tighten pressure switch hex and lock-wire.

R (4) Install electrical connector.

R (5) Remove tag and close circuit breaker opened in Step 3A(1).

R (6) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (7) Turn on electrical power (Ref. 24-41-00).

R (8) Turn on hydraulic system supplying replacement pressure switch (system A or B) (Ref. 29-11-00).

R (9) Slowly operate rudder through several left and right rudder cycles to bleed rudder.

R CAUTION: OPERATING RUDDER AT HIGH RATE CAN DAMAGE RUDDER DAMPER SEALS. OPERATE RUDDER SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

R (10) Open access door 112AB to gain access to forward electronic service center (FESC).

R (11) Locate flight control auxiliary unit (FCAU) below bottom shelf on center rack. Verify that affected RUDDER HYDRAULIC LIMITER (A or B) OFF light is off.

R (12) On FCAU, depress and hold the affected RUDDER HYDRAULIC LIMITER pushbutton (A or B) to actuate the rudder channel shutoff valve and depressurize the rudder servo

R channel. Verify that the servo channel OFF light (A or
R B) comes on.

R (13) Release pushbutton switch. Verify that OFF light goes
R off.

R (14) Check pressure switch installation for hydraulic
R leakage.

R (15) Turn off hydraulic power (Ref. 29-11-00).

R (16) Turn off electrical power (Ref. 24-41-00).

R (17) Close access doors to rudder servo and FESC.

RUDDER SERVO PRESSURE SWITCH (SYSTEM C) REMOVAL AND INSTALLATION

1. Equipment and Materials

Gasket (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring and gasket plate (Ref. Fig. 401)

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open and tag following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: SPOILER DWELL DC (B7).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

R FLAP LOAD RELIEF CHAN-1 and CHAN-2 (H12 and H20)

(2) Open access door 324AL or 324AR to gain access to rudder servo (Ref. 6-40-00).

(3) Remove pressure switch mount screws and remove switch (Ref. Fig. 401).

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Install new preformed O-ring packing on switch electrical connection groove.

(3) Verify that a gasket plate is installed on pressure switch mounting surface.

(4) Install presure switch. Secure with mount screws and lock-wire.

NOTE: Tri-wing mount screws can be replaced with NAS 1351 socket-head cap screws.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on electrical power (Ref. 24-41-00).

(8) Turn on only hydraulic system C (Ref. 29-11-00).

(9) Slowly operate rudder through several left and right rudder cycles to bleed rudder servo.

CAUTION: OPERATING RUDDER AT HIGH RATE CAN DAMAGE RUDDER DAMPER SEALS. OPERATE RUDDER SLOWLY (4 SECONDS MINIMUM STOP-TO-STOP).

(10) Open access door 112AB to gain access to forward electronic service center (FESC).

(11) Locate Flight Control Auxiliary Unit (FCAU) below bottom shelf on center rack. Verify that RUDDER HYDRAULIC LIMITER C OFF light is not on (Ref. Fig. 401).

(12) Depress and hold C OFF switch to actuate the rudder system C shutoff valve and depressurize the rudder servo C channel. Verify that the C OFF light comes on.

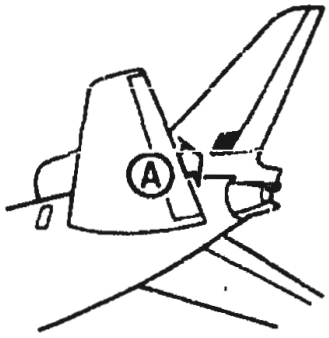
(13) Release C OFF switch to pressurize the rudder servo C channel. Verify that the C OFF light goes off.

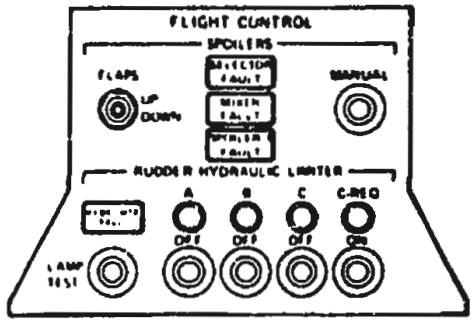
(14) Check the pressure switch installation for any oil leakage.

(15) Shut off hydraulic power (Ref. 29-11-00).

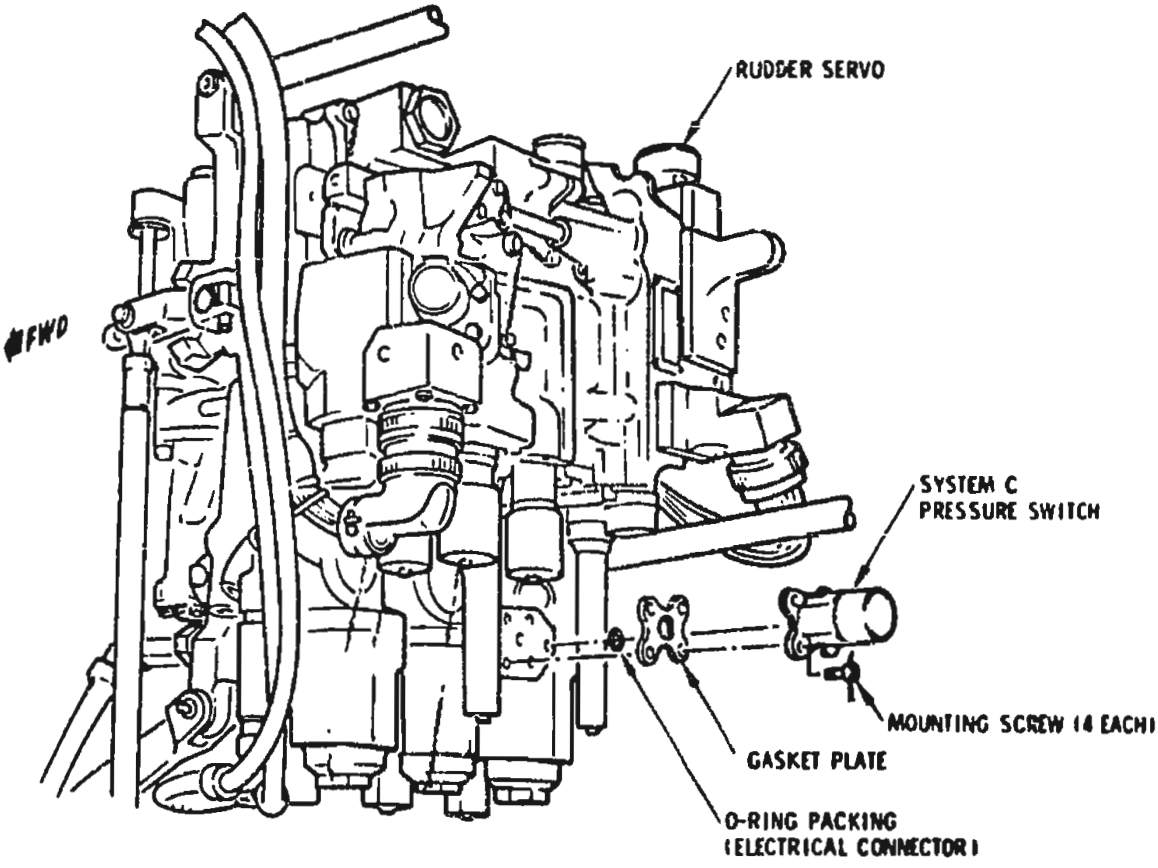
(16) Shut off electrical power (Ref. 24-41-00).

(17) Close access doors.





FLIGHT CONTROL AUXILIARY UNIT PANEL (FCAU)
(IN FORWARD ELECTRONIC SERVICE CENTER, CENTER RACK)



Ⓐ
VIEW LOOKING AT LEFT SIDE OF RUDDER SERVO

M1-0102-27-123

R
R
R

Rudder Servo Pressure Switch (System C)
Removal and Installation
Figure 401

EFFECTIVITY: ALL

0018

R RUDDER SERVO STATIC CAVITY RELIEF VALVE - REMOVAL AND INSTALLATION

R 1. General

R Some outflow from static cavity relief valves under specific
R conditions is normal. Operation of servo with one hydraulic
R system deactivated allows coupler piston in servo to be
R displaced. Pressurization of deactivated system or activation
R of all systems after complete shutdown of servo drives coupler
R piston and forces excess hydraulic fluid out pressure relief
R valve. Maximum flow caused by this condition is 7.0 cc.

R 2. Equipment and Materials:

R O-ring PN 31-914-906, or equivalent

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter or
R equivalent

R 3. Referenced Procedures:

R 6-40-00 Exterior Access Doors and Panels

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Removal and Installation

R A. Removal

R WARNING: ENSURE HYDRAULIC SYSTEMS A, B, AND C ARE OFF (REF.
R 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL AND HYDRAULIC SERVICE
R CENTER HYDRAULIC SERVICING PANEL.

R (1) In hydraulic service center, depressurize hydraulic
R systems A, B and C accumulators (Ref. 29-11-00).
R Verify zero pressure on hydraulic service panel.

R (2) Open access doors 324 AL and/or 324 AR on vertical
R stabilizer (Ref. 6-40-00).

R (3) On aircraft 001-036 with SB29-079,
R disconnect overboard drain line from static cavity
R relief valve (Ref. Fig. 401).

R (4) Loosen static cavity relief valve to relieve any
R residual pressure.

R NOTE: Step 4A(4) is a precautionary step, there should
R be no residual pressure.

R (5) Remove static cavity relief valve.

R NOTE: Any outflow of hydraulic fluid should be removed
R by wiping with rags.

R B. Installation

R (1) Verify hydraulic systems A, B, and C are off,
R accumulators are depressurized and hydraulic control
R panels are tagged (Ref. 29-11-00).

R (2) Install static cavity relief valve (Ref. Fig. 401).
R Torque to 43 to 48 lb in. and install lock-wire.

R (3) On aircraft 001-036 with SB29-079,
R attach overboard drain line to relief valve. Use new
R O-ring.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (4) Turn on hydraulic systems A, B, and C.

R (5) Remove screws from the three bleed ports.

R CAUTION: RAPID CYCLING OF RUDDER CAN DAMAGE RUDDER DAMPER
R SEALS. CYCLE RUDDER SLOWLY (MINIMUM 4 SECONDS
R STOP-TO-STOP).

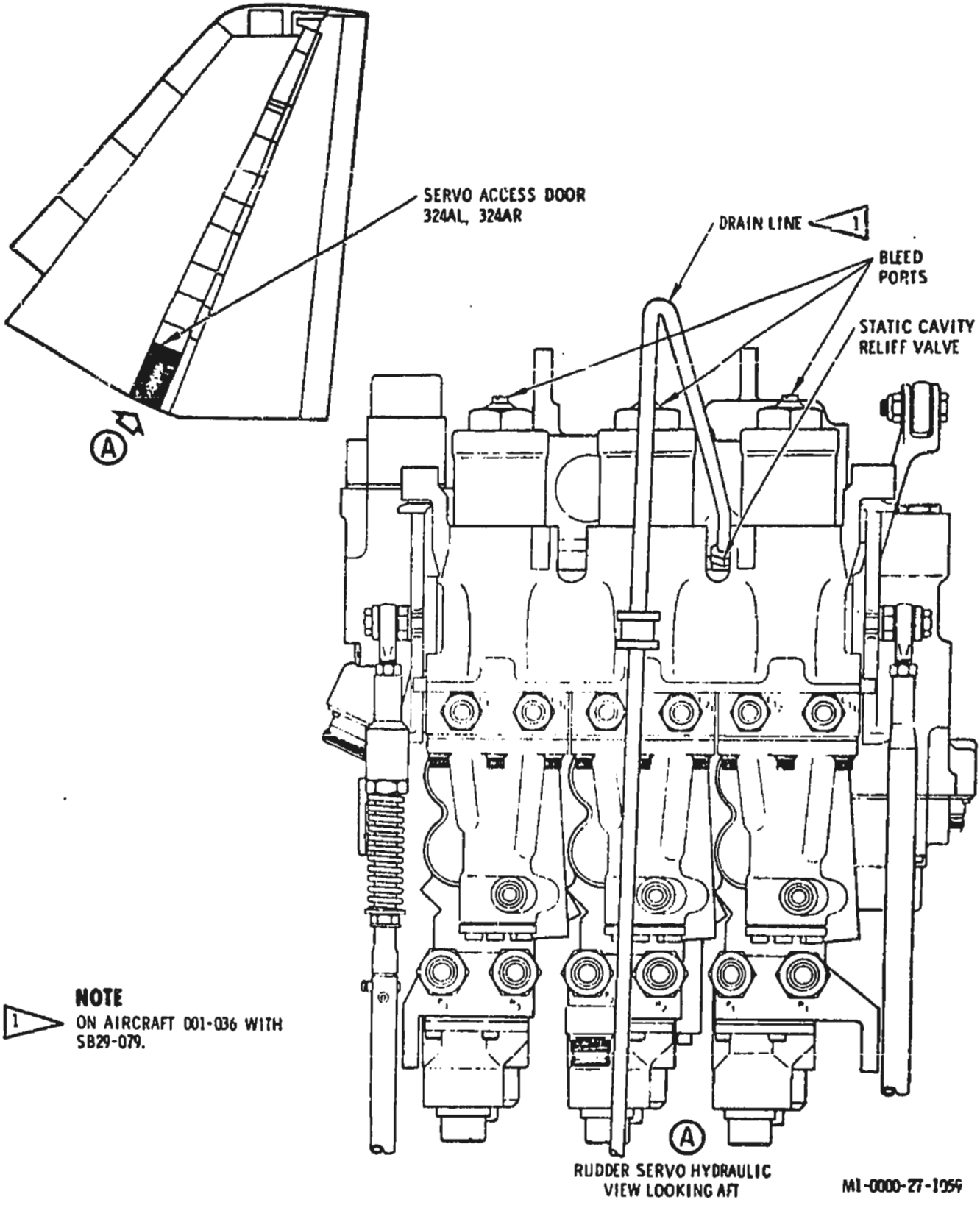
R (6) In flight station cycle rudder pedals until seepage
R from bleed ports indicates all air has been removed.

R (7) Reinstall the three screws in bleed ports. Torque to
R 35 to 50 lb in. and install lock-wire.

R (8) Perform applicable reservoir fill, air check, and air
R bleed procedures in accordance with RESERVOIR SERVICE
R INSTRUCTIONS placard (Ref. 29-11-00).

R (9) Turn off hydraulic power (Ref. 29-11-00).

R (10) Close access panels opened in Step 4A(2).



1 **NOTE**
ON AIRCRAFT 001-036 WITH SB29-079.

R Rudder Servo Static Cavity Relief Valve
R Figure 401

R RUDDER COUNTERBALANCE WEIGHT - REMOVAL AND INSTALLATION

R 1. General

R This procedure includes removal and installation of main rudder
R counterbalance weight and incremental counterbalance weights.
R Main rudder counterbalance weights are made of depleted uranium.
R Incremental weights may be made of either depleted uranium or
R tungsten. Handling tungsten counterbalance weights requires no
R special procedures. Handling undamaged depleted uranium
R counterbalance weights does not require use of protective gloves
R or clothing.

R 2. Equipment and Materials

R Lifting eye 1/4-28 threads, or equivalent

R Integral fuel tank sealing compound, PR 1422

R 1,1,1 Trichloroethane

R Lint-free cleaning rags

R 3. Referenced Procedures

R 6-40-00 Exterior Access Doors and Panels

R 24-00-00 Electrical Power - Maintenance Practices.

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Removal/Installation

R A. Main Counterbalance Weight Removal

R (1) Turn on electrical power (Ref. 24-00-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (2) Turn on hydraulic systems A, B or C.

R (3) Depress either rudder pedal to move rudder full left or
R right. Hold until hydraulic power is shut off.

R NOTE: Depress left rudder pedal if access to rudder
R counterbalance weight is desired on aircraft
R right or right pedal if access is desired on
R left.

R (4) Turn off hydraulic systems A, B and C and tag hydraulic
R control panels against operation (Ref. 29-11-00).

R WARNING: ENSURE HYDRAULIC SYSTEMS A, B AND C ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147.

R (5) Remove access panel 326 C (Ref. 6-40-00) on both sides.

R WARNING: DEPLETED URANIUM IS A HIGH DENSITY MATERIAL WITH A
R NEGLIGIBLE AMOUNT OF RESIDUAL RADIATION. HOWEVER,
R GRINDING, DRILLING, SANDING, FILING, OR MACHINING
R OF ANY DEPLETED URANIUM SURFACE BY ANYONE NOT
R HOLDING A NRC LICENSE IS PROHIBITED BY GOVERNMENT
R REGULATION.

R DEPLETED URANIUM OXIDE, YELLOW AND BLACK CORROSION
R PARTICLES, IS TOXIC.

R ALTERATION OF DEPLETED URANIUM MATERIAL BY
R MECHANICAL METHODS IS PROHIBITED BECAUSE FINELY
R DIVIDED URANIUM PARTICLES SUCH AS MIGHT
R CONSEQUENTLY BE PRODUCED AND INGESTED POSE THE
R SAME HEALTH HAZARD COMMON TO ALL HEAVY METALS
R (I.E. LEAD AND CADMIUM).

R HANDLING OF OXIDIZED COUNTERBALANCE WEIGHTS SHOULD
R BE HELD TO A MINIMUM TO PREVENT BROADCASTING OXIDE
R TO SURROUNDING PERSONNEL AND WORK AREAS.

R EATING AND SMOKING IN IMMEDIATE WORK AREA IS
R FORBIDDEN WHILE PERFORMING REPAIR WORK.

R PERSONNEL PERFORMING WORK ON OXIDIZED DEPLETED
R URANIUM WEIGHTS MUST WEAR DISPOSABLE PROTECTIVE
R GLOVES AND CLOTHES.

R DISPOSE OF ALL POTENTIALLY CONTAMINATED PROTECTIVE
R CLOTHING PER LOCAL, STATE OR FEDERAL REGULATIONS
R REGARDING RADIOACTIVE CONTAMINATED MATERIALS.

R PERSONNEL HANDLING OXIDIZED DEPLETED URANIUM MUST
R THOROUGHLY WASH PRIOR TO EATING, SMOKING, ETC.

R CAUTION: WHEN REMOVING SEALING COMPOUND DO NOT GOUGE OR
R SCRATCH COUNTERBALANCE WEIGHT.

R (6) Remove sealing compound from bolt heads, nuts and from
R fitting on top of counterbalance weight (Ref. Fig.
R 401).

R (7) Install lifting eye in fitting on top of counterbalance
R weight.

R (8) Connect a suitable hoist to lifting eye and take slack
R out of lift cable.

R NOTE: Main Counterbalance weight weighs 80 pounds.

R (9) Remove four nuts and washers that attach counterbalance
R weight and spacer to rudder.

R (10) Separate counterbalance weight - spacer assembly from
R rudder and reinstall nuts and washers on bolts finger
R tight. Lower assembly to ground.

R (11) Separate Counterbalance weight, shear pin, spacer and
R bolts.

R NOTE: It is permissible to press out bolts which are
R locked in the counterweight due to corrosion.
R Use all possible precautions to protect
R counterbalance against damage. Review Warnings
R preceding Step 4A(6) above, and adhere to all
R Warnings concerning depleted uranium weights.

R (12) All oxidized depleted uranium weights removed from
R aircraft should be placed in plastic bags.

R B. Main Counterbalance Weight Installation

R (1) Verify rudder is positioned full left or right and
R access panel 326 C (Ref. 6-40-00) is removed. If not
R perform Steps 4A(1) thru 4A(5).

R (2) Verify hydraulic systems A, B and C are off and tagged
R against operation.

R WARNING: ENSURE HYDRAULIC SYSTEMS A, B AND C ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL AND THEY HYDRAULIC
R SERVICE CENTER HYDRAULIC SERVICING PANEL.

R ENSURE COUNTERBALANCE WEIGHT AND SPACER BEING
R INSTALLED ARE THE CORRECT PART NUMBER FOR THAT
R AIRCRAFT.

R (3) Install lifting eye in fitting on top of counterbalance
R weight (Ref. Fig. 401).

R (4) Clean following surfaces with 1,1,1 trichloroethane and
R wipe dry with clean rags.

R (a) All surfaces of counterbalance weight.

R (b) Attach hardware and shear pin.

R (c) All surfaces of spacer.

R (d) Surface of rudder structure where spacer attaches

R (e) Working surfaces of tools used to install weight.

R (5) Apply sealing compound PR 1422 to the following
R surfaces:

R (a) All surfaces of counterbalance weight.

R (b) Grip of attach bolts.

R (c) Aft surface of spacer and forward surface in and
R around shear pin recess.

R NOTE: Complete installation procedure before
R sealing compound cures.

R Sealing compound must be applied in a very
R thin coat to the external surfaces of
R weight and spacer are due to small
R clearance between weight and vertical
R stabilizer.

R (6) Assemble stack consisting of weight, shear pin, spacer
R bolts, nuts and washers.

R (7) Hoist weight and spacer assembly to position and
R install on rudder. Torque to 110 to 125 pound-inches
R and install cotter pins.

R (8) Remove lifting eye.

R (9) Coat nuts, washers and lifting eye fitting with sealing
R compound PR 1422. Fill counterbalance weight bolt head
R recesses with PR 1422 and smooth to follow contours of
R weight.

R (10) Reinstall access panel 326C.

R (11) Depress rudder pedal to correspond with rudder
R position.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC
R PRESSURE.

R (12) Remove tags from hydraulic control panels and
R pressurize hydraulic systems A, B or C (Ref. 29-11-00).

R (13) Cycle rudder left and right very slowly several times.
R Verify clearance between counterbalance weight and
R vertical stabilizer.

R (14) Turn off hydraulic power (Ref. 29-11-00).

R (15) Turn off electrical power (Ref. 24-00-00).

R C. Incremental Counterbalance Weight Removal

R (1) Turn on electrical power (Ref. 24-00-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (2) Turn on hydraulic systems A, B or C.

R (3) Depress either rudder pedal to move rudder full left or
R right.

R NOTE: Depress left rudder pedal if access to rudder
R counterbalance weights is desired on aircraft
R right or right pedal if access is desired on
R left.

R (4) Turn off hydraulic systems A, B and C and tag hydraulic
R control panels against operation.

R WARNING: ENSURE HYDRAULIC SYSTEMS A, B AND C ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147.

R (5) Remove access panel 326 C (Ref. 6-40-00).

R WARNING: DEPLETED URANIUM IS A HIGH DENSITY MATERIAL WITH A
R NEGLIGIBLE AMOUNT OF RESIDUAL RADIATION. HOWEVER,
R GRINDING, DRILLING, SANDING, FILING, OR MACHINING
R OF ANY DEPLETED URANIUM SURFACE BY ANYONE NOT
R HOLDING AN NRC LICENSE IS PROHIBITED BY GOVERNMENT
R REGULATION.

R DEPLETED URANIUM OXIDE, YELLOW AND BLACK CORROSION
R PARTICLES, IS TOXIC.

R ALTERATION OF DEPLETED URANIUM MATERIAL BY
R MECHANICAL METHODS IS PROHIBITED BECAUSE FINELY
R DIVIDED URANIUM PARTICLES SUCH AS MIGHT
R CONSEQUENTLY BE PRODUCED AND INGESTED POSE THE
R SAME HEALTH HAZARD COMMON TO ALL HEAVY METALS
R (I.E. LEAD AND CADMIUM).

R HANDLING OF OXIDIZED COUNTERBALANCE WEIGHTS SHOULD
R BE HELD TO A MINIMUM TO PREVENT BROADCASTING OXIDE
R TO SURROUNDING PERSONNEL AND WORK AREAS.

R EATING AND SMOKING IN IMMEDIATE WORK AREA IS
R FORBIDDEN WHILE PERFORMING REPAIR WORK.

R PERSONNEL PERFORMING WORK ON OXIDIZED DEPLETED
R URANIUM WEIGHTS MUST WEAR DISPOSABLE PROTECTIVE
R GLOVES AND CLOTHES.

R DISPOSE OF ALL POTENTIALLY CONTAMINATED PROTECTIVE
R CLOTHING PER LOCAL, STATE OR FEDERAL REGULATIONS
R REGARDING RADIOACTIVE CONTAMINATED MATERIALS.

R PERSONNEL HANDLING OXIDIZED DEPLETED URANIUM MUST
R THOROUGHLY WASH PRIOR TO EATING, SMOKING, ETC.

R CAUTION: WHEN REMOVING SEALING COMPOUND DO NOT GOUGE OR
R SCRATCH COUNTERBALANCE WEIGHT.

R (6) Remove sealing compound from bolt heads and nuts (Ref.
R Fig. 401).

R (7) Remove bolts, nuts and washers.

R (8) Remove incremental counterbalance weights and record
R number and location of weights removed.

R NOTE: It is permissible to press out bolts which are
R locked in the counterweights due to corrosion.
R Use all possible precautions to protect
R counterbalance against damage. Review Warnings
R preceding Step 4A(6) above, and adhere to all
R Warnings concerning depleted uranium weights.

R (9) All oxidized depleted uranium weights removed from
R aircraft should be placed in plastic bags.

R D. Incremental Counterbalance Weight Installation

R (1) Verify rudder is positioned full left or right and
R access panel 326 C (Ref. 6-40-00) is removed. If not
R perform Steps 4C(1) thru 4C(5).

R (2) Verify hydraulic systems A, B and C are off and tagged
R against operation.

R WARNING: ENSURE HYDRAULIC SYSTEMS A, B AND C ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC
R SERVICE CENTER HYDRAULIC SERVICING PANEL.

R (3) Clean following surfaces with 1,1,1 trichloroethane and
R dry with clean rags:

R (a) All exposed surfaces of each incremental weight.

R (b) Attach hardware.

R (c) Rudder structure where incremental weights attach.

R (d) Working surfaces of tools used to install weights.

R (4) Apply sealing compound PR 1422 to the following
R surfaces (Ref. Fig. 401):

R (a) All exposed surfaces of each incremental weight.

R (b) Grip of attach bolts.

R NOTE: Complete installation operation before sealing
R compound cures.

R (5) Attach incremental weights with bolts, nuts and
R washers. Torque to 110 to 125 pound-inches.

R (6) Coat bolt heads, nuts and washers with sealing compound
R PR 1422.

R (7) Reinstall access panel 326 C.

R (8) Depress rudder pedal to correspond with rudder
R position.

R R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R R R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

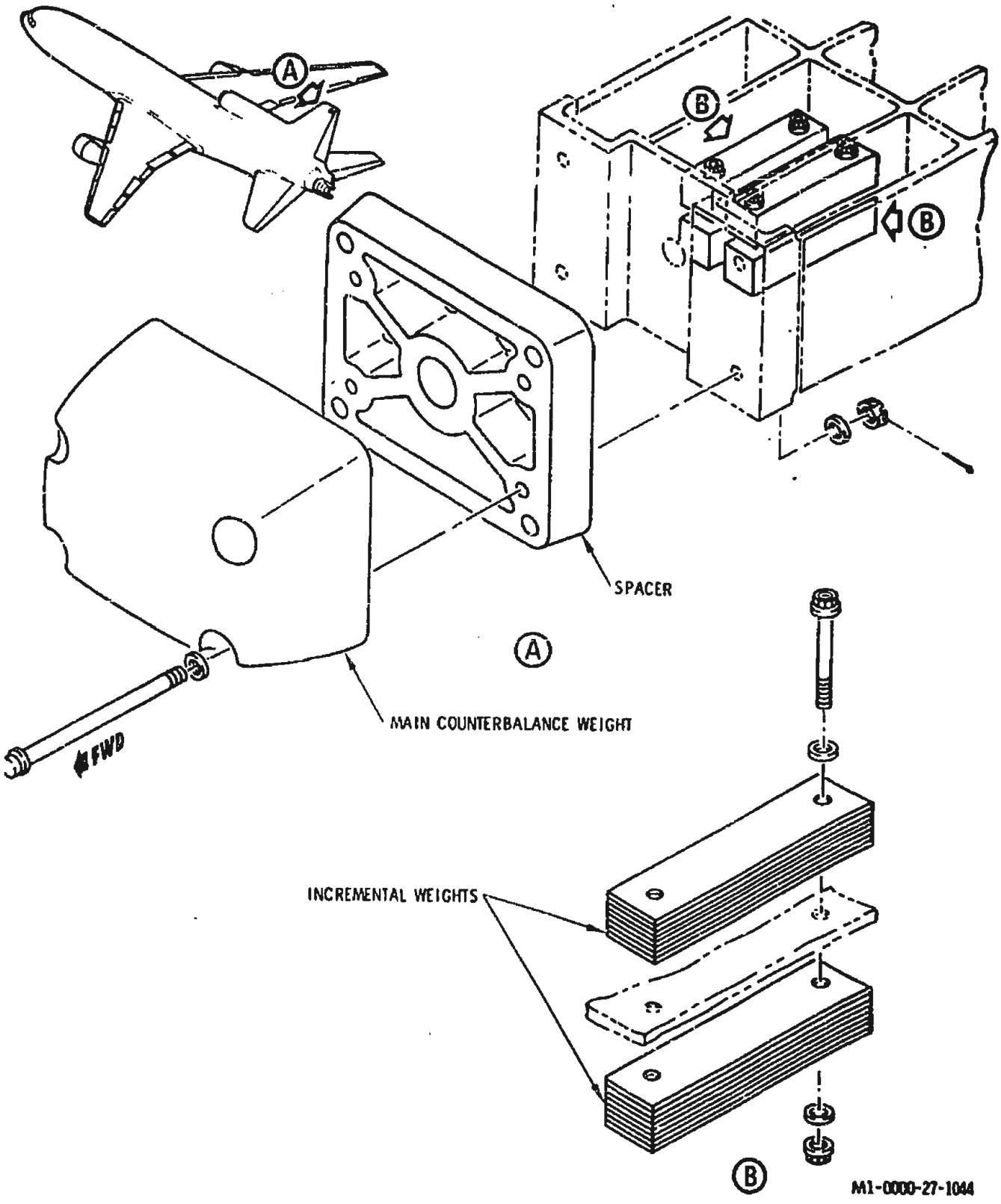
R R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (9) Remove tags from hydraulic control panels and R pressurize hydraulic systems A, B or C (Ref. 29-11-00).

R (10) Cycle rudder left and right several times. Verify R smooth operation.

R (11) Turn off hydraulic power (Ref. 29-11-00).

R (12) Turn off electrical power (Ref. 24-00-00).



R Rudder Counterbalance Weight - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

RUDDER TRIM CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

The rudder trim system allows the pilot to apply small manual inputs into the rudder control system to trim the yaw axis. The trim system inputs are applied to the pilots rudder servo input linkage, and produces a position command to the rudder (Ref. Fig. 1).

Rudder trim is accomplished by rotating the yaw control wheel on the aileron and rudder trim control assembly located at the rear
R of the center console. A torque tube and two universal
R couplings transmit trim inputs to a cable drum beneath the flight station floor. Two 3/32-inch diameter cables extend from the drum rearward through openings in the floor beams to the afterbody. Split nylon-ball cable seals are used at the rear pressure bulkhead to seal the cable openings. The cables are then routed around the left side of the No. 2 engine inlet duct to the rudder trim actuator located just below and forward of the rudder servo (zone 314).

Cable inputs into the mechanical jackscrew actuator causes the actuator to extend or retract. The output of the actuator is applied to the rudder control system through the feel spring and shifts the neutral force position of the feel spring. The rudder servo responds and moves the rudder to the new trim position. Rudder trim capability is ten degrees left and right from neutral.

R 2. Cable Drum

R A. Description and Operation

R The cable drum converts rudder trim control shaft inputs to
R cable motion. The cable drum assembly consists of a splined
R shaft which is bearing-mounted to a bracket; the hub is
R splined and coupled to the shaft.

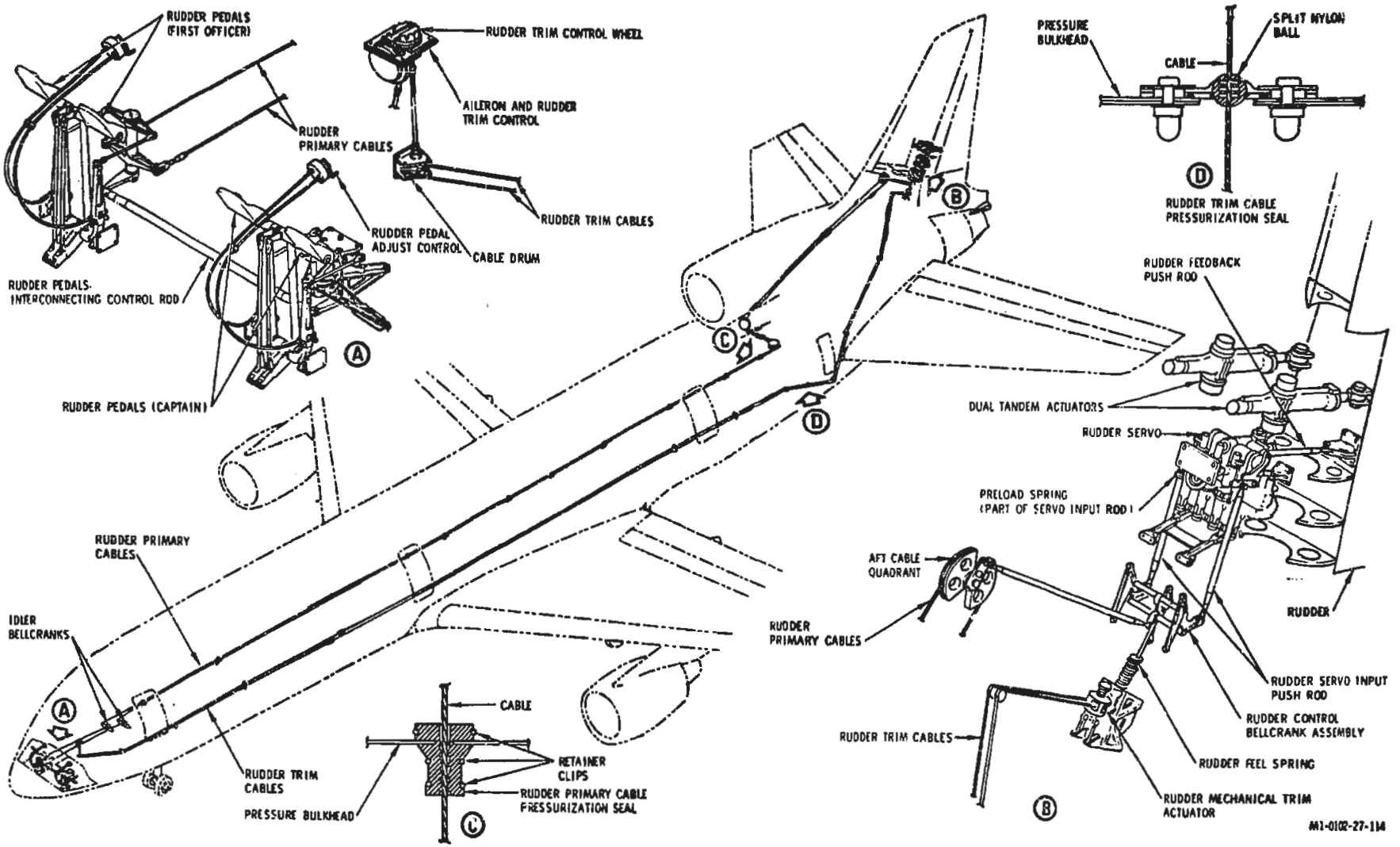
R The cable drum shaft extends above the drum and incorporates
R a universal coupling. The top half of the universal
R coupling contains a splined stub shaft which mates with the
R rudder trim control shaft.

R The cable drum contains spiral grooves for wrapping the trim
R cables. A keyhole slot is provided on top and on the bottom
R of the drum to retain the trim cable ball ends. Two holes
R are drilled through the drum to provide for safetying the
R ball ends with lock-wire.

R 3. Rudder Trim Control

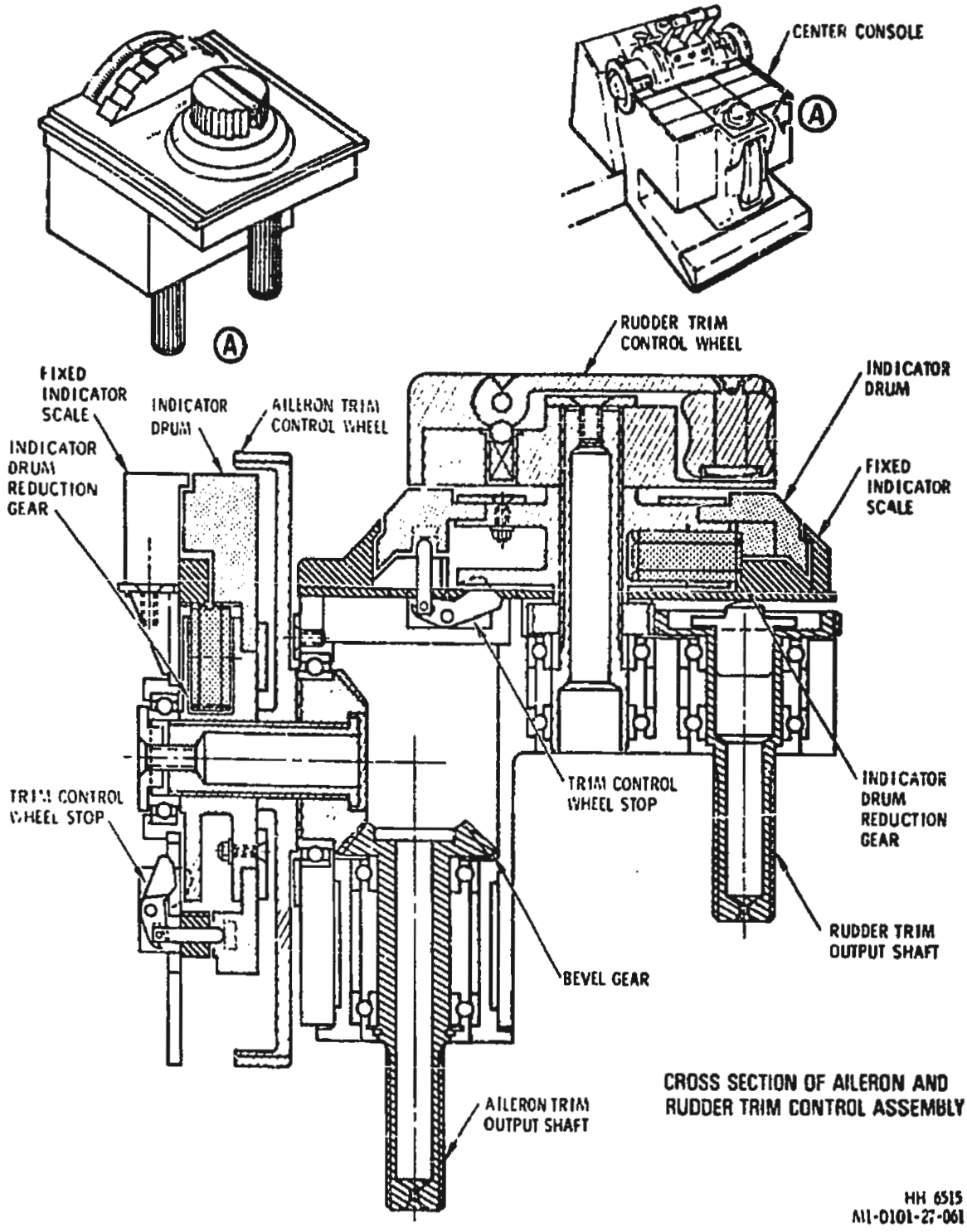
R A. Description and Operation

The rudder and aileron trim control units are housed in one assembly. The rudder control (Ref. Fig. 2) is mounted on the rear section of the housing and consists of a notched wheel, with a folding tiller handle, an indicator drum, and a splined output shaft. The indicator drum contains a pointer that is driven by the control wheel through a differential gear reduction. The splined output shaft is driven by a reduction spur gear and extends vertically from the bottom of the assembly. Six revolutions of the Yaw control wheel produces four revolutions of the output shaft, and will move the indicator drum pointer from NOSE R 10 degrees to NOSE L 10 degrees. Control wheel rotation is limited to six revolutions by a stop actuated by the indicator drum.



Rudder Trim Control System
Figure 1

EFFECTIVITY: ALL



Aileron and Rudder Trim Control Assembly
Figure 2

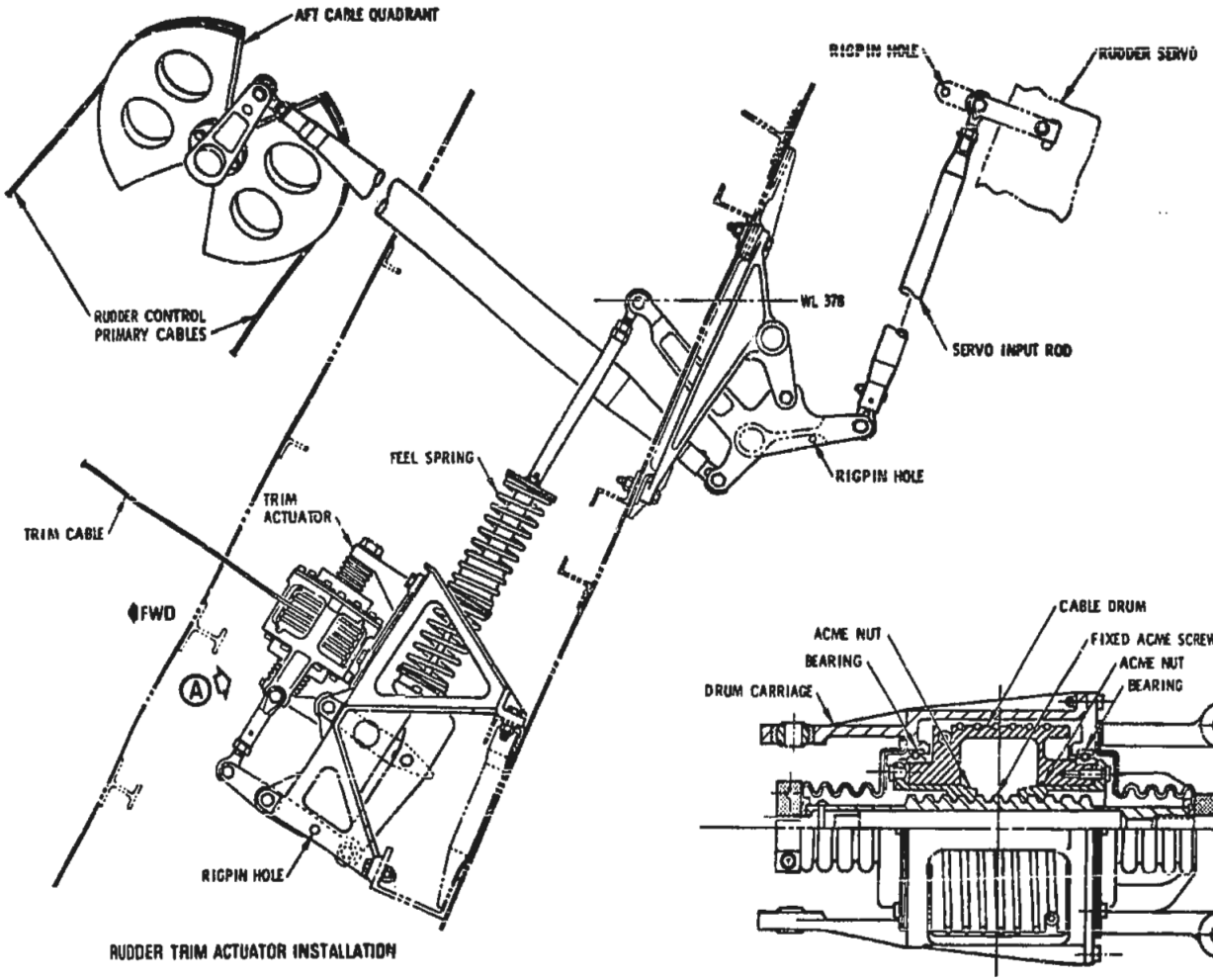
R 4. Rudder Trim Actuator

A. Description and Operation

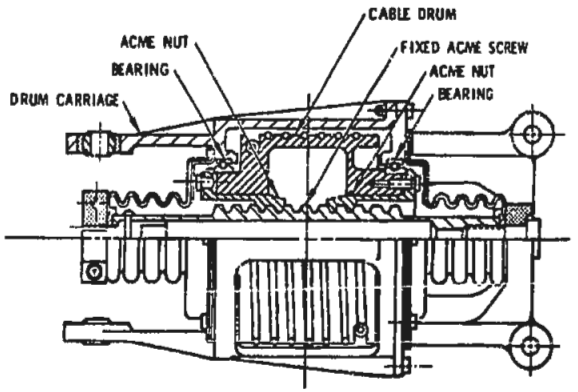
The rudder trim actuator is a mechanical jackscrew actuator that converts cable drum rotation to a lineal output. The jackscrew output is applied to the pilots rudder control system through the feel spring cartridge. The actuator consists of a cable drum, running on an acme screw, that drives two output arms (Ref. Fig. 3).

The trim cables enter the drum near the center and winds in spiral grooves, one in each direction to the drum ends, where the cable ball ends are clamped to the drum. Cable motion causes the drum to wind the cable onto one end of the drum while it unwinds from the other end. Two Acme nuts in the center of the drum translate rotary motion into lineal motion. The nuts and drum travel along the acme screw which is held fixed by the housing.

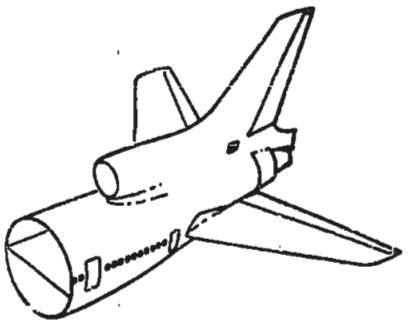
The pitch of the screw and the pitch of the drum cable grooves are the same, so the drum moves at the same rate as the cable advances. Consequently, the plane through the cables remains fixed with respect to the housing. The lineal output motion of the two nuts running on the screw is transmitted from the nuts through bearings to the drum carriage. The carriage includes two output arms that contain self-aligning bearings. Carriage linear movement is approximately one and three-quarter inches.

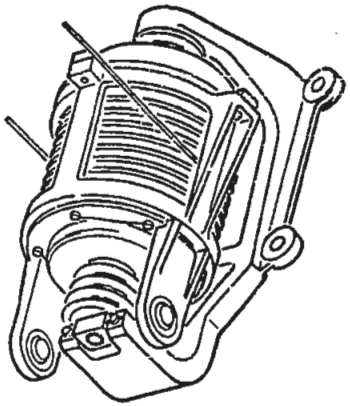


RUDDER TRIM ACTUATOR INSTALLATION



CROSS SECTION OF TRIM ACTUATOR





A

TRIM ACTUATOR ASSEMBLY

G 1011
M1-0102-27-115

Rudder Trim Actuator
Figure 3

EFFECTIVITY: ALL

001B

RUDDER TRIM CONTROL SYSTEM - ADJUSTMENT AND TEST

1. General

These procedures must be used to perform a rigging check (Ref. Para. 4) and adjustment/test (Ref. Para. 5) of the rudder trim control system.

The L-1011 flight control system is designed and adjusted to provide straight and level flight with the rudder trim indicator between plus and minus 2 marks.

NOTE: On aircraft 001 only, the adjustment of the YAW trim wheel has been biased to provide straight and level flight with the YAW trim wheel at zero. A decal located at the left underside of the alternate landing gear control cover specifies 0.5 mark R YAW trim bias for aircraft 001. It should be noted that for the 0.5 mark NOSE R bias specified, the YAW trim wheel is set to 0.5 mark NOSE L with the rig pin in the YAW trim cable drum. Removing the rig pin and positioning the YAW trim wheel to zero produces a 0.5 mark NOSE R bias.

SB 11-088 installs the YAW trim bias decal on aircraft 001-031.

All other aircraft have incorporated the decal in production.

2. Equipment and Materials

Tensiometer, Pacific Scientific PN1601009, or equivalent

5/16-inch-diameter rig pins, 3 inches long (2 each) (part of B734 rig pin kit)

R Rudder Trim Wheel Torque Adapter F20123 Det. -0303

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test

R 27-22-04 Rudder Trim Actuator - Removal and Installation

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Rigging Check

R A. Rudder Trim Control System

R (1) On Pilots overhead circuit breaker panel CB1, zone 210,
R verify that CB SURF POS IND (J23) is open.

R (2) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, verify that all 3 CB
R RUDDER SERVO (K12, K13, K14) are open.

R (3) Open following access doors (Ref. 6-40-00):

R (a) 112 AB to forward electronic service center.

R (b) 313FR to trim actuator in upper afterbody.

R (4) On aircraft 001,
R position YAW trim wheel to 0.5 mark NOSE L.

R (4) On aircraft 002-033,
R position YAW trim wheel to 0.

R (5) Rig pin R3 must fit freely through bracket and rudder
R trim cable drum (2) below flight station (Ref. Fig.
R 501), and if not, perform the following:

R (a) Loosen screws holding aileron and rudder trim
R control to console, and raise trim control to
R disengage drive spline from shaft.

R NOTE: Raising trim control will disengage both
R aileron and rudder shafts.

R (b) Position aileron trim cable drive drum to allow
R installation of rig pin R3 through bracket and
R cable drum [(1)(beneath flight station floor)].

R (c) Position rudder trim cable drive drum to allow
R installation of rig pin R3 through bracket and
R cable drum [(2)(beneath flight station floor)].

R (d) On aircraft 001,
R position YAW trim control wheel to 0.5 mark NOSE
R L.

R (d) On aircraft 002-033,
R position YAW trim control wheel to 0.

R (e) Position roll trim control wheel to the neutral
R rig position (Ref. Roll Trim Bias, Table 501,
R 27-11-00, Adjustment and Test).

R (f) Engage trim control roll and yaw output spline
R drives with aileron and rudder shaft splines.

R 1. Tighten trim control attaching screws.

R (g) On aircraft 001,
R verify that YAW control wheel still reads 0.5 mark
R NOSE L, and ROLL control wheel is at neutral rig
R position (Ref. Roll Trim Bias Table 501, 27-11-00,
R Adjustment and Test).

R (g) On aircraft 002-033,
R verify that YAW trim wheel still reads 0, and ROLL
R control wheel is at neutral rig position (Ref.
R Roll Trim Bias Table 501, 27-11-00, Adjustment and
R Test).

R (h) Remove rig pin from aileron trim cable drum (1).

R (6) Gain access to rudder trim actuator in afterbody dorsal
R saddle area.

R (7) Verify that the length of trim actuator output links
R (6) is 3.28 (±0.060) inches between attaching bolt
R centers (Ref. Fig. 501, View C).

R (8) With rig pin R3 in rudder trim cable drum, rig pin R3
R should fit freely through the rudder trim actuator
R output bellcrank (3) and bracket, and trim cable
R tension must conform to temperature compensation chart
R (Ref. 501).

R NOTE: If not, adjust turnbuckles (4) and (5). If a
R cable adjustment is made, remove all rig pins
R and operate rudder trim wheel through three full
R cycles to stabilize cables before making final
R rigging check.

R (9) Verify that clearance between actuator drum carriage
R assembly and both rudder trim cables are 1/32 (0.031)
R inch or more (Ref. 27-22-04, Fig. 401).

R (10) Remove all rig pin.

(11) On Pilots overhead circuit breaker panel CB1, zone 210, verify that CB SURF POS IND (J23) is closed.

(12) On Flight Engineer/Second Officers overhead circuit breaker CB2, zone 215, verify that all 3 CB RUDDER SERVO (K12, K13, K14) are closed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(13) Turn on electrical power (Ref. 24-41-00).

(14) Turn on any one of following hydraulic systems A, B, or C (Ref. 29-11-00).

(15) Position the YAW trim wheel to 10 marks NOSE L.

(a) To minimize the effect of friction hysteresis depress rudder pedal in corresponding trim direction and allow pedal to freely return.

(b) Verify that RUD pointer on the surface position indicator moves to 10 degrees nose left. Verify the rudder travels from 13.9 to 15.3 inches left (10 ±0.5 degrees).

R

CR
C
C
CR
C
C
C
C
C

NOTE: If rudder throw is short of the 13.9 minimum in (8) and (9) but returns within limits when the rudder is deflected past the maximum 15.3 with the rudder pedals and then released, the most likely cause is friction in the system. The most frequent cause of excessive friction is seized pulleys under the aft lavatories at fuselage station 1809.

(16) Position the YAW trim wheel to 10 marks NOSE R.

(a) To minimize the effect of friction hysteresis depress rudder pedal in corresponding trim direction and allow pedal to freely return.

(b) Verify that RUD pointer on the surface position indicator moves to 10 degrees nose right. Verify
R the rudder travels from 13.9 to 15.3 inches right (10 ±0.5 degrees).

(17) Return YAW trim wheel to zero.

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-21-00).

(20) Close access doors opened in Step 4A(3).

B. Rudder Trim Travel and Forces Check

(1) On aircraft 001, position YAW trim control wheel to 0.5 mark NOSE L.

(1) On aircraft 002-999, position YAW trim control wheel to zero.

(2) Verify rudder is faired ±0.5 degrees.

(3) Position YAW trim control wheel to 10 marks NOSE L.

(4) Depress left rudder pedal, then allow pedal to return to trim position.

(5) On aircraft 001, verify rudder deflection is 9.0 to 10.0 degrees (13.1 to 14.6 inches from rudder trailing edge to fixed trailing edge).

(5) On aircraft 002-999, verify rudder deflection is 9.5 to 10.5 degrees (13.9 to 15.3 inches from rudder trailing edge to fixed trailing edge).

(6) On aircraft 001, position YAW trim control wheel to 9.5 marks NOSE R.

(6) On aircraft 002-999, position YAW trim control wheel to 10 marks NOSE R.

(7) Depress right rudder pedal, then allow pedal to return to trim position.

(8) Verify rudder deflection is 9.5 to 10.5 degrees (13.9 to 15.3 inches from rudder trailing edge to fixed trailing edge).

(9) Position YAW trim control wheel to zero.

(10) Install rudder trim wheel torque adapter F20123 Det. -0303 on crank of rudder trim wheel.

(11) Verify torque to start rotation of trim wheel is less than 8.1 lb-in in either direction.

(12) Depress and hold left rudder pedal at full left rudder position.

(13) Verify torque required to position rudder trim wheel to full left rudder trim does not exceed 17.0 lb-in.

(14) Release left rudder pedal and depress and hold right rudder pedal at full right rudder position.

(15) Verify torque required to position rudder trim wheel to full right rudder trim does not exceed 17.0 lb-in.

5. Adjustment/Test

(1) On Pilots overhead circuit breaker CB1, zone 210, verify that CB SURF POS IND (J23) is closed.

(2) On Flight Engineer/Second Officers overhead circuit breaker CB2, zone 215, verify that all 3 CB RUDDER SERVO (K12, K13, K14) are closed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on electrical power (Ref. 24-41-00).

(4) Turn on any one of following hydraulic systems A, B, or C (Ref. 29-11-00).

(5) Operate YAW trim wheel from full NOSE L to full NOSE R three times. The trim control system must operate smoothly (no binding).

(6) Position YAW trim wheel to full NOSE L. To minimize the effect of friction hysteresis, depress rudder pedals in corresponding trim direction and allow pedal to freely return.

(7) Verify RUD needle on surface position indicator reads 9.5 to 10.5 degrees left rudder.

(8) Position YAW trim wheel to full NOSE R. To minimize the effect of friction hysteresis, depress rudder pedals in corresponding trim direction and allow pedal to freely return.

(9) Verify RUD needle on surface position indicator reads 9.5 to 10.5 degrees right rudder.

(10) Position wheel to zero.

NOTE: Rudder trim less that ±2 marks is considered normal and should not require any maintenance action other than a visual check of flight control surfaces for obvious damage.

Rudder trim more than ±2 marks is considered abnormal and following checks should be made:

1. Check rudder trim rigging (Ref. Para. 4).

2. Visually check spoilers for damage, floating, or misrigging.

3. Visually check flaps and slats for damage or misrigging, particularly for proper retract position.

4. Visually check rudder for damage or misrigging.

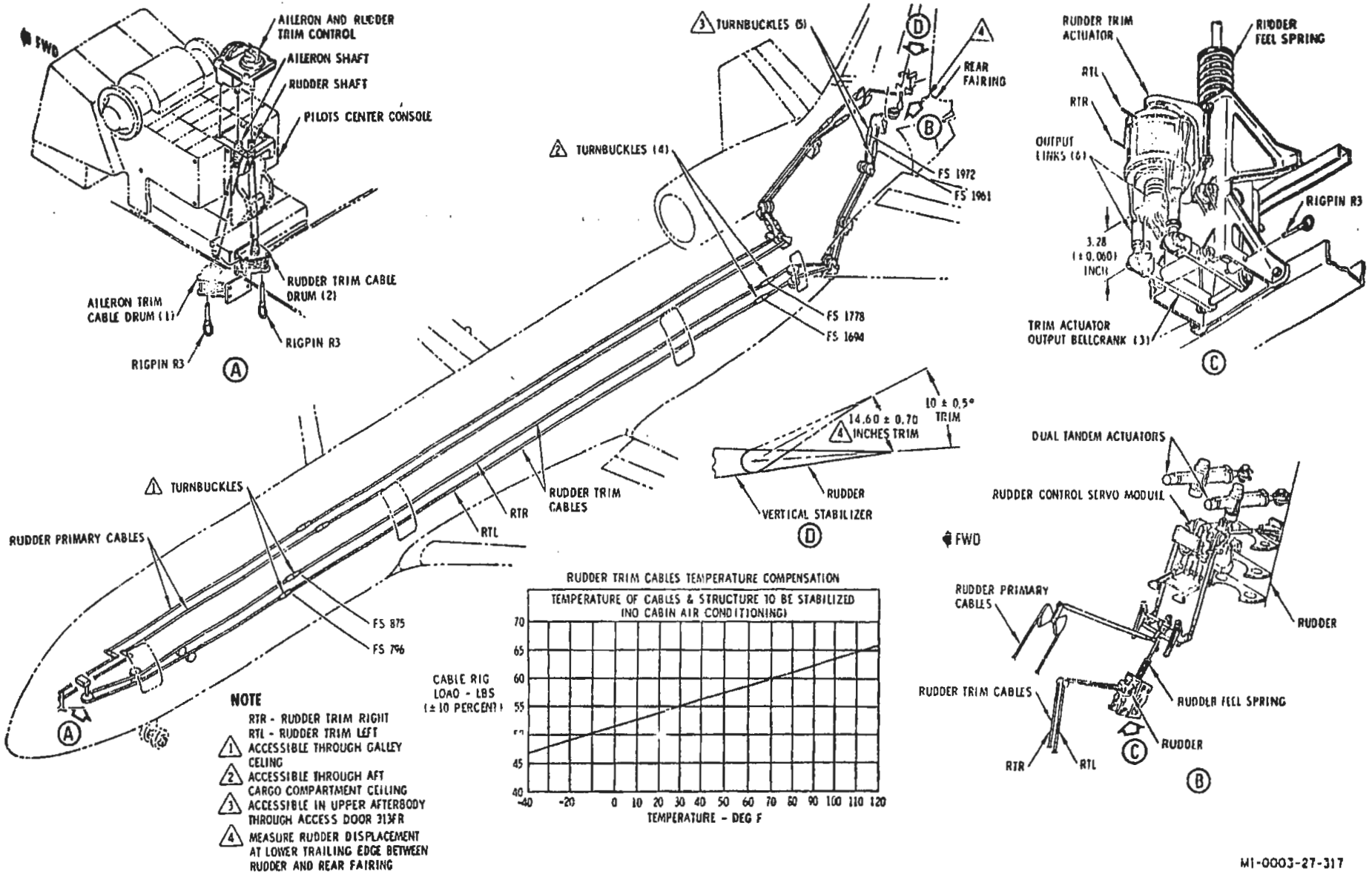
5. Visually check external structure of the wings, horizontal and vertical stabilizer.

6. Perform an operational check of primary flight control system. Verify that surfaces respond properly to control inputs.

Surface throw checks are not required. Visually check operation of surface and surface position indicator with respect to control inputs.

(11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(12) Turn off electrical power if no longer required (Ref. 24-41-00).



MI-0003-27-317

R Rudder Trim Control System - Rigging Check and Adjustment
R Figure 501

EFFECTIVITY: ALL

001B

RUDDER TRIM CABLE DRUM ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin - 5/16-inch diameter by 3 inches long (R3) (2 each)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020 inch diameter

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
25-12-12	Pilots Handset Holder - Removal and Installation
25-13-05	Center Console Trim Covers - Removal and Installation
27-22-00	Rudder Trim Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Adjustment and Test

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Position the YAW trim wheel on center console to zero (neutral position) (on aircraft 001, position YAW trim wheel to 1/2 mark NOSE L).

(2) Remove pilots headset and console aft trim panel to gain access to rudder trim vertical shaft (Ref. 25-12-12, and 25-13-05).

(3) Open access panel 313FR on right side of dorsal fin to gain access to rudder trim actuator in upper afterbody (Ref. 6-40-00).

(4) Install rig pin (R3) through bracket and the rudder trim actuator output bellcrank in upper afterbody (Ref. Fig. 401).

(5) Gain access to galley. Remove access panels in galley ceiling to gain access to rudder trim cable turnbuckles

R which are located at fuselage stations 796 and 875,
R buttline 30 left.

R (6) Tag rudder trim cables for identification.

R (7) Disconnect both rudder trim cable turnbuckles in galley
R ceiling. Install cable blocks or use bungee chord to
R tie aft trim cables to structure (to prevent
R disconnected cables from becoming slack and fouling on
R structure or equipment).

R (8) Open access door 112AB to forward electronic service
R center (FESC).

R (9) Locate rudder trim cable drum assembly bolted to aft
R side of floor beam at fuselage station 189. Remove
R four bolts, washers, and nuts attaching cable drum
R assembly to floor beam. Move drum assembly downward to
R disengage vertical shaft from trim control unit.

R (10) Remove cables from drum assembly as follows:

R (a) Tag cables for identification (tag left cable RTL
R and right cable RTR).

R NOTE: Note that RTL cable ball end is in bottom
R keyhole slot and RTR cable ball end is in
R top keyhole slot.

R (b) Remove cotter pins and washers and remove three
R cable guard pins.

R (c) Remove lock-wire retaining cable ball ends in
R keyhole slots.

R (d) Disengage cable ball ends from keyhole slots and
R unwrap cables from drum. Remove drum assembly
R with vertical shaft from aircraft.

R (e) Reinstall guard pins on drum assembly.

R (11) Remove vertical shaft from drum assembly by removing
R the bolt connecting the vertical shaft to the universal
R coupling.

R B. Installation

R (1) Install cables in replacement drum assembly as follows:

R (a) Remove cable guard pins.

(b) With drum assembly held in the installed position, insert the RTL (left) cable in bottom keyhole slot. Rotate cable drum counterclockwise (looking up) 2.5 turns. (Keyhole slot should end up on aft side.)

(c) Starting on right side of cable drum, wrap RTR (right) cable, 2.5 turns clockwise (looking up) on cable drum. Then insert ball end in the top keyhole slot.

(d) Safety ball ends by inserting lock-wire from top to bottom through two holes. Twist lock-wire on bottom and tuck lock-wire in cable slot so lock-wire does not contact drum bracket. Rotate cable drum one full rotation to verify that lock-wire does not rub on drum bracket. Return drum to rig position (keyhole slots facing aft).

(2) Insert rig pin R3 through bracket and drum to lock drum in neutral position.

(3) Engage rudder trim vertical shaft to drum assembly splined shaft and install the connecting bolt, washer, and nut.

(4) With assistant in flight station guiding the rudder trim vertical shaft into engagement with the rudder trim control shaft, position drum assembly in the mounted position. Install the four mounting bolts, washers, and nuts.

R (5) Verify that the YAW trim wheel is still in the
R zero-degree position (on aircraft 001, YAW trim wheel should read 1/2 mark NOSE L). Remove rig pin from cable drum.

(6) In galley ceiling, reconnect rudder trim cable turnbuckles.

(7) Rig rudder trim cables: Adjust cable turnbuckles until cable tension conforms to temperature compensation chart (Ref. Fig. 401) and rig pin R3 fits freely through the forward cable drum. Safety turnbuckles.

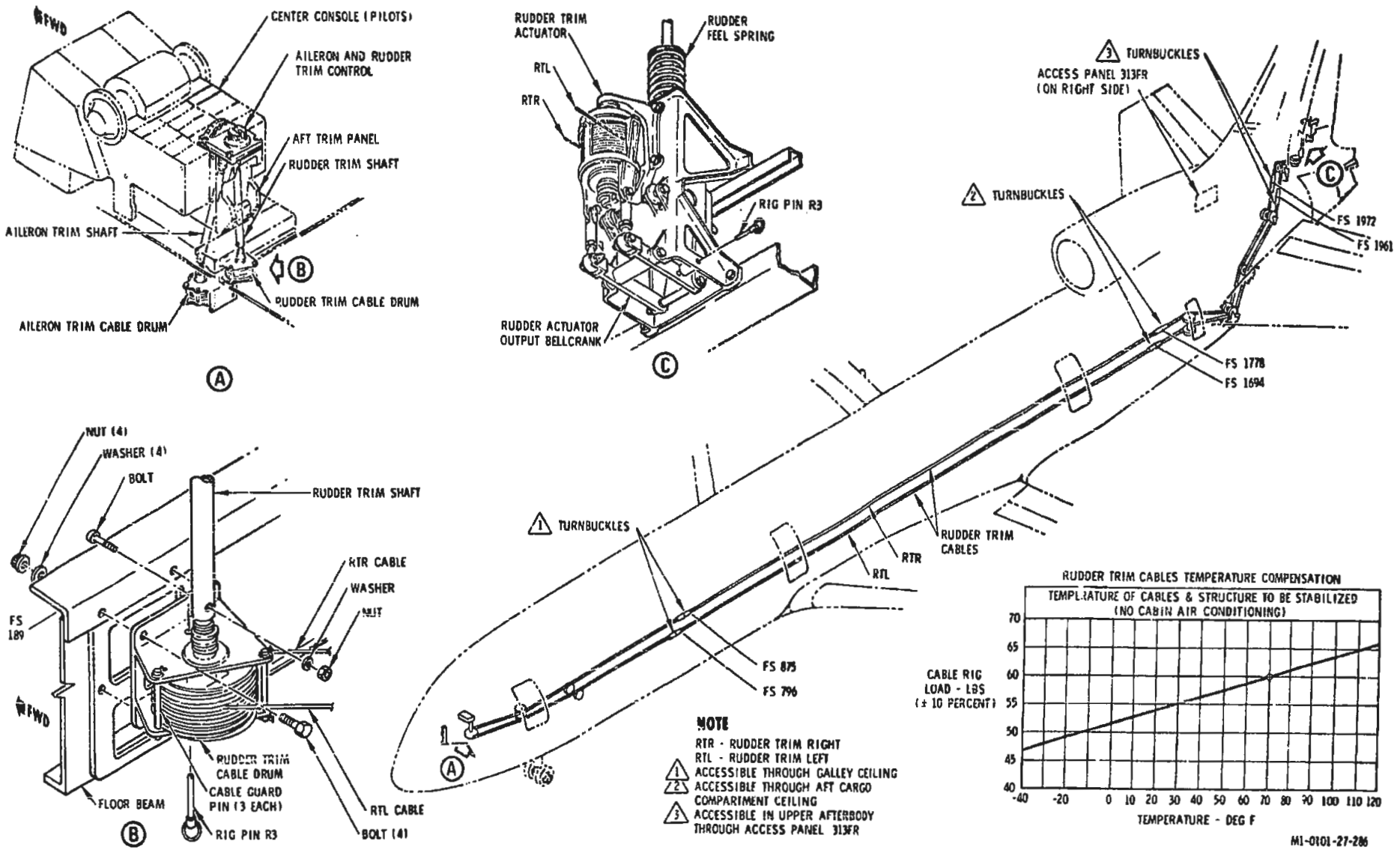
CAUTION: AFTER RIGGING TURNBUCKLES, VERIFY THAT NO MORE THAN THREE THREADS ARE EXPOSED ON CABLE TERMINAL, OR THAT CABLE TERMINAL END IS NOT FLUSH OR EXTENDING INTO SAFETY HOLE IN MIDDLE OF TURNBUCKLE WHICH WOULD PREVENT FULL ENGAGEMENT OF TURNBUCKLE LOCKING CLIPS.

(8) Remove all rig pins.

(9) Perform an operational test of the rudder trim control system (Ref. 27-22-00, Adjustment and Test).

(10) Install console aft trim panel and pilots headset (Ref. 25-12-12 and 25-13-05).

(11) Close and install access doors and panels.



R Rudder Trim Cable Drum - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
0018

RUDDER TRIM ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

   Rig Pin Kit, PN B-734, or equivalent

R Cable Tensiometer T-5 (Pacific Scientific), or equivalent

R Cotter Pin, MS24665-153, or equivalent

2. Referenced Procedures

   6-40-00 Exterior Access Doors and Panels

   27-22-00 Rudder Trim Control System - Adjustment and Test

   29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

R A. Removal

   WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

   TAG RUDDER PEDALS AND RUDDER TRIM CONTROL WHEEL.

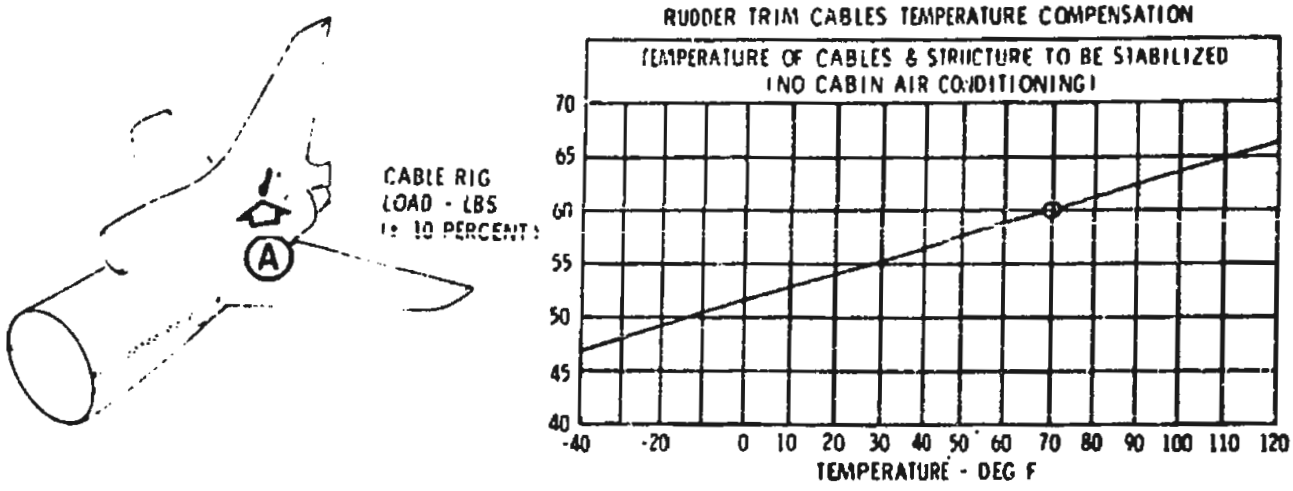
   (1) Set rudder trim control wheel to 0-degree (neutral) position (on aircraft 001, set rudder trim control wheel to 1/2 mark NOSE L).

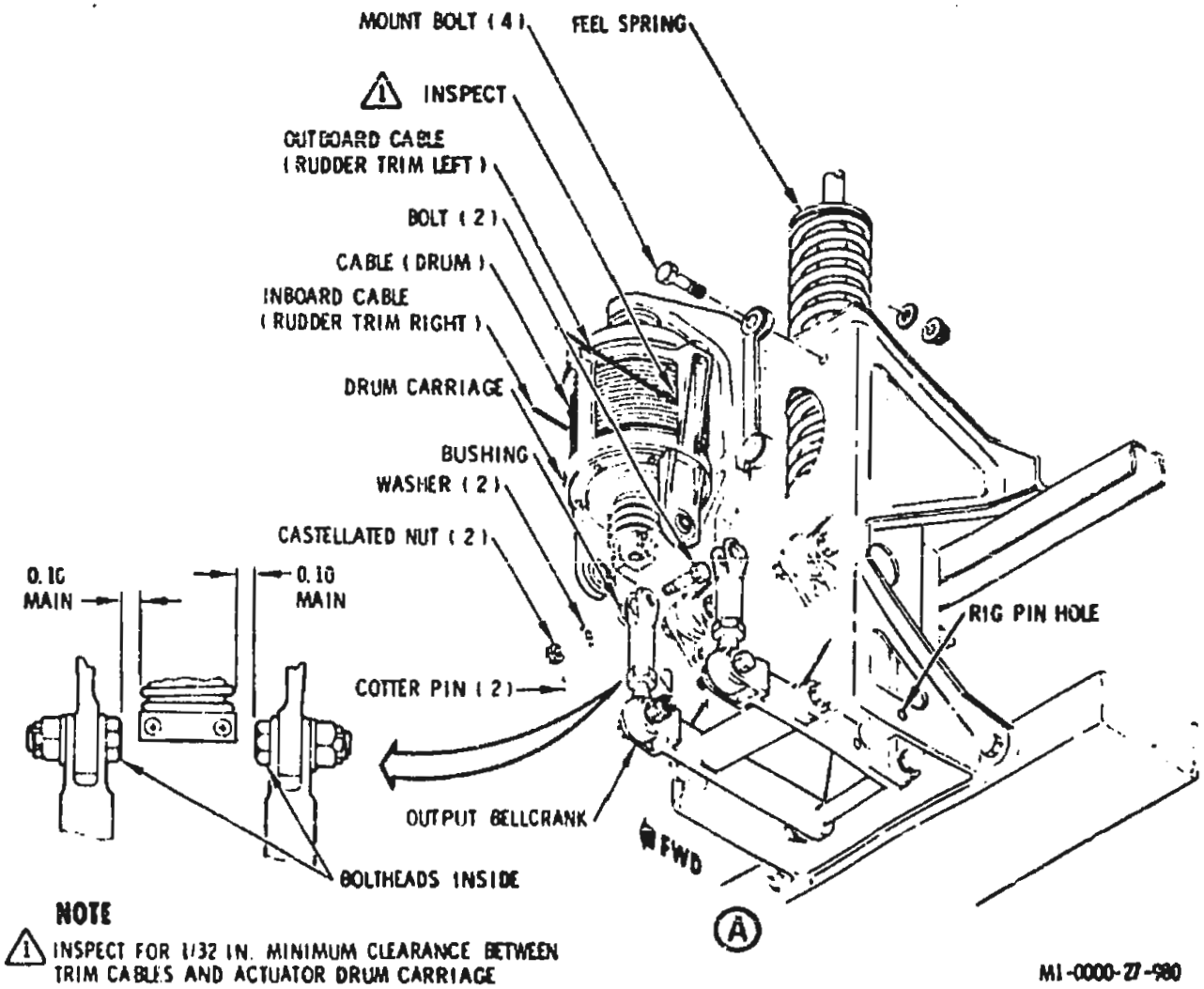
   (2) Set rudder in faired position.

R WARNING: INSTALL RUDDER HOLDING DEVICE IF RUDDER IS SUBJECT TO WINDY CONDITIONS. (USE WOODEN BLOCKS TO CLAMP RUDDER TO FIXED FUSELAGE FAIRING.)

   (3) Open access door 313FR in dorsal area to gain access to the rudder actuator located in the upper afterbody area. (Ref. 6-40-00).

   (4) Disconnect output links from actuator drum carriage by removing connecting bolts at upper end of links (Ref. Fig. 401).


A
CABLE RIG LOAD - LBS (± 10 PERCENT)
RUDDER TRIM CABLES TEMPERATURE COMPENSATION
TEMPERATURE OF CABLES & STRUCTURE TO BE STABILIZED (NO CABIN AIR CONDITIONING)
70
65
60
55
50
45
40
-40 -20 0 10 20 30 40 50 60 70 80 90 100 110 120
TEMPERATURE - DEG F



NOTE

INSPECT FOR 1/32 IN. MINIMUM CLEARANCE BETWEEN TRIM CABLES AND ACTUATOR DRUM CARRIAGE

MI-0000-27-980

CR
CR

Rudder Trim Actuator - Removal and Installation
Figure 401

(5) Locate trim control cable turnbuckles approximately 6 feet from actuator.

NOTE: After disconnecting trim cables, tie cables to structure with bungee cord to prevent slack cables from fouling on equipment or structure.

(6) Disconnect inboard trim control cable turnbuckle and tag each disconnected end INBOARD.

(7) Disconnect outboard trim control cable turnbuckle and tag each disconnected end OUTBOARD.

(8) Remove guard pins from trim control cable pulleys located between actuator and turnbuckles.

(9) Pull turnbuckle ends through bulkhead cable openings to actuator.

(10) Remove actuator by removing mount bolts. Place actuator on workbench.

(11) Pull one cable from actuator drum until fully unwound from drum and remove cable ball end lockscrew.

NOTE: For reference in the following steps, the actuator end that connects the output links will be referred to as BOTTOM. The opposite end will be referred to as TOP in relation to the aircraft mounted position.

(12) Slip cable ball end from keyhole slot and tag cable end as BOTTOM or TOP as indicated.

(13) Pull remaining cable from actuator drum until fully unwound from drum and remove cable ball end lockscrew.

(14) Slip ball end from keyhole slot and tag cable end as BOTTOM or TOP as indicated.

R B. Installation

(1) Ensure that rudder trim control wheel is set to 0-degree (neutral) position (on aircraft 001, ensure that rudder trim control wheel is set to 1/2 mark NOSE L).

(2) Ensure that rudder is in faired position.

R (3) Open forward electronic service center access door
R 112AB (Ref. 6-40-00).

(4) Install rig pin in trim control cable drum and bracket located beneath flight station floor at center.

(5) Place actuator on workbench with mount pads to workbench surface.

NOTE: For reference in the following steps, the actuator end that connects the output links will be referred to as BOTTOM. The opposite end will be referred to as TOP in relation to the aircraft mounted position.

(6) Rotate cable drum until keyhole slot on BOTTOM end of drum is positioned right of carriage center frame (which faces mechanic).

(7) Engage ball of cable end tagged BOTTOM in keyhole slot of drum BOTTOM. Install lockscrew and remove tag.

(8) Rotate drum to right (as viewed from BOTTOM) winding BOTTOM cable completely up drum with keyhole slot at TOP of drum left of carriage center frame.

(9) Engage ball of cable end tagged TOP in keyhole slot of drum TOP. Install lockscrew and remove tag.

(10) Rotate drum to left (as viewed from BOTTOM) winding TOP cable until middle point of drum is reached.

(11) View cable drum at point closest to actuator mounting holes, and check that all grooves are wound with cable. Repeat previous installation steps if all grooves are not wound with cable.

(12) Install actuator on mounting pad. Secure with mount bolts, washers, and nuts.

(13) Align output links to actuator drum carriage by pulling applicable cable to rotate actuator drum.

(14) Connect output links to actuator drum carriage with bolts, bushings, nuts, washers, and cotter pins. Install bolts with heads facing. See Fig. 401.

CR
CR NOTE: Do not adjust output links to connect to actuator drum carriage.

(15) Run cable tagged OUTBOARD through bulkhead openings and over outboard pulley. Install pulley cable guard pins.

(16) Run cable tagged OUTBOARD down and connect turnbuckle ends tagged OUTBOARD and remove tags. Remove bungee cord that was installed to prevent cable fouling.

(17) Run cable tagged INBOARD through bulkhead openings and over inboard pulley. Install pulley cable guard pins.

(18) Run cable tagged INBOARD down and connect turnbuckle ends tagged INBOARD and remove tags. Remove bungee cord that was installed to prevent cable fouling.

(19) Check that trim control cables are seated on the cable pulleys and that the cables are properly seated in the actuator drum grooves.

(20) Tighten both trim control cable turnbuckles until cable tension conforms to chart shown in Figure 401, and rig pin can be installed in actuator output bellcrank.

CAUTION: AFTER RIGGING TURNBUCKLES, VERIFY THAT NO MORE THAN THREE THREADS ARE EXPOSED ON CABLE TERMINAL, OR THAT CABLE TERMINAL END IS NOT FLUSH OR EXTENDING INTO SAFETY HOLE IN MIDDLE OF TURNBUCKLE WHICH WOULD PREVENT FULL ENGAGEMENT OF TURNBUCKLE LOCKING CLIPS.

(21) Verify that actuator drum carriage assembly and both rudder trim cables have a minimum clearance of 1/32 inch (Ref. Figure 401).

CAUTION: IF CLEARANCE BETWEEN ACTUATOR DRUM CARRIAGE ASSEMBLY AND BOTH RUDDER TRIM CABLES ARE LESS THAN 1/32 INCH OR SHOWS EVIDENCE OF RUBBING AS INDICATED BY BRIGHT OR WORN AREAS ON EITHER CABLES OR ACTUATOR, THEN TRIM ASSEMBLY MUST BE MODIFIED IN ACCORDANCE WITH SB27-198, PARAGRAPH 2.C.

R

(22) Safety turnbuckles.

(23) Remove rig pin from trim control cable drum in forward electronic service center.

(24) Remove rudder holding device if installed.

(25) Remove tags from rudder pedals and rudder trim control wheel.

(26) Operate rudder trim control wheel through several full left and right cycles. Control wheel should operate smoothly without binding throughout control range.

(27) While operating rudder trim control wheel, visually determine that trim actuator operates smoothly and that cables are properly engaged in actuator drum grooves and pulleys.

(28) Perform rudder trim control system operational test (Ref. 27-22-00). (Adjustment/Test)

CR

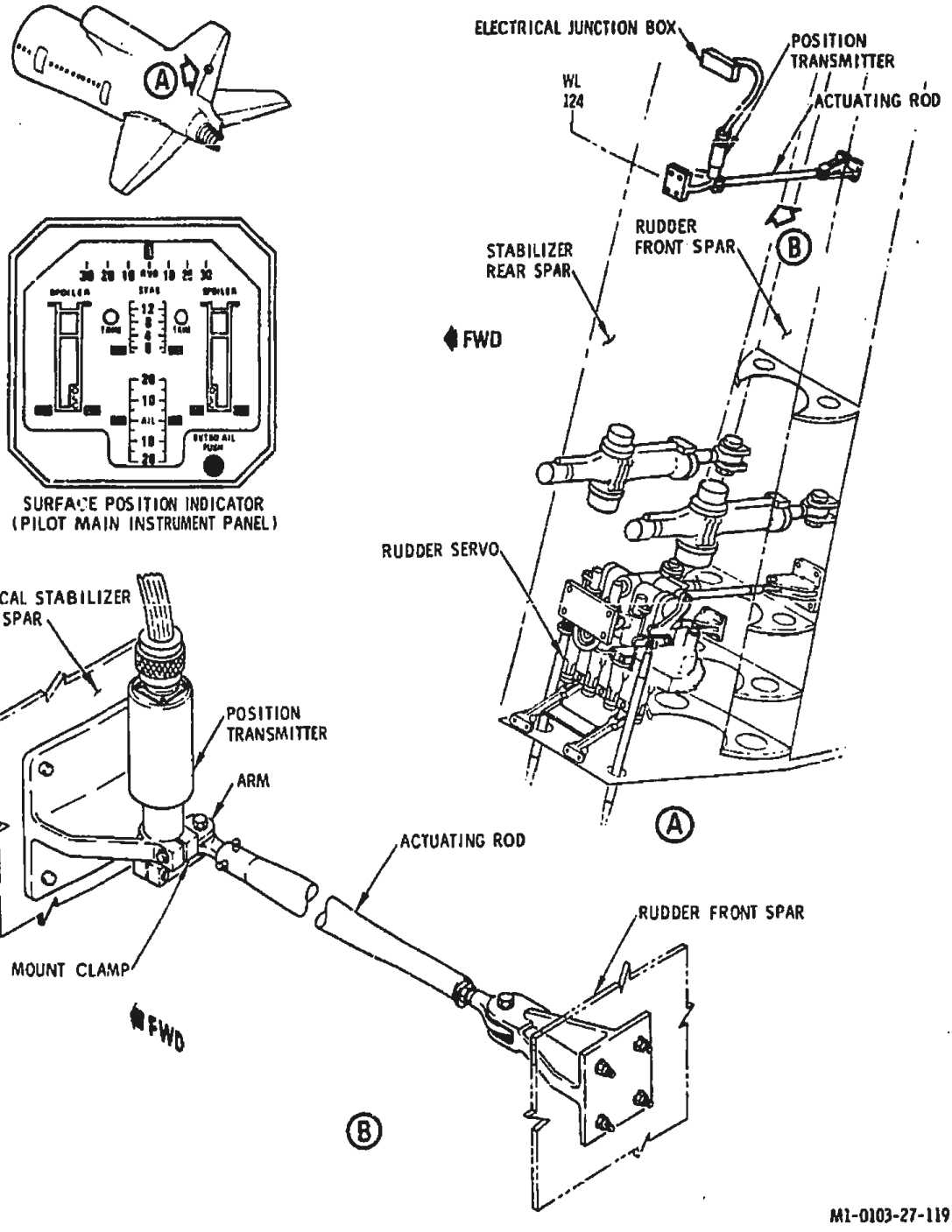
(29) Close access doors (Ref. 6-40-00).

RUDDER POSITION INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

R The rudder position indicating system consists of a synchro
R position transmitter, coupled to the rudder surface, and a
R position indicator on the pilots main instrument panel (Ref.
R Fig. 1 and 2). The position indicator has a horizontal scale marked in ten degree increments from zero to 30 degrees each side of neutral (Ref. 27-00-01).

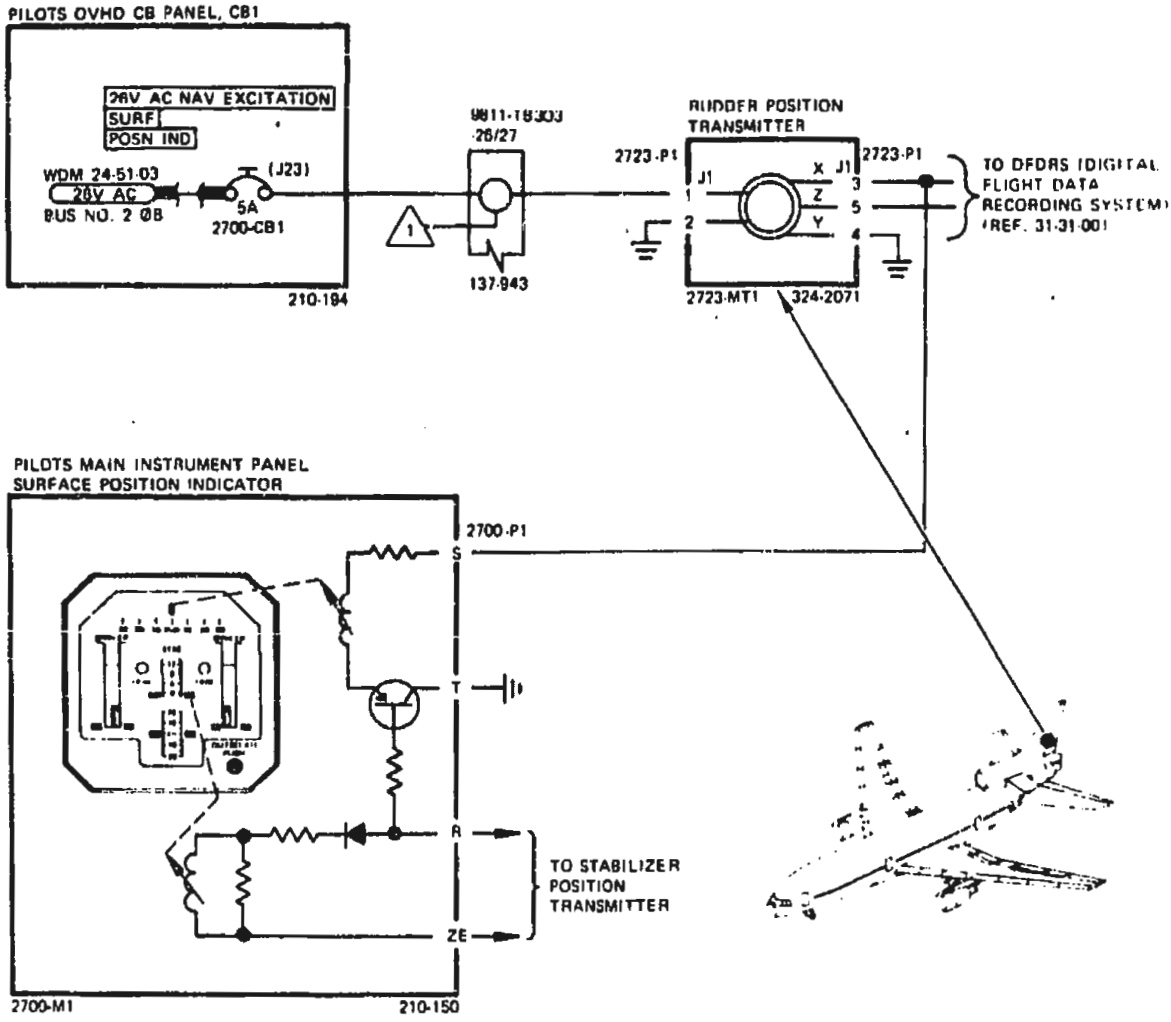
The transmitter installation consists of a position transmitter, bracket mounted to the rear spar of the vertical stabilizer, and a control rod coupled to the rudder surface, zone 324. The transmitter is mounted to a clamping bracket. Null adjustment of the transmitter is accomplished by loosening the clamp locking bolt and rotating the transmitter.



R
R

Rudder Position Indicating System
Figure 1

EFFECTIVITY: ALL



WIRING DIAGRAMS
27 23-01

NOTE

1. TO AILERON (27-13-00), STABILIZER (27-43-00), AND SPOILERS (27-82-00) POSITION TRANSMITTERS

EM1-0102 27 330

R Rudder Position Indicating System Electrical Schematic
R Figure 2

R # RUDDER POSITION INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the fault diagram or schematic.

R If the flight crew reports a problem by using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specified the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in this section.

R Fault Isolation Diagrams and Schematic List
R Table 101

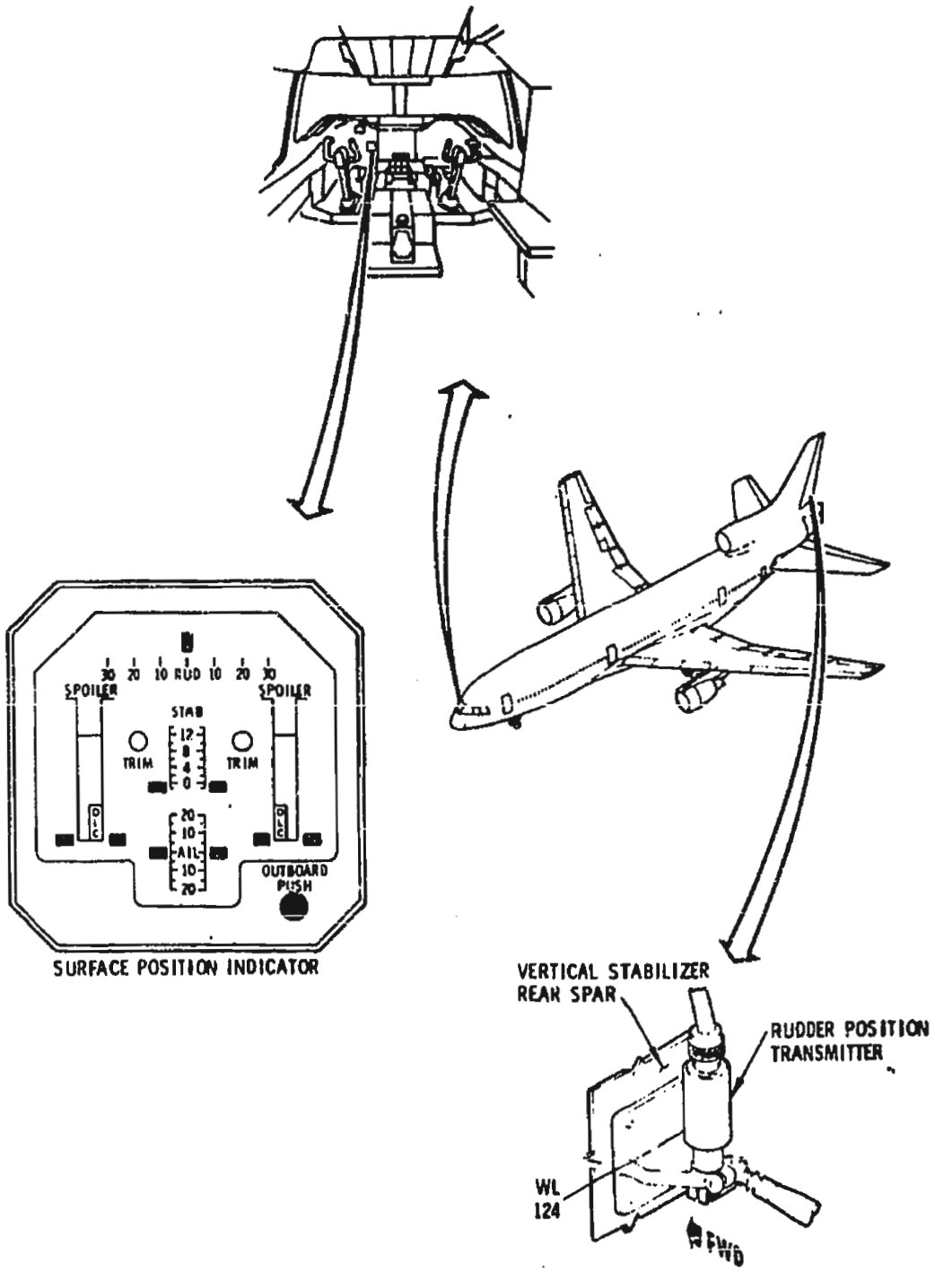
FIGURE	TITLE
101	Rudder Position Indicating System Component Location Index
102	Rudder Position Indicating System Component Locators
103	Rudder Position Indicator Inoperative
104	Rudder Position Indicator Electrical Schematic SCHEM 1

COMPONENT	QTY.	AREA/ACCESS	REFERENCE
INDICATOR – SURFACE POSITION	1	FLT STA, PILOTS PANEL	27-00-00
TRANSMITTER – SURFACE POSITION	1	VERT STAB/324CL, 324CR	27-23-01

M1-0003-27-340

R R Rudder Position Indicating System Component Location Index
Figure 101

R R 0018 EFFECTIVITY: ALL

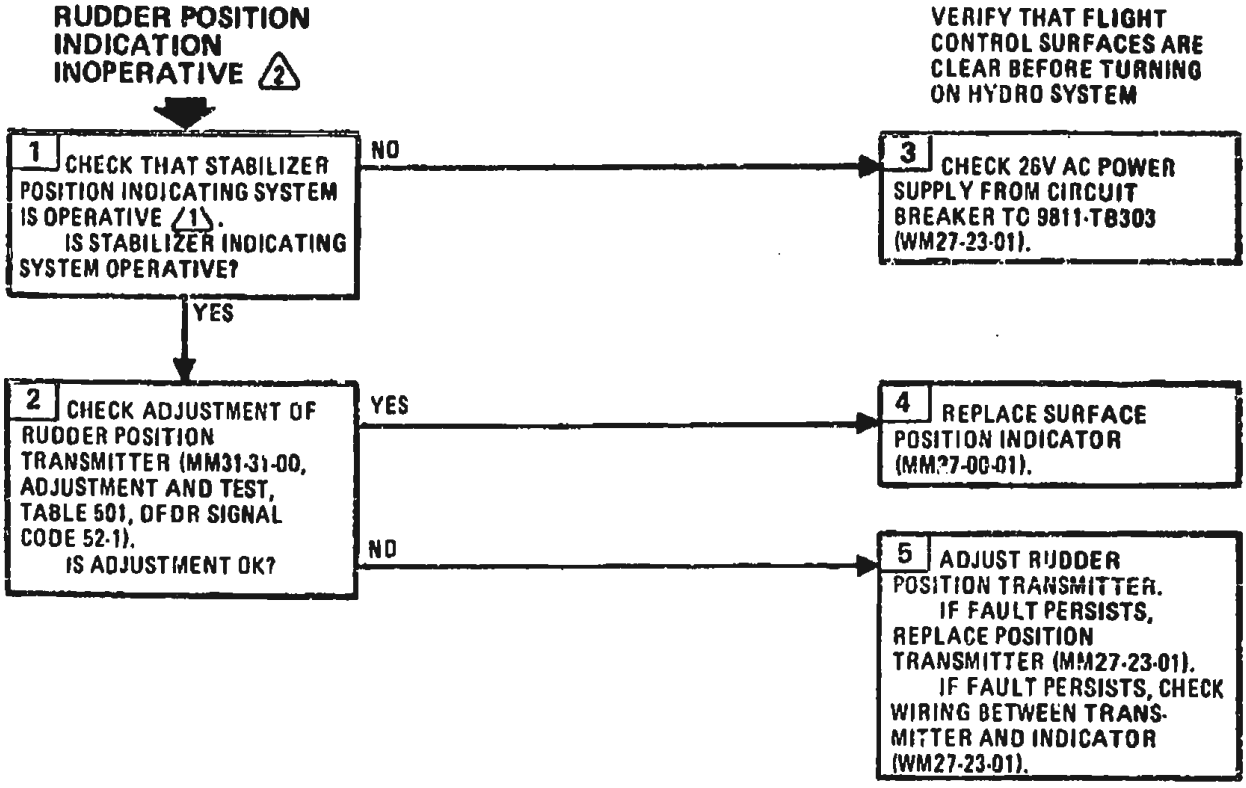


R Rudder Position Indicating System Component Locators
R Figure 102

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
HYDRAULIC POWER SYSTEM B (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB's: CB1-J23

WARNING
VERIFY THAT FLIGHT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEM


RUDDER POSITION INDICATION INOPERATIVE (2)
1 CHECK THAT STABILIZER POSITION INDICATING SYSTEM IS OPERATIVE (1). IS STABILIZER INDICATING SYSTEM OPERATIVE?
NO
3 CHECK 26V AC POWER SUPPLY FROM CIRCUIT BREAKER TC 9811-TB303 (WM27-23-01).
YES
2 CHECK ADJUSTMENT OF RUDDER POSITION TRANSMITTER (MM31-31-00, ADJUSTMENT AND TEST, TABLE 501, OFDR SIGNAL CODE 52-1). IS ADJUSTMENT OK?
YES
4 REPLACE SURFACE POSITION INDICATOR (MM27-00-01).
NO
5 ADJUST RUDDER POSITION TRANSMITTER. IF FAULT PERSISTS, REPLACE POSITION TRANSMITTER (MM27-23-01). IF FAULT PERSISTS, CHECK WIRING BETWEEN TRANSMITTER AND INDICATOR (WM27-23-01).

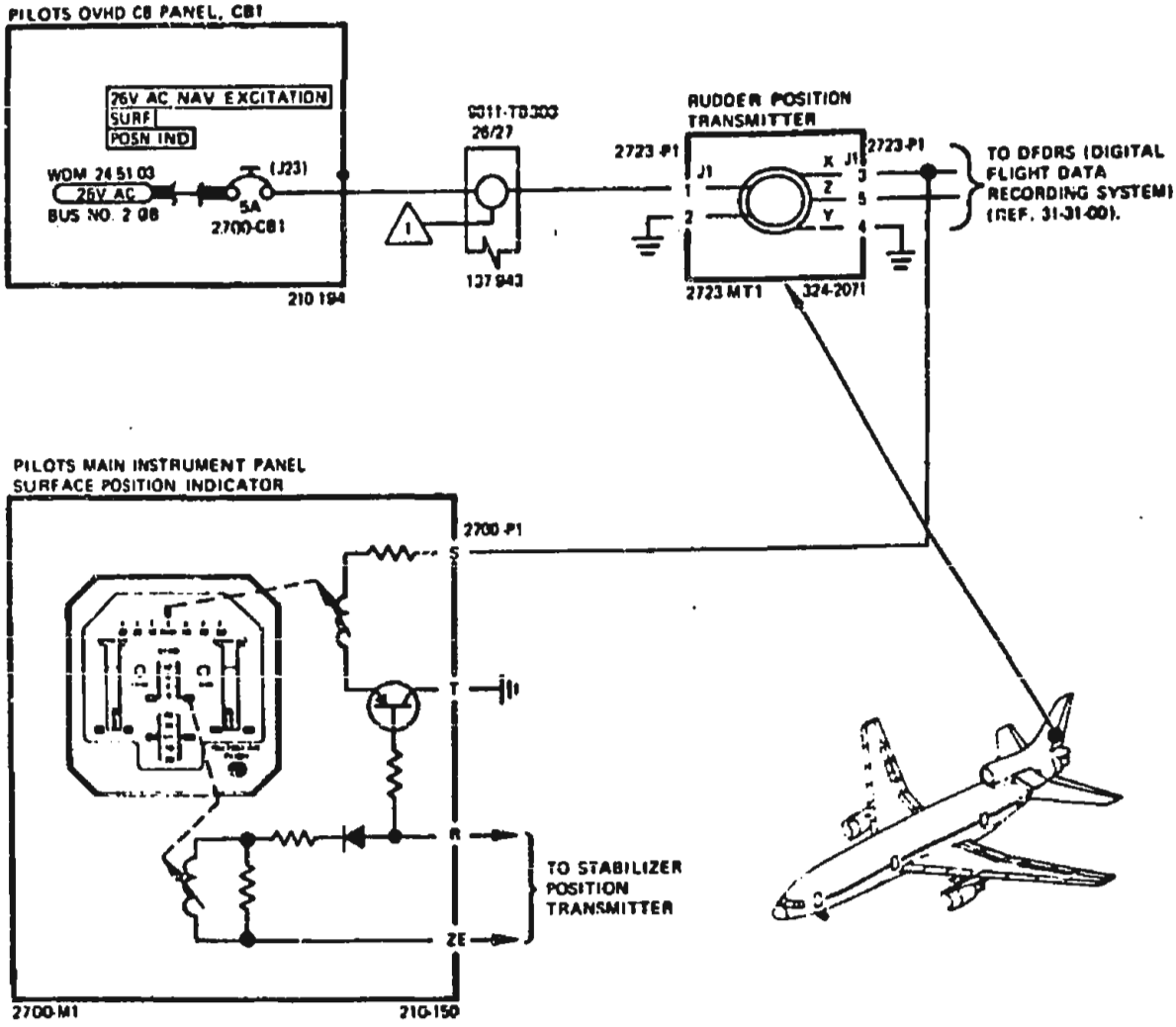
NOTE

(1) THE STABILIZER POSITION TRANSMITTER PROVIDES A REFERENCE SIGNAL FOR THE RUDDER INDICATION.

(2) AN ASSOCIATED RUDDER OR STABILIZER POSITION SYNCHRO ADJUSTED TO THE WRONG NULL (E-Z 180 DEGREES OUT OF PHASE) WILL RESULT IN OPPOSITE RUDDER DEFLECTION ON THE SURFACE POSITION INDICATOR.

M1-0004-27-523

R Rudder Position Indicator Inoperative
R Figure 103



WIRING DIAGRAMS
27 23 01

NOTE

1. TO AILERON (27-13-00), STABILIZER (27-43-00), AND SPOILERS (27-67-00) POSITION TRANSMITTERS

EM1-0102-27-330

R Rudder Position Indicating System Electrical Schematic
R SCHEM 1

R EFFECTIVITY: ALL
R
001B

RUDDER SURFACE POSITION TRANSMITTER (SINGLE) REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Position Transducer Breakout Box G/ITEL NO. 22-13-05

R AC Voltmeter capable of reading 100 mv full scale, Triplet Model
R 601, or equivalent

R 2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Removal/Installation

R A. Removal (Ref. Fig. 401)

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker 28 VAC NAV EXCITATION - SURF POSN IND (J23).

(2) Open vertical stabilizer access door 324CL (Ref. 6-40-00).

R (3) Disconnect electrical connector from transmitter.

(4) Remove clamp bolt from arm at transmitter shaft end.

(5) Remove transmitter mount clamp bolt and remove transmitter.

R B. Installation (Ref. Fig. 401)

R (1) Verify that circuit breaker opened in Step A(1) is open and tagged.

WARNING: VERIFY ALL HYDRAULIC POWER IS TURNED OFF AND HYDRAULIC CONTROL PANELS ARE TAGGED.

(2) Set rudder in faired position (±0.10 inch). Fair rudder by aligning rudder lower trailing edge with fixed fairing.

(3) Verify that EZ (electrical zero) index mark on transmitter shaft is aligned with EZ mark on housing.

(4) Insert transmitter partially into mount clamp to allow clearance to connect arm. Install transmitter so that EZ marks are visible.

(5) Hold arm in position and insert transmitter into mount clamp and transmitter shaft into arm. Verify that EZ marks are still aligned.

R CAUTION: TRANSMITTER MUST BE ALIGNED SINCE INTERNAL STOPS WILL BE DAMAGED IF SHAFT IS ROTATED BEYOND 90° FROM EZ MARK.

(6) Install bolt, washer, and nut in arm. Tighten bolt.

(7) Verify that bolt groove in transmitter housing is aligned with mounting clamp holes. Install bolt, washers, and nut in transmitter mount clamp.
CR Temporarily tighten bolt. (8) Remove tag and close
C circuit breaker opened in Step A(1).

CR (9) Turn on electrical power (Ref. 24-41-00).

CR (10) Remove tags from hydraulic control panels.

CR (11) Adjust transmitter, as follows:

CR (a) With rudder in faired position (±0.10 inch),
CR verify that rudder pointer on surface position
CR indicator is centered on zero degree graduation.
CR If not loosen clamp bolt and rotate transmitter
CR housing to null.

CR (b) Tighten clamp bolt to 30 to 35 pound-inches.
CR Verify that rudder pointer stays centered on zero
CR degree graduation.

CR C WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

C PITCH TRIM WHEEL IS AT ZERO DEGREES.

C C LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

C C C TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

C C THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

C (12) Turn on hydraulic system A, B, or C (Ref. 29-11-00).

CR C C C C C CAUTION: THE RUDDER HAS HYDRAULIC SURFACE DAMPERS. CYCLING RUDDER AT A HIGH RATE CAN DAMAGE DAMPER SEALS. OPERATE RUDDER PEDALS SLOWLY (MINIMUM 4 SECONDS, STOP-TO-STOP). Verify that RUD pointer on surface position indicator moves left and follows rudder travel.

CR CR CR CR (13) Position yaw trim for max left turn. Verify the rudder pointer on surface position indicator is centered plus or minus one half a pointer width on 10 degree left turn graduation.

CR C C C (14) Return yaw trim to zero degrees. (15) Slowly position rudder pedals full right. Verify that RUD pointer on surface position indicator moves right and follows rudder travel. Return rudder pedals to neutral.

CR CR (16) Check rudder position transmitter linkage for interference during operation.

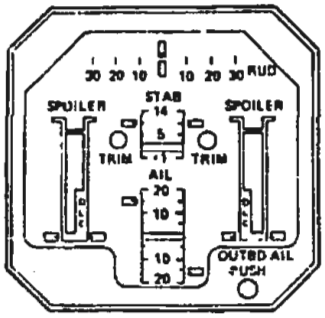
CR (17) Pull either control column aft and hold.

CR (18) Repeat Steps (13) to (15).

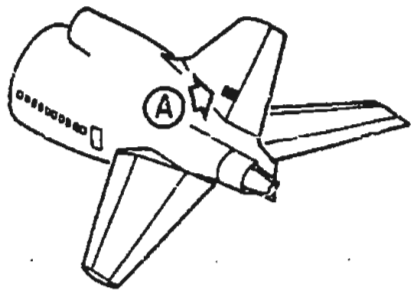
CR (19) Allow control column to return to neutral.

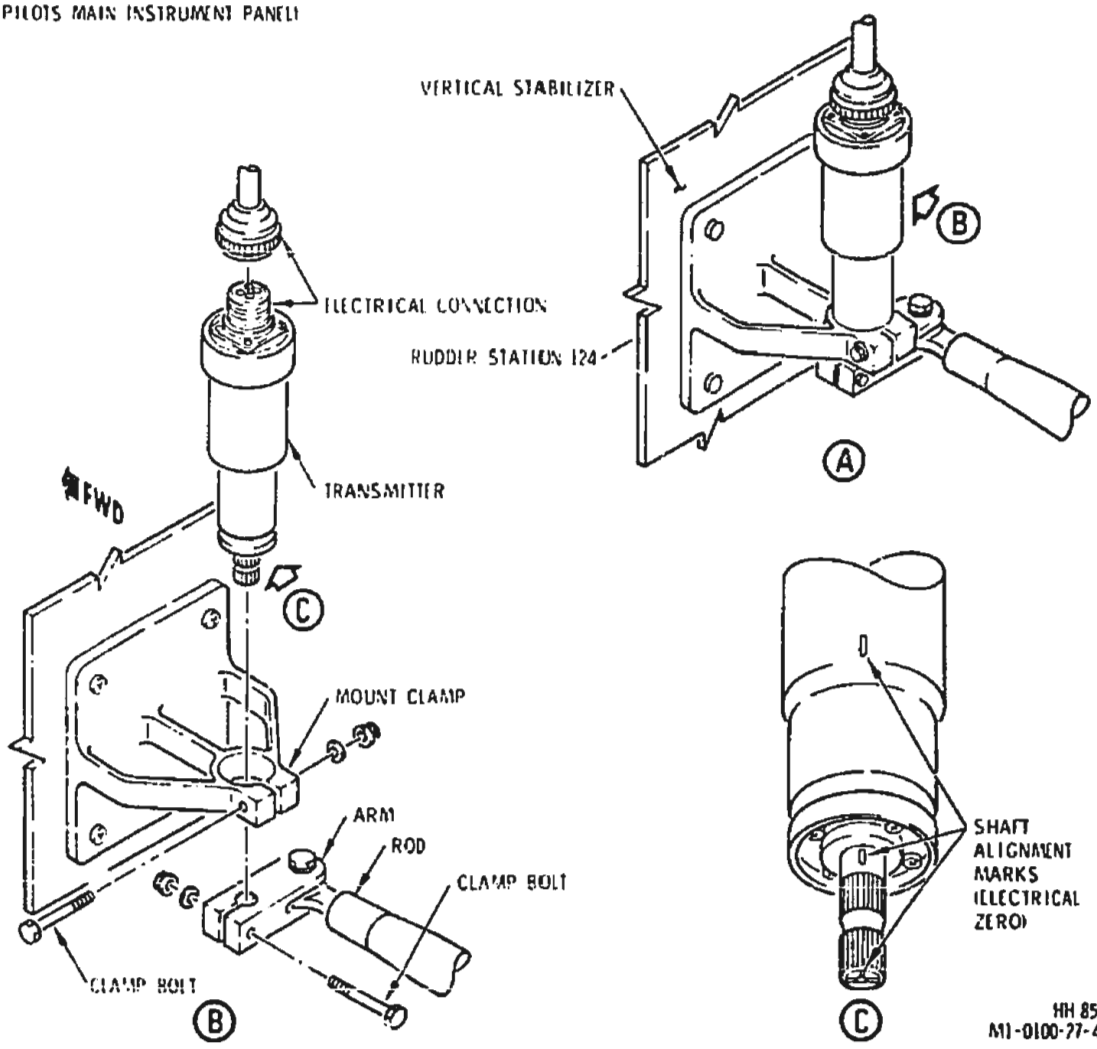
C C C C C NOTE: The stabilizer position transmitter supplies a phase reference signal to the rudder position circuit. Checking rudder position signals with the stabilizer deflected verifies correct stabilizer reference signals.

CR CR (20) Turn off hydraulic power if no longer required (Ref. 29-11-00).



SURFACE POSITION INDICATOR
(PILOTS MAIN INSTRUMENT PANEL)





C Rudder Surface Position Transmitter (Single)
C Removal and Installation
C Figure 401

R EFFECTIVITY: ALL
R
001B

CR CR (21) Turn off electrical power if no longer required (Ref. 24-41-00).

CR (22) Close vertical stabilizer access door.

ELEVATOR CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

Two elevators are used to improve the pitch control performance of the flying stabilizer. Each elevator is positioned by a separate cable linkage control system (Ref. Fig. 1). The control system consists of a cable system which positions an aft drive quadrant. The drive quadrant then positions the elevator through a hook-shaped pushrod assembly.

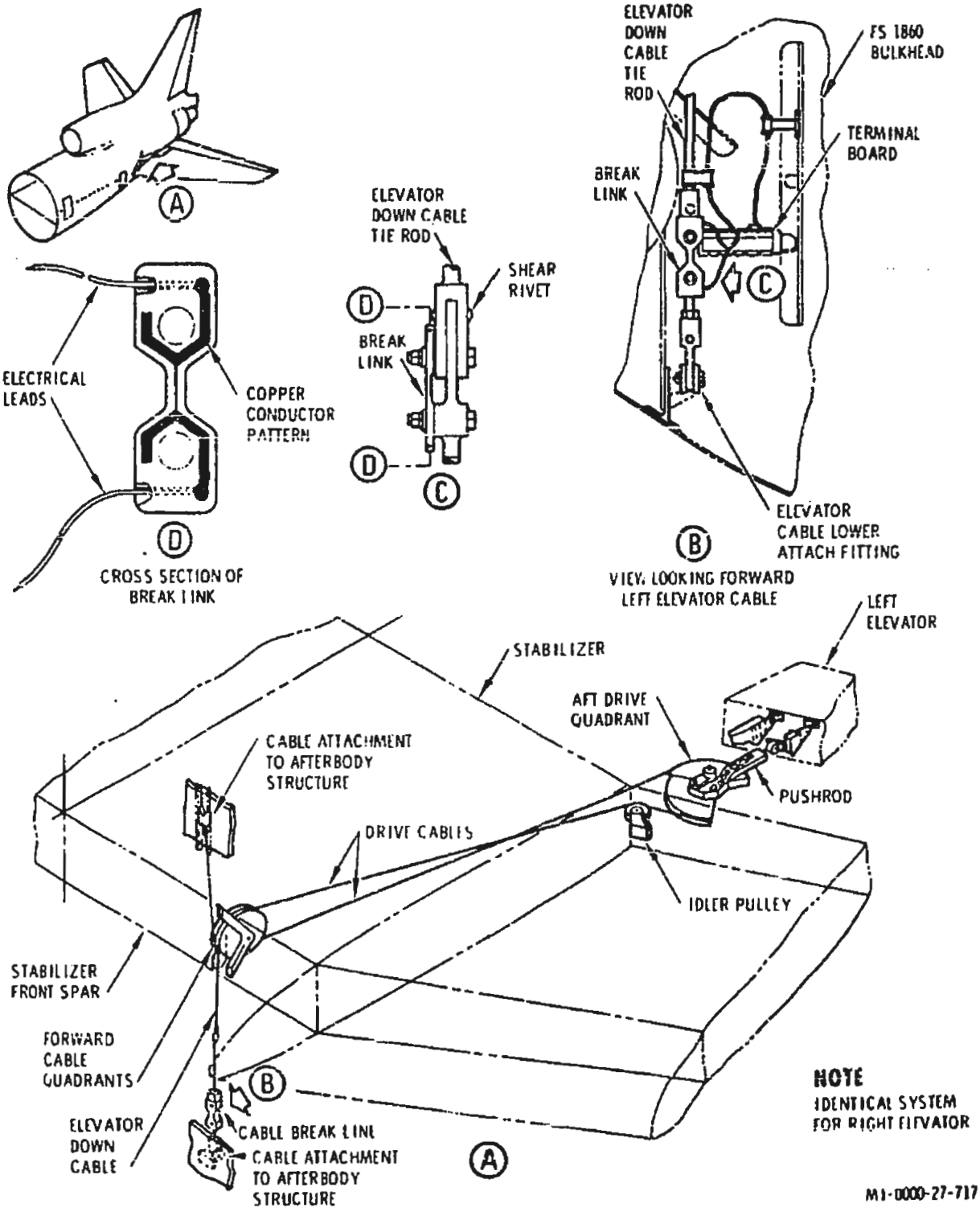
The elevator control system components are mounted to the horizontal stabilizer structure. However, the cable drive system is connected (grounded) to the afterbody structure. Consequently, the elevator is positioned as a function of stabilizer movement. Stabilizer leading edge down movement (pitch up) deflects the elevator in a trailing edge up direction. As the stabilizer leading edge moves from one degree up to 14 degrees down, the elevator is automatically positioned from faired with the stabilizer to 25 degrees trailing edge up from faired with stabilizer.

Each elevator control system consists of two cable runs that terminate at the aft drive quadrant. The other ends of the cables are attached to afterbody structure. The cables are guided and supported by cable pulleys and fairleads, and extend through the stabilizer box beam. The cables terminate at the aft drive quadrant assembly, mounted between two elevator truss ribs in the stabilizer trailing edge. A hook-shaped pushrod transmits aft drive quadrant rotation to elevator deflection. The pushrod attachment to the elevator is adjustable for rigging the elevator. Cable tension is controlled by a turnbuckle in each cable run. An elevator drive failure system is provided to warn the flight crew of a jammed elevator. The system consists of a cable failure sensor in each elevator down cable and flight station visual and aural warnings (Ref. Fig. 1).

2. Elevator

A. Description

Two elevators are hinged to the trailing edge of the stabilizer and are used to improve the aerodynamic effectiveness of the stabilizer elevator combination. Each elevator is positioned by a separate control mechanism mounted in the stabilizer and connected to the fuselage structure so that the elevator is positioned as a function of stabilizer movement.



Elevator Control System
Figure 1

The elevator primary structure consists of aluminum alloy front and rear spars, intermediate and hinge ribs, and riveted skins. Aluminum alloy leading edge shrouds, which project forward of the front spar, close the gap between the elevator and stabilizer during elevator movement.

R On aircraft with standard elevator (PN 1524058-107 and -108), thirteen balance weight support structures are attached to the front spar and project forward of the hinge line. Depleted uranium balance weights are bolted to the support structure (Ref. Fig. 2).

R On aircraft with improved elevator (PN 1524058-111 and -112), ten balance weight support structures are attached to the front spar and project forward of the hinge line. Depleted uranium balance weights are bolted to the support structure (Ref. Fig. 2).

CR NOTE: AD 75-9-16 applies to all improved elevators (10 balance weight positions) which have dampers installed with small reservoirs.

R The improved elevator (PN 1524058-111 and -112) incorporates a honeycomb trailing edge structure and eliminates the three most inboard balance weights. Two hydraulic dampers are installed between the elevator and stabilizer at hinges No. 2 and 6 to provide elevator damping in the event of a "free" elevator (open elevator control).

R The standard elevator and the improved elevator are interchangeable; however, it is very important that the hydraulic dampers are installed with the improved elevator. A decal on the elevator front spar next to each damper location warns against installing the improved elevator without the dampers (Ref. Fig. 2).

CR NOTE: Improved elevators (10 balance weight positions) installed on planes 001 thru 025 must be approved by engineering. Early elevators (13 balance weight positions) installed on 026 thru 999 must also be approved by engineering. Adjustments to the inspections required by AD 75-9-16 may be required.

R Since the elevators are interchangeable, it is permissible to install a standard elevator on one side and an improved elevator on the other side of the same aircraft.

The elevator is a balanced surface. Weight and balance information is provided on a data placard located at the inboard end of the front spar at elevator station 75.

Access to the placard is through access panels 334CB and 344CB. Balancing procedures are covered in Structure Repair Manual, Section 51-90-00.

Each elevator is attached to the stabilizer by eight hinge fittings. The hinge fitting are bolted to the elevator front spar and pick up the hinge rib structure. The hinge fittings which contain the hinge bearings can be easily replaced by removing the hinge fitting attaching bolts. Grease fittings are threaded into the hinge fittings and provide for lubricating the hinge bearings.

3. Elevator Damper (On improved elevator, PN 1524058-111 and -112)

A. Description and Operation

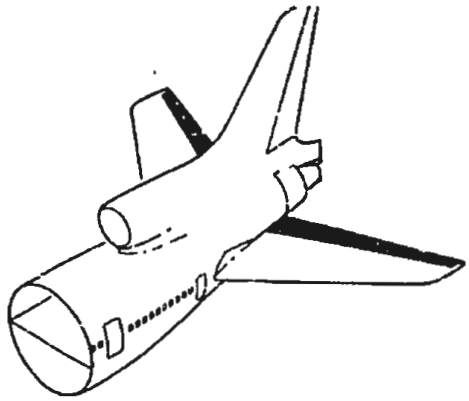
Two hydraulic dampers are installed between the elevator and stabilizer on each elevator. The dampers are mounted between machined clevis fittings on the elevator hinge and the stabilizer hinge bearing fittings at the No. 2 and 6 hinges (Ref. Fig. 3).

The damper is a linear, hydraulic piston-type with an integral reservoir. Any elevator flutter oscillations will produce rapid reciprocating piston stroking. Dampening action is produced by controlling the fluid flow across the damper piston.

The hollow damper piston rod contains a spool valve that controls the hydraulic flow across the piston by controlling the spool port openings. The spool valve is load-sensitive (the higher the fluid pressure, the larger the spool openings) and responds to damper pressures to produce an essentially lineal (straight) dampening curve. The spool also incorporates two ball relief valves to allow flow across the damper piston if the spool jams.

The damper reservoir fluid level is determined by viewing the reservoir piston indicator through a sight glass window in the cylinder housing. Inscribed indicator marks on the housing (FULL and REFILL) show when the reservoir should be recharged with hydraulic fluid.

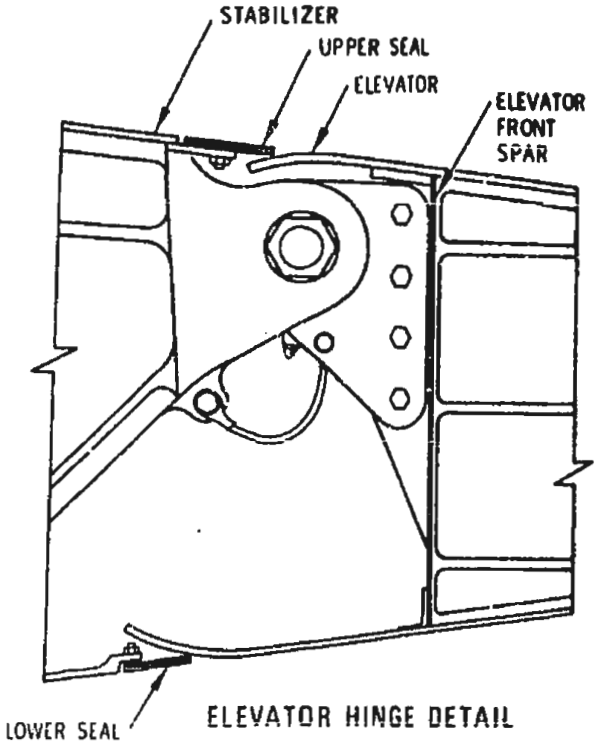
The piston rod end of the cylinder contains two ports for filling the damper and charging the reservoir. One port contains a check valve and is used for charging; the other port contains a threaded plug used for bleeding the damper during the filling procedure. The damper piston rod and the cylinder mounting lug contain self-aligning spherical bearings. A lube fitting is provided for both bearings.



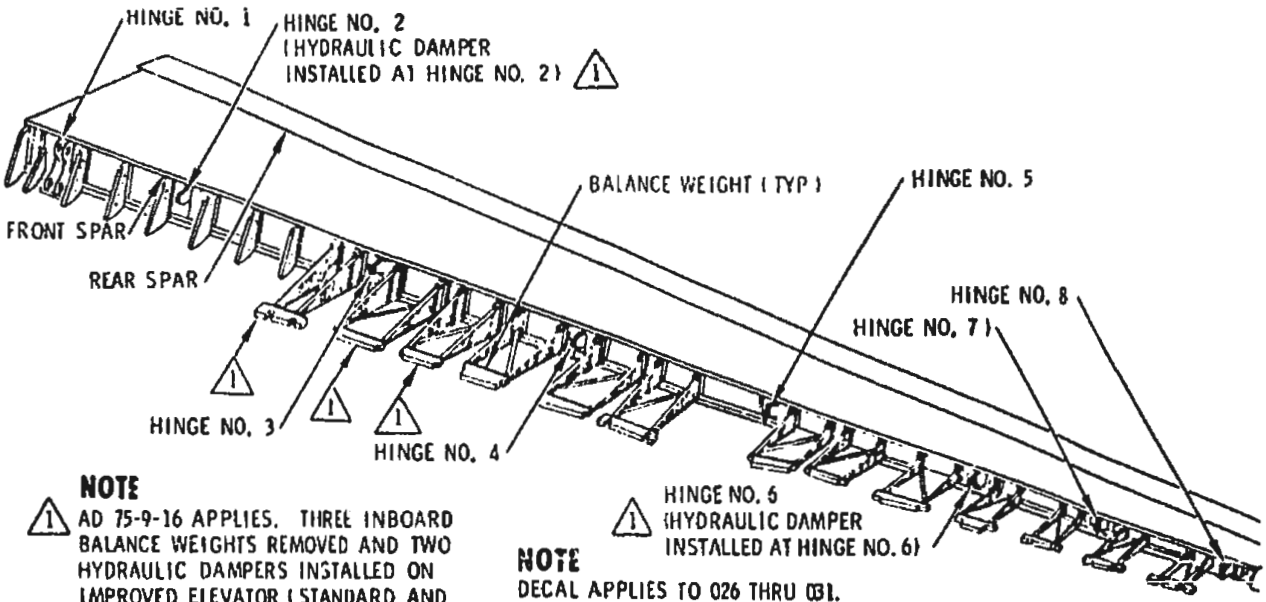
WARNING

ELEV DAMPER, PART NO. 672470-105, MUST BE INSTALLED PRIOR TO FLIGHT

1 AD 75-9-16 APPLIES. DECAL ON ELEVATOR FROM SPAR NEXT TO BOTH DAMPER INSTALLATIONS



ELEVATOR HINGE DETAIL


HINGE NO. 1
HINGE NO. 2 (HYDRAULIC DAMPER INSTALLED AT HINGE NO. 2) 1
FRONT SPAR
REAR SPAR
BALANCE WEIGHT (TYP)
HINGE NO. 5
HINGE NO. 8
HINGE NO. 7
HINGE NO. 3
HINGE NO. 4
HINGE NO. 6 (HYDRAULIC DAMPER INSTALLED AT HINGE NO. 6) 1

NOTE

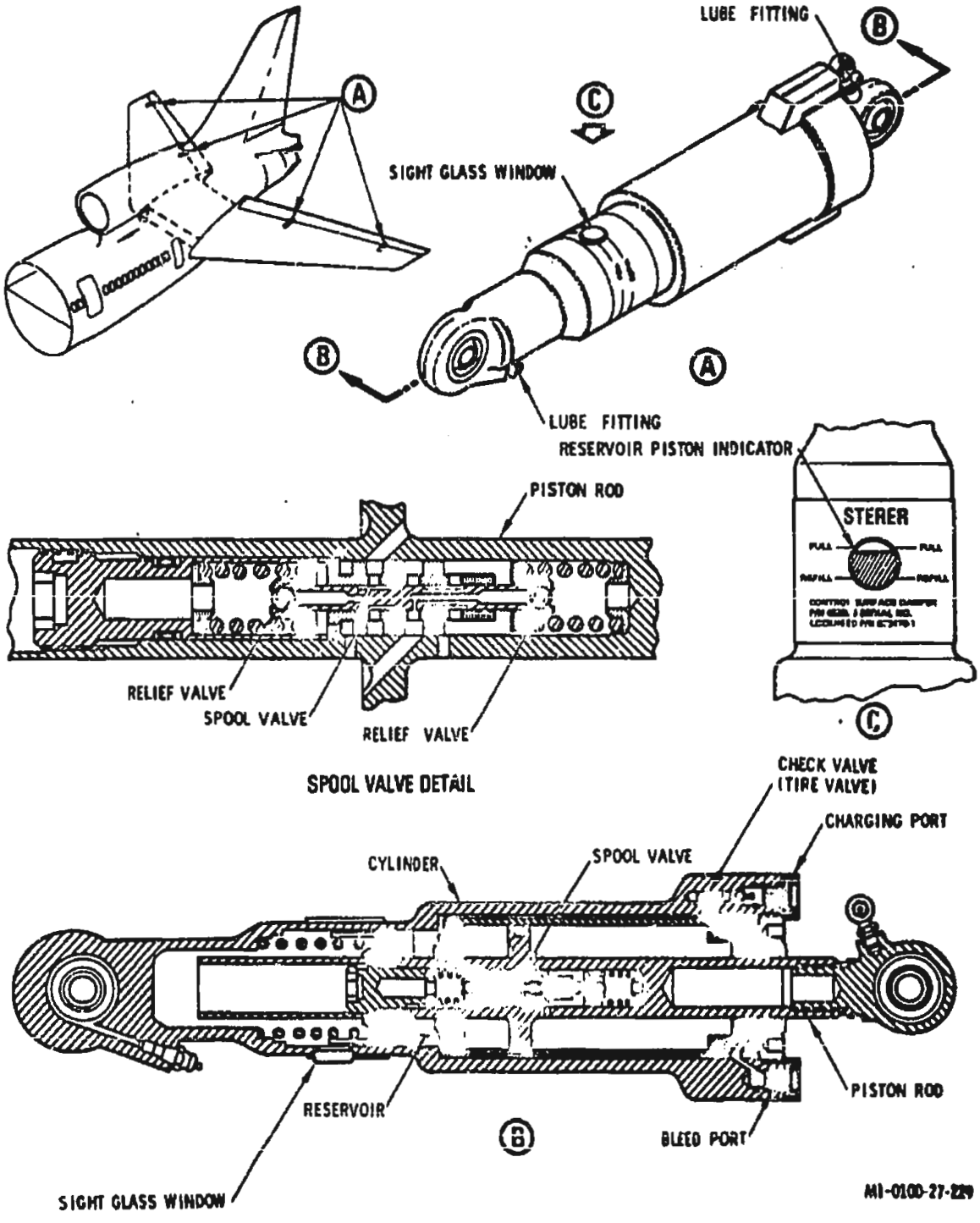
1 AD 75-9-16 APPLIES. THREE INBOARD BALANCE WEIGHTS REMOVED AND TWO HYDRAULIC DAMPERS INSTALLED ON IMPROVED ELEVATOR (STANDARD AND IMPROVED ELEVATORS ARE INTERCHANGEABLE)

NOTE

DECAL APPLIES TO 026 THRU 031. 672470-107 DAMPERS ARE INSTALLED AND MUST BE MAINTAINED ON 032-999 AIRCRAFT

M1-0000-27-1210

C C Elevator Assembly
Figure 2



Elevator Surface Damper (On Improved Elevator)
Figure 3

R 4. Elevator Drive Failure System (Ref. Fig. 1 and 4)

A. Description and Operation

An elevator drive failure system is installed to warn the flight crew of a jammed elevator. The remote possibility of an elevator jam can be caused by an aft drive quadrant bearing failure and the preflight controls check which positions the stabilizer and elevator to extreme throws.

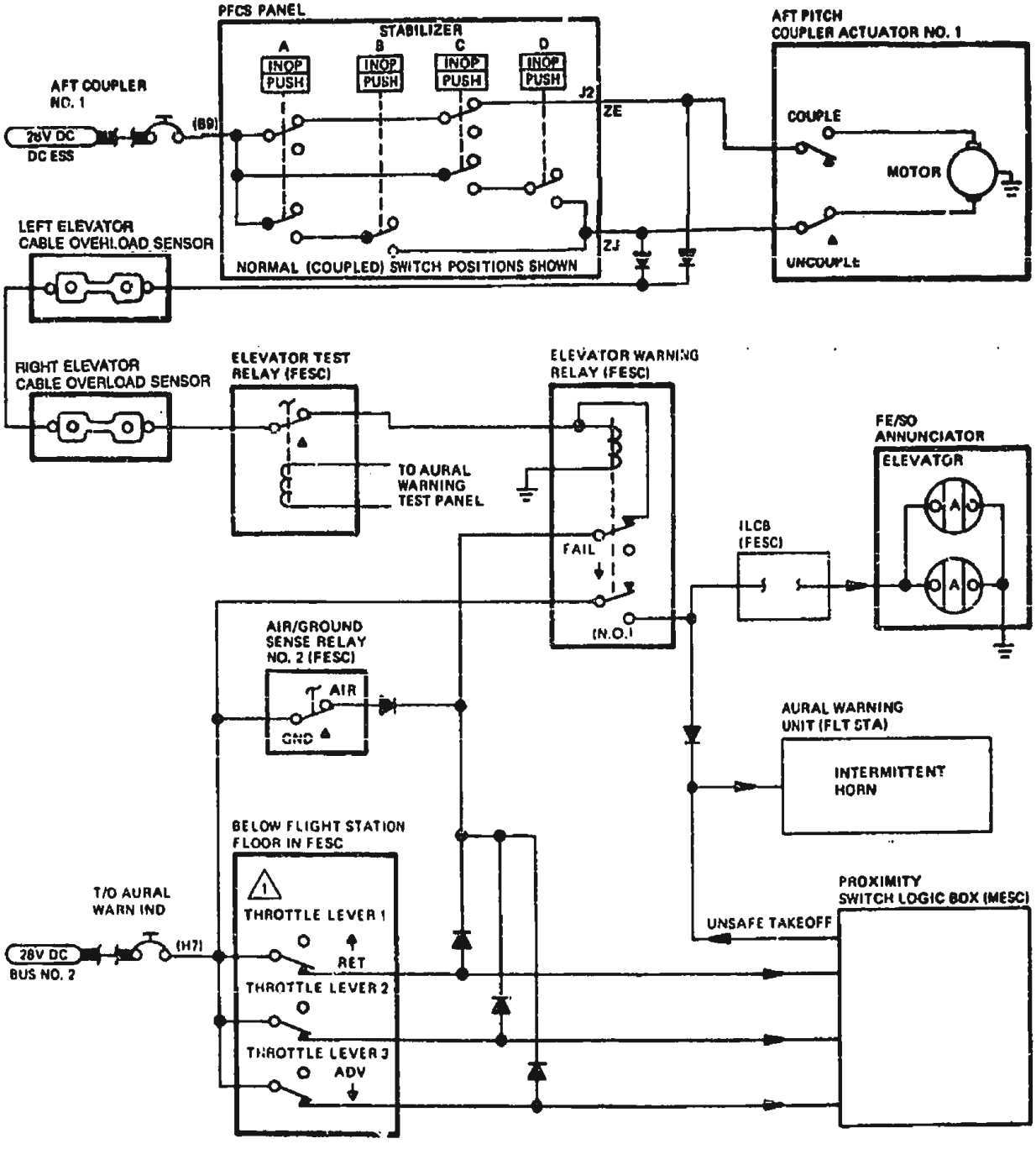
When the elevator jams during a preflight check, the elevator down cable is overstressed. A fail sensor in the elevator down cable will sense this overstress and activate a warning light (ELEVATOR warning light on the FE/SO annunciator panel) and the unsafe takeoff aural warning (intermittent horn) in the flight station. Since the above condition can only be experienced on the ground, the elevator drive failure warning system is enabled only when the aircraft is on the ground and all three throttles are positioned below the takeoff position.

The cable fail sensor consists of a break link bolted between each elevator down cable tie rod and the cable lower attach fitting that is mounted to the fuselage station 1860 bulkhead. The break link is located just outboard of each stabilizer servo module, zone 317.

The break link consists of a phenolic sheet with a printed circuit board bonded to the sheet. The printed circuit board incorporates a copper strip electrical path to complete a circuit across the break link and a wire at each end of the break link to connect to ships wiring.

Power for the break link is supplied from the stabilizer aft coupler actuator extend and retract circuits and is supplied by the NO. 1 AFT COUPLER circuit breaker (Ref. Fig. 4). With electrical power on the aircraft, 28V DC is routed in series through both elevator break links to actuate the elevator warning relay. With the relay actuated, the relay contacts that supply 28V DC power to the aural warning unit and ILCB is open.

In addition, with any one of the three throttles positioned above the takeoff position, or the air/ground sensing relay No. 2 in the air mode, 28V dc is supplied through another set of closed contacts in the elevator warning relay to maintain the relay actuated. Thus, with 28V dc power through the fail sensors, or 28V DC power from any throttle above takeoff, or the aircraft in the air, the elevator warning relay is actuated to open the circuit to the aural warning and annunciator light.



NOTE

1 THROTTLES SHOWN ADVANCED PAST TAKEOFF POSITION

2 ALL FUNCTIONS SHOWN WITH POWER ON AIRCRAFT

M1-0008-27-713

R Elevator Drive Failure System Electrical Schematic
R Figure 4

R ELEVATOR CONTROL SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for
R fault isolation any time a fault is reported or suspected. The
R PREREQUISITES listed at the top of each fault isolation diagram
R must be satisfied prior to starting fault isolation. Uncommon
R abbreviations are defined on the fault diagram or schematic.

R If the flight crew reports a problem by the use of a fault code
R number, the code number can be found in the Fault Isolation
R Reference Table in the Chapter 27 Fault Code Index. The index
R specifies the exact maintenance manual section, fault isolation
R diagram, and block number on the diagram where the fault
R isolation procedure should start. Schematics are included at
R the end of the section to supplement the fault code diagrams or
R as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed
R discussion of the Fault Isolation Reporting Method (FIRM) and
R use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in
R this section.

R Table 10

FIGURE	TITLE
101	Component Locator Index
102	Component Locator Diagram
103	Elevator Light and Unsafe Takeoff Horn On

COMPONENT	QTY	AREA/ACCESS	REFERENCE
TIE ROD, ELEVATOR CABLE	1	RIGHT & LEFT OF CENTER LINE, 1060 BULKHEAD	27-31-11
DETECTOR LINK, CABLE OVERLOAD BRAKE	1	RIGHT & LEFT HAND CABLE TIE ROD	27-31-12

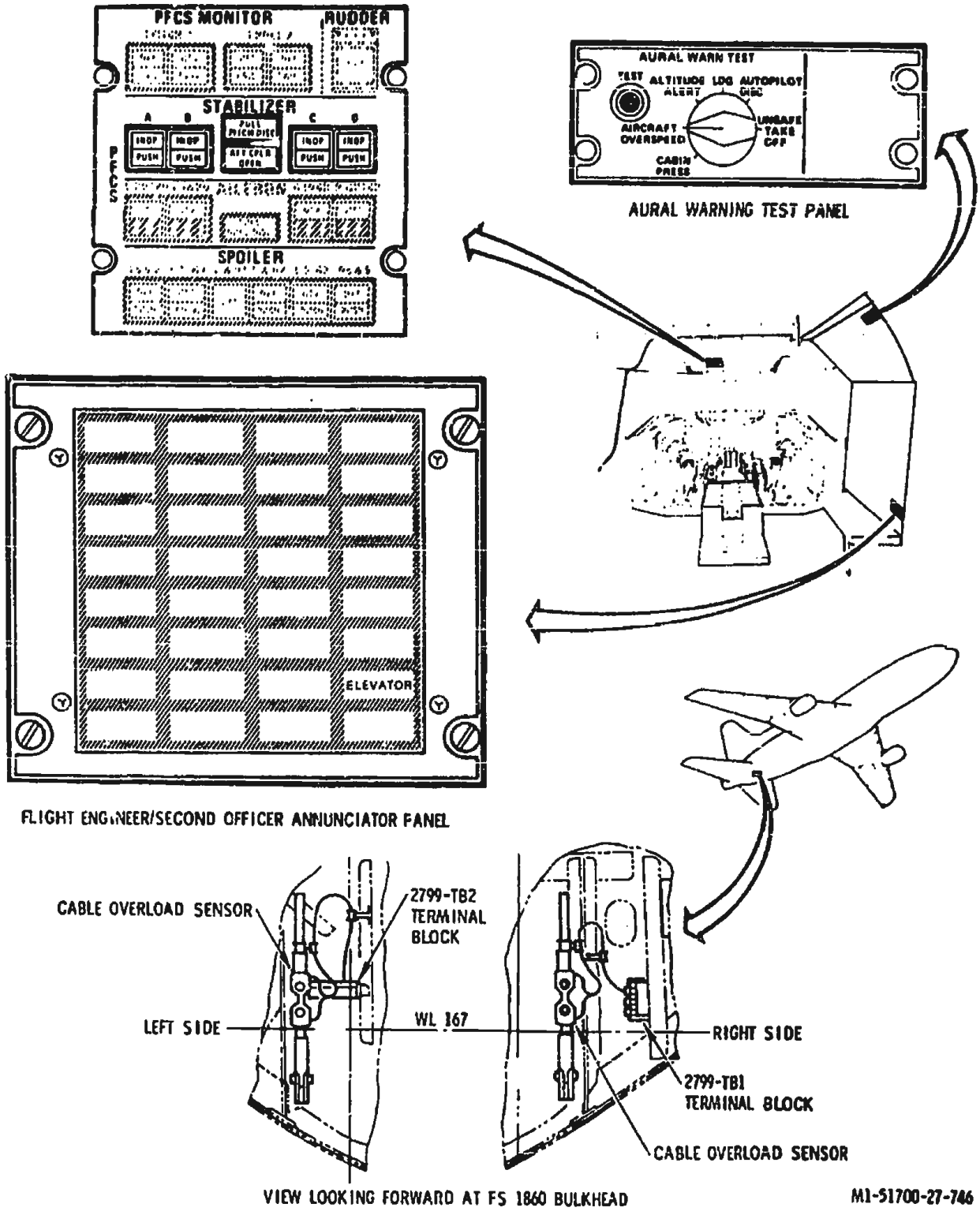
M1-0000-27-755

R
R

Component Locator Index
Figure 101

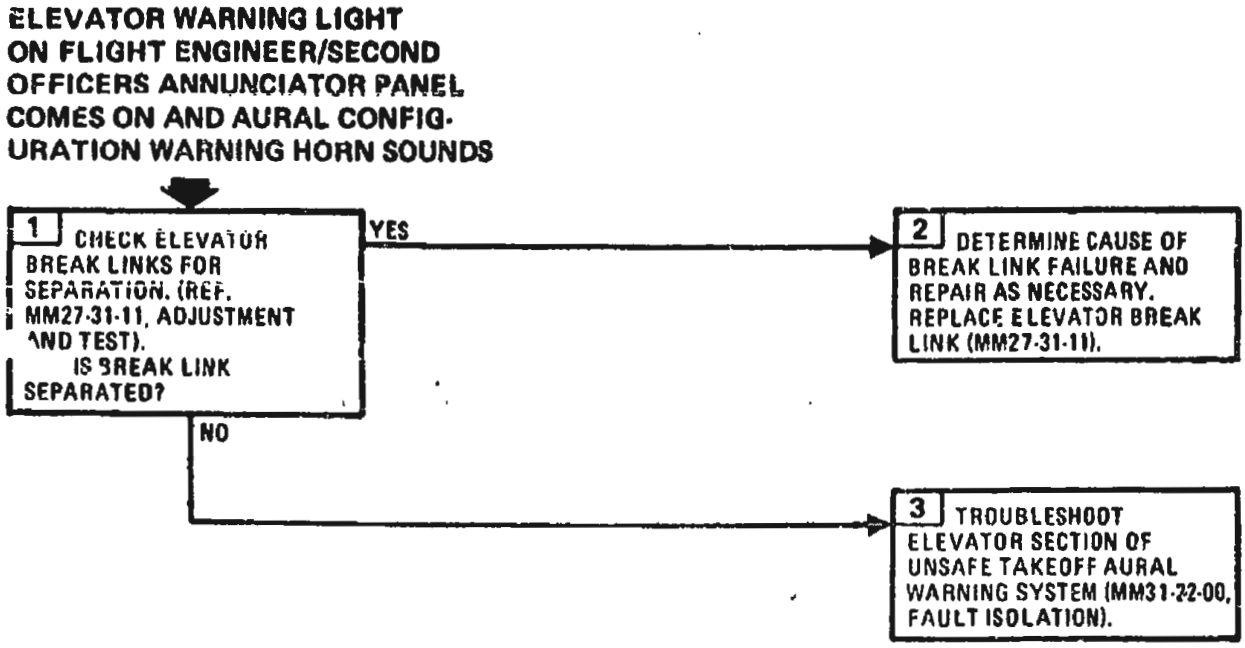
EFFECTIVITY: 001-031 WITH SB27-174 AND 032-999

001B



R Component Locator Diagram
R Figure 102

R EFFECTIVITY: 001-031 WITH SB27-174 AND 032-999
R
001B


ELEVATOR WARNING LIGHT ON FLIGHT ENGINEER/SECOND OFFICERS ANNUNCIATOR PANEL COMES ON AND AURAL CONFIGURATION WARNING HORN SOUNDS
1 CHECK ELEVATOR BREAK LINKS FOR SEPARATION. (REF. MM27-31-11, ADJUSTMENT AND TEST).
IS BREAK LINK SEPARATED?
YES
2 DETERMINE CAUSE OF BREAK LINK FAILURE AND REPAIR AS NECESSARY. REPLACE ELEVATOR BREAK LINK (MM27-31-11).
NO
3 TROUBLESHOOT ELEVATOR SECTION OF UNSAFE TAKEOFF AURAL WARNING SYSTEM (MM31-22-00, FAULT ISOLATION).

M1-0003-27-749

R Elevator Light and Unsafe Takeoff Horn On
R Figure 103

ELEVATOR CONTROL SYSTEM - ADJUSTMENT AND TEST

1. Adjustment/Test

These procedures must be used to perform an operational test (Ref. Para. 4) and a rigging check and adjustment (Ref. Para. 5) of the elevator control system.

2. Equipment and Materials

Elevator Neutral Rigging Tool, LAC BF 79, or equivalent

Control Column and Trim Wheel Lock PN BA80-101, or equivalent

Rig Pin, 9/16-inch diameter by 7 inches long (part of B734 rig pin kit)

R Corossion Preventative Compound MIL-C-16173, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Test

A. Elevator Control System

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on one hydraulic system for each stabilizer servo: system A or B and C or D (Ref. 29-11-00).

R (2) Position pitch trim wheel to 4 degrees.

(3) Slowly operate column through three full pitch cycles. Verify that both elevators operate smoothly (no binding).

(4) Push control column fully forward (nose-down). Verify that horizontal stabilizer leading edge positions full up (pointer on surface position indicator should be full down). Elevators will be faired with stabilizer.

(5) Pull control column fully aft (nose-up). Verify that horizontal stabilizer positions to leading edge full-down (pointer on surface position indicator should R be full up). Elevators should position a minimum of R 24.5 degrees up from faired with stabilizer.

(6) Allow control column to return to neutral.

(7) Shut off all hydraulic power (Ref. 29-11-00).

5. Rigging Check and Adjustment

A. Elevator Control System

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

INSTALL CONTROL COLUMN AND TRIM WHEEL LOCK TO PREVENT INADVERTENT MOVEMENT OF THE STABILIZER/ELEVATOR.

(1) Open the following access doors as needed (Ref. 6-40-00):

(a) 317AB and 317CB to elevator cable load turnbuckles.

(b) 317BB to elevator cable upper turnbuckles.

(c) 334CB and 344CB to elevator drive quadrant.

(d) 335DB and 345DB to elevator and drive push rod attachment bolt.

(e) 334EB, 344EB, 334FB, 344FB to No. 2 elevator hinge.

(2) With hydraulic power off (stabilizer will be at +1 degree), verify that the setscrew gap in the load turnbuckle (1) (Ref. Fig. 501) is within inspection range limits of temperature compensation chart (Ref. Fig. 501), and that the rig pin fits freely through bracket and cable quadrant (2). If not, adjust turnbuckles (1) and (3). If turnbuckles are adjusted, adjust cable tension to bring load turnbuckle setscrew gap within adjustment limits of temperature compensation chart. Verify that turnbuckle locking clips or lock-wire is installed.

NOTE: If upper or lower turnbuckle runs out of adjustment (cable and tie-rod threads bottomed in turnbarrel) before proper cable tension is reached, loosen turnbarrel, remove bolt connecting rod end fitting to elevator drive attachment. Coat threaded section and keyway of rod end with corrosion preventative compound and thread rod end fitting into tie-rod. Install attach bolt, tighten and lock-wire jamnut; then adjust turnbuckle (Ref. Fig. 501).

R
R

CAUTION: IF LOAD TURNBUCKLE IS ADJUSTED, VERIFY THAT LOCKING WASHER ON BOTH ENDS OF TURNBUCKLE IS PROPERLY INSTALLED BEFORE TIGHTENING JAMNUT. LOCKING WASHER OFFSET TANG MUST FACE AWAY FROM JAMNUT AND MUST ENGAGE SLOT IN TURNBUCKLE. LOCK-WIRE JAMNUT (REF. FIG. 501).

(3) If a turnbuckle adjustment is made, remove rig pin and control column lock, turn on hydraulic power (Ref. 29-11-00), and slowly cycle stabilizer a minimum of three times to stabilize cables. Turn off hydraulic power (Ref. 29-11-00), reinstall the control column lock and repeat Step 5A(2).

NOTE: Allow a minimum of 5 minutes after hydraulic shutdown to allow stabilizer actuator pistons to bottom (+1 degree stabilizer position).

(4) With rig pin installed in cable quadrant (2), verify that elevator is in neutral. Use elevator neutral rigging tool (Ref. Fig. 501). If elevator neutral is out of tolerance, adjust elevator actuation pushrod (4). (If elevator actuation pushrod is adjusted, verify that the locking washer offset tab is properly engaged in pushrod slot. Torque rod-end locking nut 1600 to 1800 lb in. and lock-wire locking nut to locking washer)

NOTE: An alternate method of verifying elevator neutral is with the use of a 10-foot straight-edge. Use straight-edge on top and bottom of stabilizer and elevator. Adjust pushrod (4) to obtain equal measurements between straight-edge and upper and lower surfaces of elevator.

After rod end adjustment and jam nut tightening, clean thread and keyway slot area around jam nut, then brush overcoat with MIL-C-16173 corrosion preventitive compound, making certain
CR that keyway slots are filled (or use Parker
CR O-Lube).

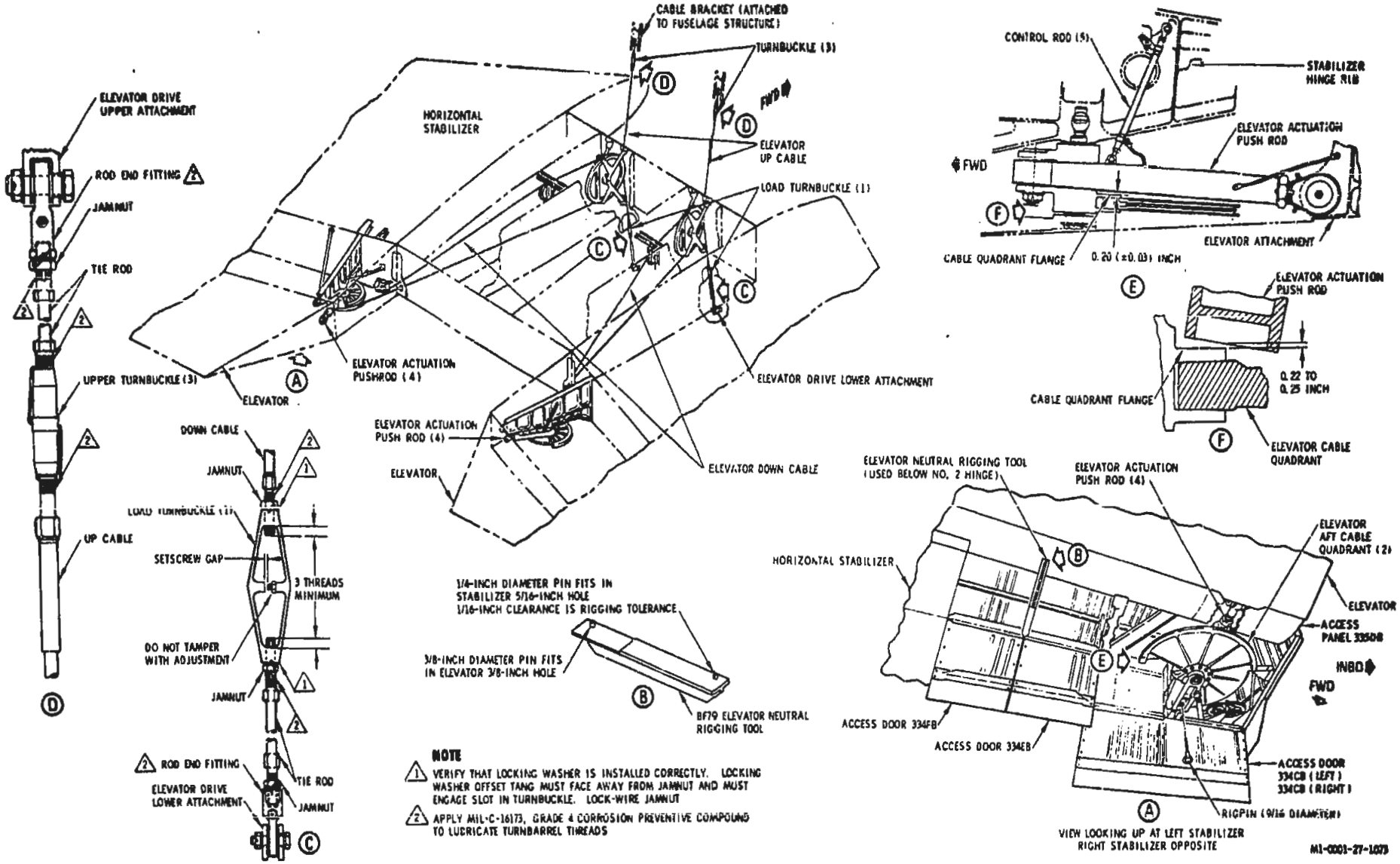
(5) Verify that the clearance between the bottom surface of the elevator actuation pushrod and the top surface of the cable quadrant flange is 0.20 (±0.03) inch (Ref. Fig. 501, View E). If not, adjust control rod (5) rod ends equally to obtain dimension. (If control rod is adjusted, verify that rod-end locking nuts are torqued and lock-wired to locking washer.)

(6) Remove rig pin.

(7) Close access doors opened in Step 5A(3).

(8) Remove the control column lock.

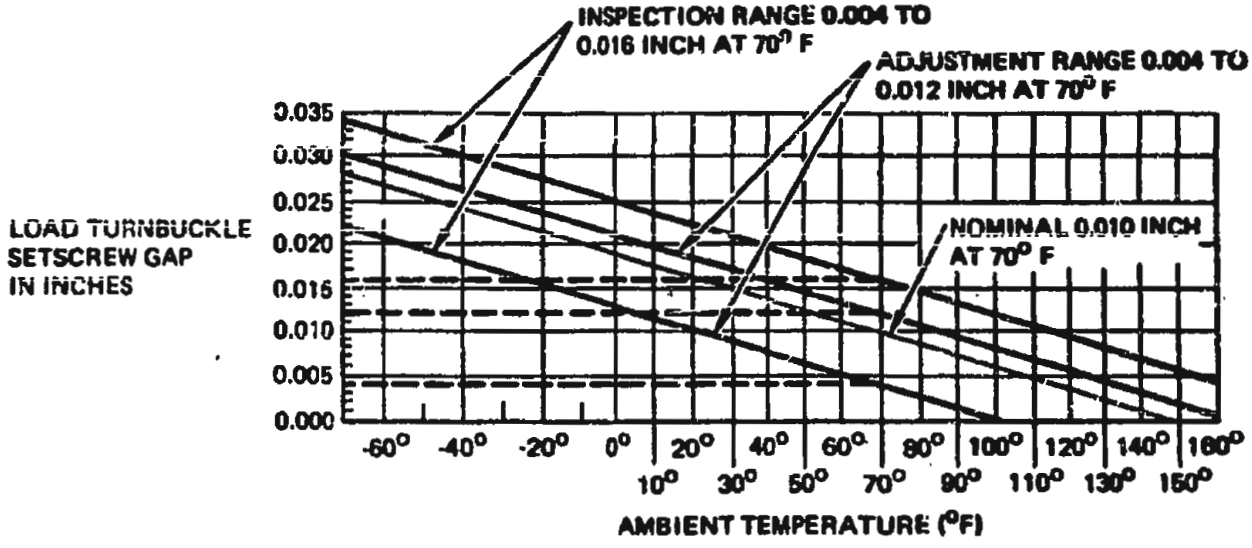
(9) Perform operational test (Ref. Para. 4).

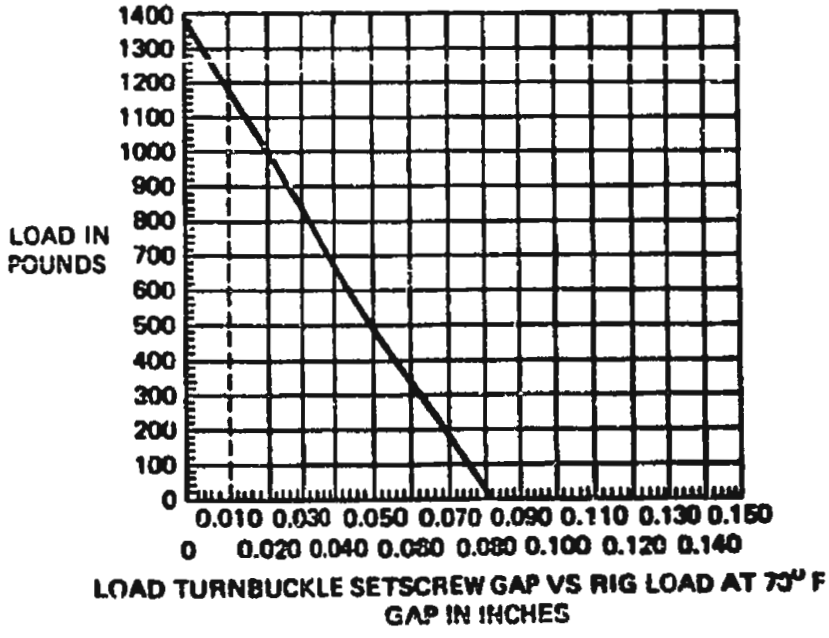


CR Elevator Control System - Rigging Check and Adjustment
CR Figure 501 (Sheet 1)

EFFECTIVITY: ALL

0018


INSPECTION RANGE 0.004 TO 0.016 INCH AT 70° F
ADJUSTMENT RANGE 0.004 TO 0.012 INCH AT 70° F
NOMINAL 0.010 INCH AT 70° F
LOAD TURNBUCKLE SETSCREW GAP IN INCHES
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-60° -40° -20° 0° 20° 40° 60° 80° 100° 120° 140° 160°
10° 30° 50° 70° 90° 110° 130° 150°
AMBIENT TEMPERATURE (°F)
(TEMPERATURE MEASURED AT STABILIZER CENTER SECTION LEADING EDGE)
TEMPERATURE COMPENSATIONS SCALE



M1-0100-27-640

R Elevator Control System - Rigging Check and Adjustment
R Figure 501 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

ELEVATOR CONTROL SYSTEM - INSPECTION AND CHECK

1. General

Elevator play is produced by clearance at the following joints:

A. Elevator hinge bearings

B. Elevator pushrod to elevator aft cable quadrant clevis

C. Elevator pushrod to elevator drive horn clevis

The following procedure provides a method for determining total free play in the elevator drive system. The left and right elevators are not interconnected so both elevators must be checked individually.

2. Equipment and Materials

Control Column and Trim Wheel Lock, PN BA80-101, or equivalent

Force Gage, reading up to 200 pound

Dial Indicator

Dial Indicator Support Fixture

R Load Distribution Pads (Use 1-inch thick plywood or a 2X4, approximately 20 square inches in area)

Lead weight or equivalent to apply 25 pound down load

A jack or equivalent to apply 125 pound up load

3. Referenced Procedures

27-31-00 Elevator Control System - Adjustment and Test

29-11-00 Hydraulic Power System - Maintenance Practices

4. Inspection/Check

A. Elevator Free Play Check (Ref. Fig. 601)

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Install control column and trim wheel lock.

(2) Attach by means of double-faced tape a cantilevered, rigid dial indicator support to the upper stabilizer surface. The dial gage should contact the elevator upper surface at a point 15.4 to 15.7 inches aft of, and normal to the elevator seal attaching screw centerline at elevator station ES 86.35. (Elevator station 86.35 is the elevator pushrod rib, Ref. Fig. 601, View A.)Set the dial indicator at zero.

(3) Carefully apply a 25 pound down load on the upper surface of the elevator at a point 49.5 to 51.5 inches aft of, and normal to the elevator seal attaching screw centerline at elevator station 126.85. (Elevator station 126.85 is the No. 2 hinge rib, Ref. Fig. 601, View B.)

NOTE: Load distribution pads (20 square inches minimum) are to be used when applying load to prevent damage to the elevator. These pads should be positioned so that the load is applied to the rib.

(4) Measure elevator deflection by recording dial movement.

(5) Remove the 25 pound down load and carefully apply a 125 pound up load on the lower surface at the same elevator station and position as the down load.

NOTE: Load distribution pads (20 square inches minimum) should be used when applying the above loads to prevent damage to the elevator. These pads should be positioned so that the load is applied to the rib.

(6) Measure elevator deflection by recording dial movement.

R (7) The sum of the two dial gage readings must not exceed 0.040 inches.

(8) If elevator free play exceeds 0.040 inch, replace or repair elevator drive components as necessary to bring elevator free play below the 0.040 inch maximum allowable.

R R NOTE: Maximum free play of individual joints is as follows:

R R (a) Pushrod to cable quadrant clevis: 0.014 inch.

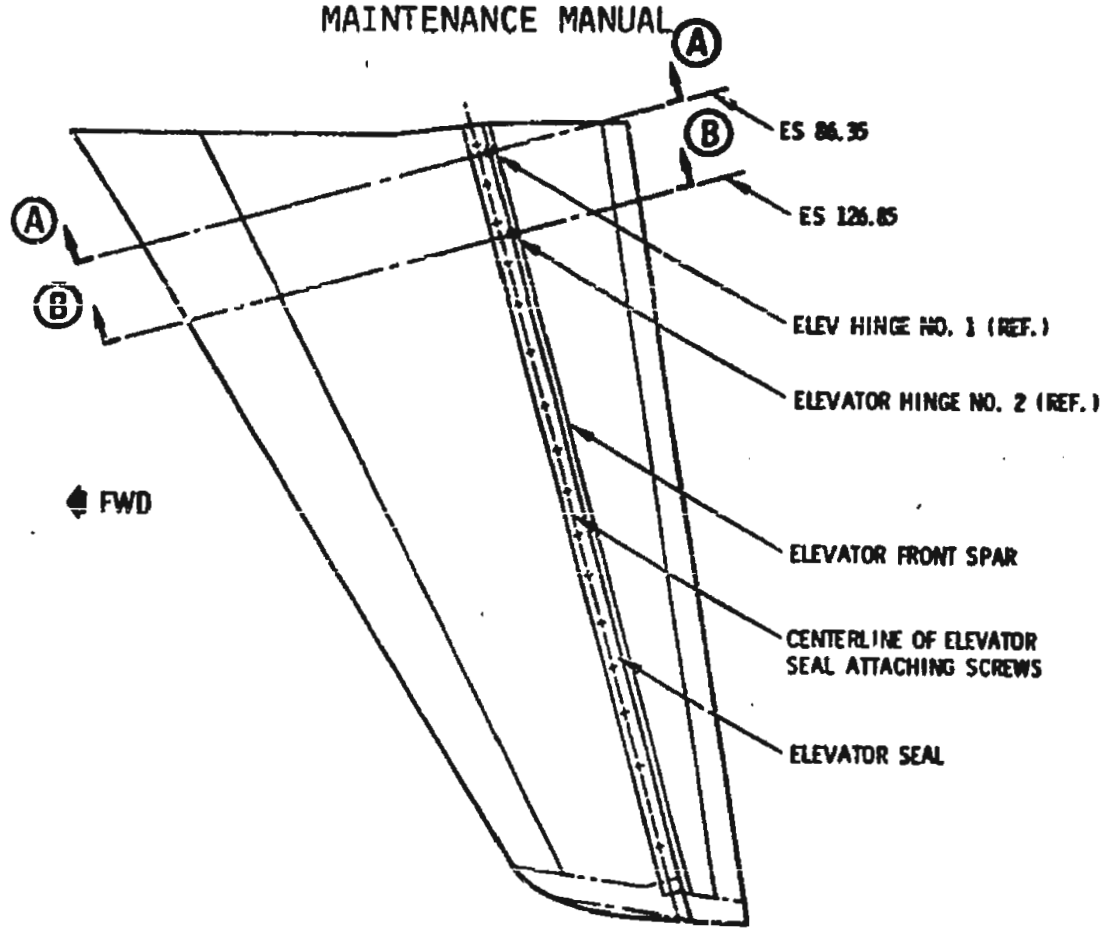
R R (b) Pushrod to elevator drive horn clevis: 0.008 inch.

R (9) Remove control column and trim wheel lock.

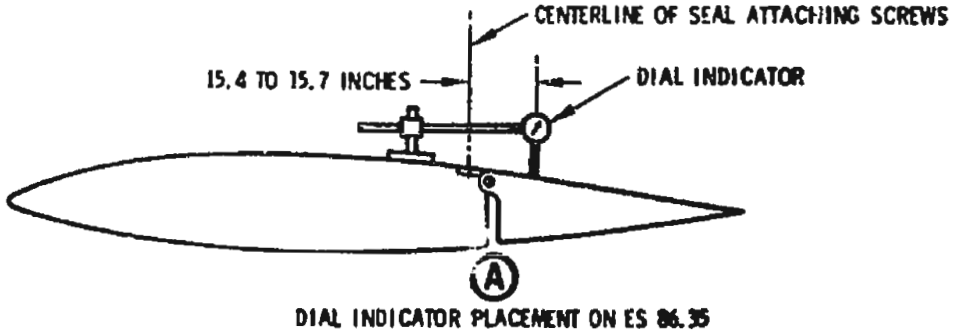
R (10) Remove tags from hydraulic control panels.

R R R (11) If any elevator components were repaired or replaced, perform elevator control system operational test (Ref. 27-31-00, Adjustment and Test, Paragraph 4).

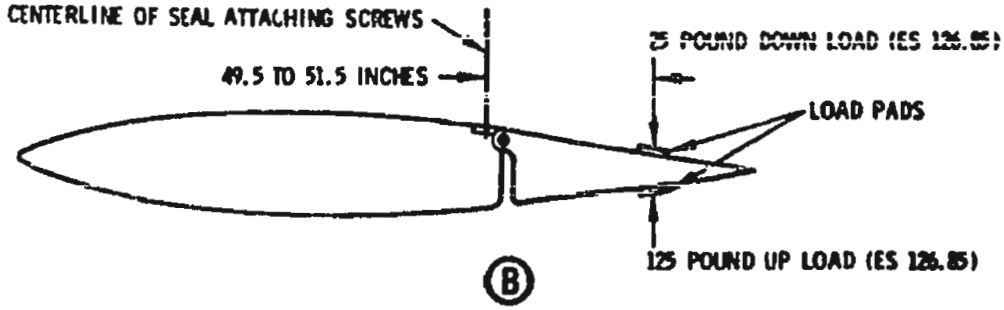
R R R R (a) While performing operational test, visually verify normal operation of elevator control system components in trailing edge of horizontal stabilizer.



LEFT HORIZONTAL STABILIZER TOP VIEW
(RIGHT HORIZONTAL STABILIZER OPPOSITE)



DIAL INDICATOR PLACEMENT ON ES 86.35



LOAD APPLICATION ON ES 126.85

M1-0101-27-601

R
R Elevator Free Play Check
Figure 601

R EFFECTIVITY: ALL
R
R
001B

ELEVATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Elevator Rig Tool, PN BF79, or equivalent

General Purpose Sling, PN B715, or equivalent

Control Column and Trim Wheel Lock, PN BA80-101, or equivalent

Lockwire, Fed. Spec. QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

Cotter Pin, MS24665-153, or equivalent

Cotter Pin, MS24665-300, or equivalent

Cotter Pin, MS24665-302 or equivalent

Sealant, MIL S8802, or equivalent

Sealing Compound, PR7401K, or equivalent

Grease, MIL-G-23827, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-15	Elevator Hinges Lubrication
20-24-04	Electrical Bonding and Grounding Connections - LCP84-1027B
20-51-04	Environmental Sealing of Model L-1011 Airplane - PB75-425D
27-31-00	Elevator Control System - Adjustment and Test
27-31-04	Depleted Uranium Elevator Counterbalance Weights - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

CR NOTE: An improved elevator is installed on aircraft 026-999. The improved elevator incorporates a honeycomb trailing

edge structure and eliminates the three most inboard balance weights. Two hydraulic dampers are installed between the elevator and stabilizer at hinges No. 2 and 6 to provide elevator damping in the event of a "free"
C elevator (open elevator control). (See Caution below)The standard elevator [PN 1524058-107 and -108 (13 balance weights)] and the improved elevator [PN 1524058-111 and -112 (10 balance weights)], are interchangeable; however, it is very important that the hydraulic dampers are installed with the improved elevator. A decal on the elevator front spar next to each damper location warns against installing the improved elevator without the dampers (Ref. Fig. 402).

Since the elevators are interchangeable, it is permissible to install a standard elevator on one side and the improved elevator on the other side of the same aircraft.

Installation of the hydraulic dampers for the first time will require rework of the damper mounting lugs on the stabilizer hinge rib to provide adequate clearance between the damper and mounting lugs (Ref. SB 55-011).

CR AD 75-9-16 APPLIES TO THE FOLLOWING CAUTION.

C CAUTION: A 500 FLT. HR. CHECK IS REQUIRED ON ELEVATOR DAMPERS
C PER FORM M11-AD-03. FOR THIS REASON, MAINTAIN
C ELEVATOR INSTALLATION IN THE "AS DELIVERED" CONFIG.
C AIRPLANES 001 THRU 025 HAVE THE ADDITIONAL WEIGHTS AS
C DESCRIBED. AIRPLANES 026 & ON HAVE DAMPERS.

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

WITH BOTH ELEVATORS INSTALLED, A SUBSTANTIAL LOAD IS REQUIRED ON THE LEADING EDGE OF THE STABILIZER TO MOVE THE STABILIZER FROM ITS NORMAL POWER OFF TRAILING EDGE DOWN POSITION.

WITH ONE ELEVATOR REMOVED THE LEADING EDGE LOAD REQUIRED TO MOVE THE STABILIZER LEADING EDGE DOWN IS SIGNIFICANTLY REDUCED.

WITH BOTH ELEVATORS REMOVED THE STABILIZER MAY MOVE AT ANY TIME TO THE LEADING EDGE DOWN POSITION WITH LITTLE OR NO LOAD APPLIED TO THE STABILIZER.

A. Removal

(1) Install control column and trim wheel lock.

(2) Open following access panels to gain access to elevator hinges (Ref. 6-40-00):

Left Stabilizer:

334CB, 335DB, 334FB, 334HB, 334LB, 334MB, 334NB, 334QB, 334SB, 334TB, 334UB, 334VB, 334WB, 335AB, 335BB, 335CB.

Right Stabilizer:

334CB, 345DB, 344FB, 344HB, 344LB, 344MB, 344NB, 344QB, 344SB, 344TB, 344UB, 344VB, 344WB, 345AB, 345BB, 345CB.

WARNING: DEPLETED URANIUM IS A HIGH DENSITY MATERIAL WITH A NEGLIGIBLE AMOUNT OF RESIDUAL RADIATION. HOWEVER, GRINDING, DRILLING, SANDING, FILING, OR MACHINING OF ANY DEPLETED URANIUM SURFACE BY ANYONE NOT HOLDING AN NRC LICENSE IS PROHIBITED BY GOVERNMENT REGUALTION.

DEPLETED URANIUM OXIDE, YELLOW AND BLACK CORROSION PARTICLES, IS TOXIC.

ALTERATION OF DEPLETED URANIUM MATERIAL BY MECHANICAL METHODS IS PROHIBITED BECAUSE FINELY DIVIDED URANIUM PARTICLES SUCH AS MIGHT CONSEQUENTLY BE PRODUCED AND INGESTED POSE THE SAME HEALTH HAZARD COMMON TO ALL HEAVY METALS (I.E. LEAD AND CADMIUM).

HANDLING OF OXIDIZED COUNTERBALANCE WEIGHTS SHOULD BE HELD TO A MINIMUM TO PREVENT BROADCASTING OXIDE TO SURROUNDING PERSONNEL AND WORK AREAS.

EATING AND SMOKING IN IMMEDIATE WORK AREA IS FORBIDDEN WHILE PERFORMING REPAIR WORK.

PERSONNEL PERFORMING WORK ON OXIDIZED DEPLETED URANIUM WEIGHTS MUST WEAR DISPOSABLE PROTECTIVE GLOVES AND CLOTHS.

DISPOSE OF ALL POTENTIALLY CONTAMINATED PROTECTIVE CLOTHING PER LOCAL, STATE OR FEDERAL REGULATIONS REGARDING RADIOACTIVE CONTAMINATED MATERIALS.

PERSONNEL HANDLING OXIDIZED DEPLETED URANIUM MUST THOROUGHLY WASH PRIOR TO EATING, SMOKING, ETC.

(3) Remove any corroded counterbalance weights (Ref. 27-31-04).

(4) Disconnect elevator aft cable quadrant pushrod from elevator by disconnecting the bonding jumpers and the pivot pin retaining bolt. Remove the pivot pin and the laminated washer. Retain laminated washer (Ref. Fig. 401).

(5) Remove plugs from elevator sling fittings on elevator upper surface. Attach sling mounting plates to elevator.

NOTE: The three pairs of elevator sling attach points incorporate 1/4-inch allen-socket headless setscrews installed in nut plates. Two pairs of attach points are located just aft of the front beam, one just outboard of hinge fitting No. 3, and one just outboard of hinge fitting No. 5. The third pair of attach points is located approximately 17 inches forward of trailing edge on the same station as hinge No. 4.

(6) With general purpose sling attached to overhead hoist, attach sling to mounting plates.

(7) Adjust sling to position elevator to a slight trailing edge-up position.

NOTE: One hundred pounds of ballast must be secured to aft hoist point to balance elevator.

(8) If hydraulic dampers are installed (improved elevator), disconnect both dampers from elevator by removing the connecting bolt (Ref. Fig. 402).

(9) Remove nuts, bolts, washers, split cone bushings, and bonding jumpers at hinge numbers 2, 3, 5, 6, 7, and 8 .

(10) Raise hoist to support elevator weight.

NOTE: Elevator weighs approximately 700 pounds (without ballast weight).

(11) Remove nut, bolt, washers, split cone bushings, and bonding jumper at hinge number 4.

(12) Remove nuts, dual bolts, washers, and bonding jumpers at hinge number 1.

(13) Carefully move elevator aft until counterweights clear stabilizer trailing edge structure, then lower to dolly.

(14) Disconnect sling from mounting plates.

(15) Remove mounting plates from elevator. Install plugs in mounting plate fittings.

B. Installation

NOTE: Replacement elevator must be balanced per Structural Repair Manual, Section 51-90-00. Weight and balance information is provided on a data placard located at the inboard end of the front spar at elevator station 75.

Before installing elevator, verify that cone bushings on hinges 2 through 8 are flush with inside face of trailing edge hinge rib lugs, to prevent damage to
C cone bushings during elevator installation. Check
C weight installation (Ref. Fig. 403).

C During elevator installation, the hinge bolt holes
C may be misaligned by up to one third of the hole
C diameter. The elevator can be deflected in order to
C install the hinge bolt.

(1) Verify that all hydraulic power is turned off and hydraulic control panels tagged (Ref. 29-11-00).

(2) Verify that control column lock is installed.

(3) Remove plugs and install sling mounting plates to elevator.

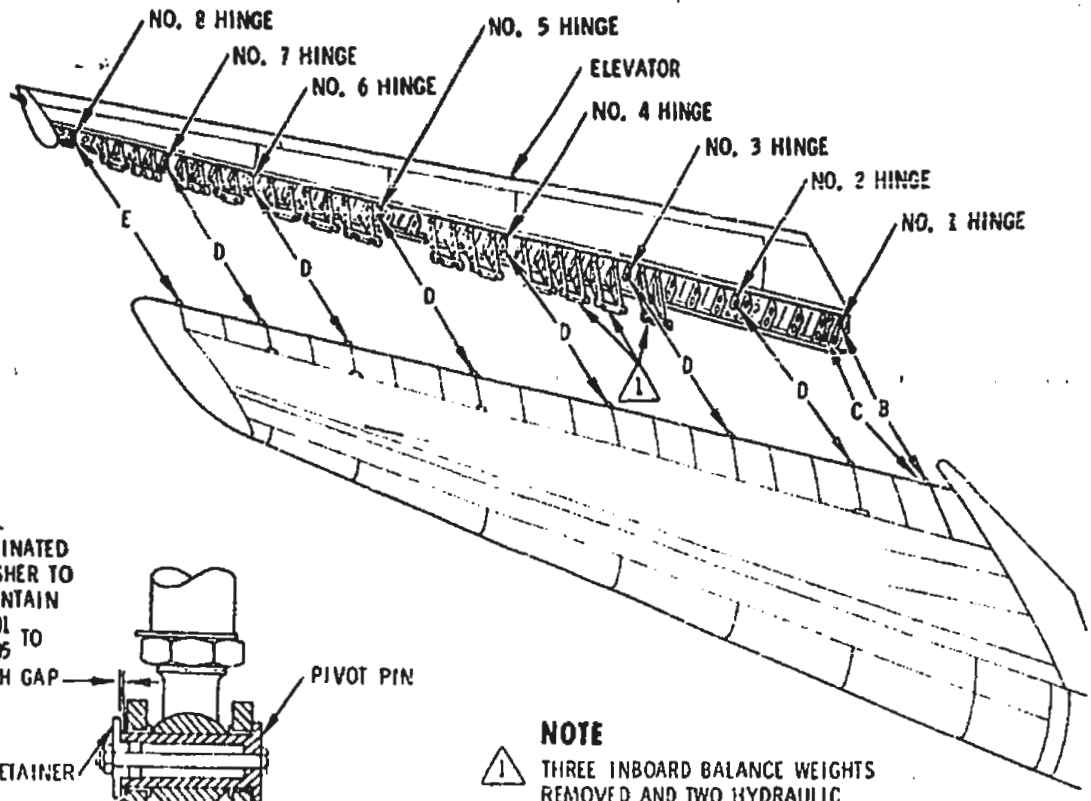
(4) Attach sling to elevator mounting plates. Verify that 100-pound ballast is secured to aft hoist point.

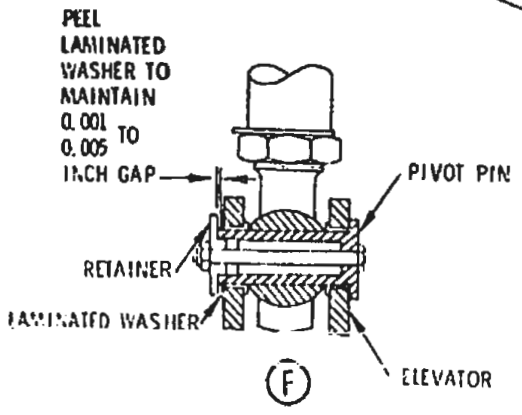
(5) Adjust sling to position elevator to a slight trailing edge-up position.

(6) Raise elevator into position and carefully move elevator forward to engage elevator hinge bearings between hinge rib lugs.

(7) Temporarily install hinge number 4 split cone bushings and bolt to align elevator. Do not install nut.

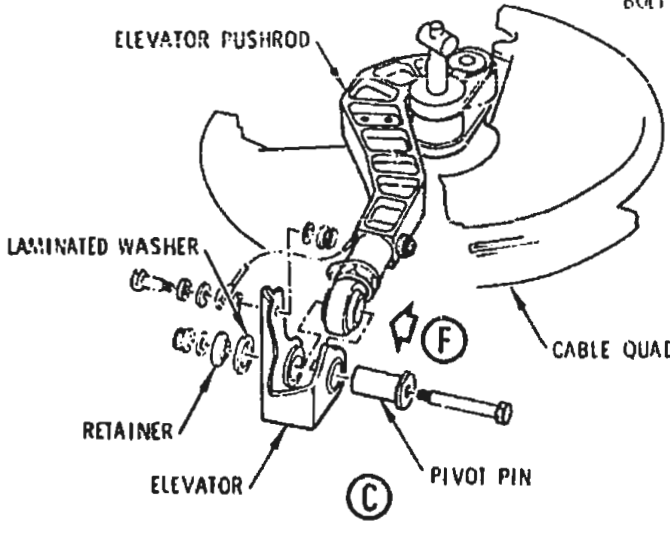
(8) Install hinge number 1 hollow bolt, washers, and nut. Install inner bolt, washers, and nut. Do not torque.



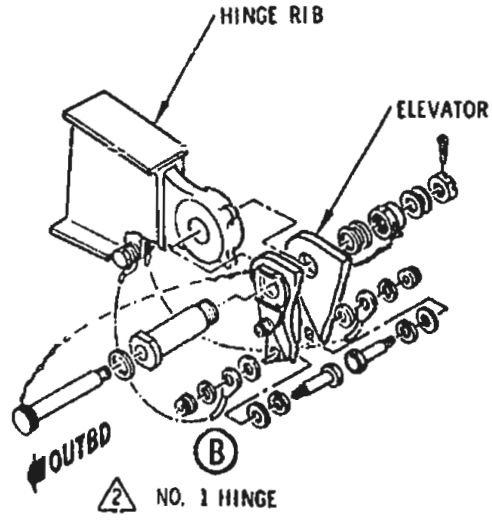


NOTE

1. THREE INBOARD BALANCE WEIGHTS REMOVED AND TWO HYDRAULIC DAMPERS INSTALLED ON IMPROVED ELEVATOR (BOTH ELEVATORS INTERCHANGEABLE)
2. THE INSTALLATION ORIENTATION FOR HINGE NO. 1 BOLT HEAD IS OUTBOARD



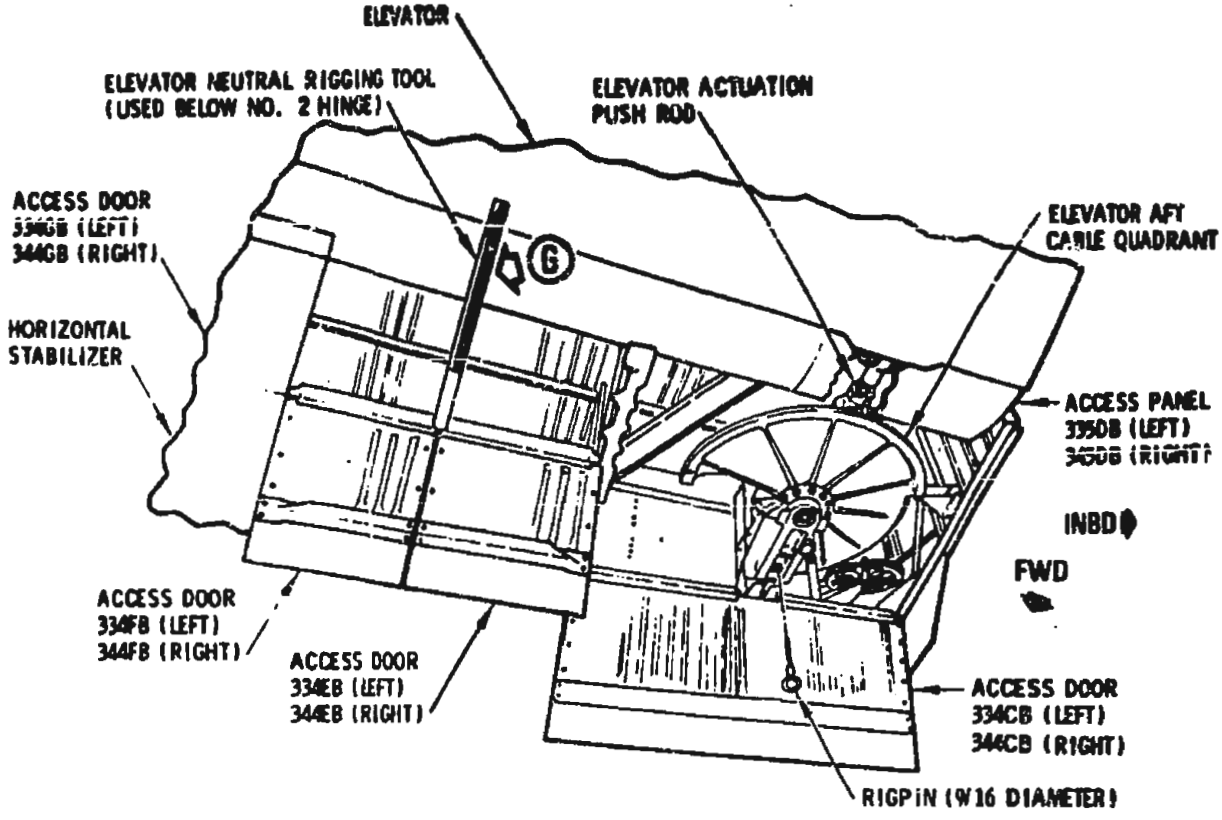
ELEVATOR DRIVE QUADRANT PUSHROD



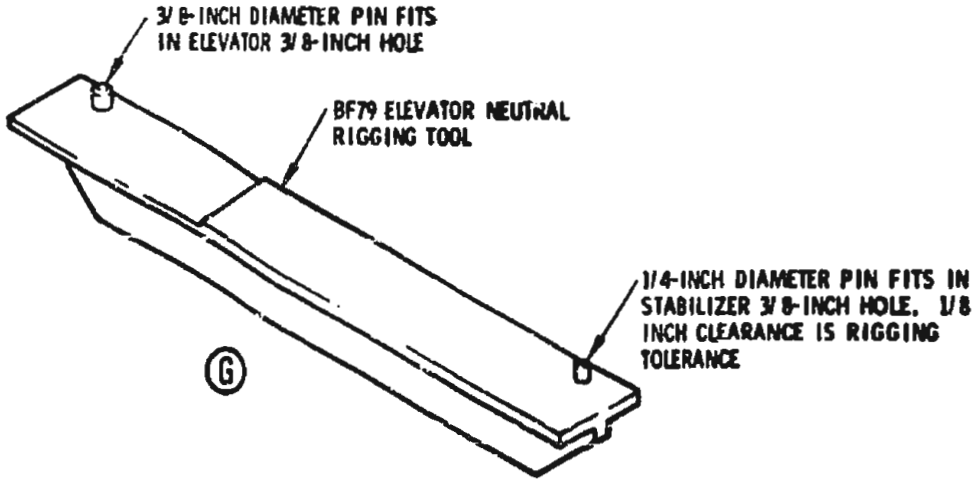
2 NO. 1 HINGE

MI-0104-27-166

R Elevator - Removal and Installation
R Figure 401 (Sheet 1)

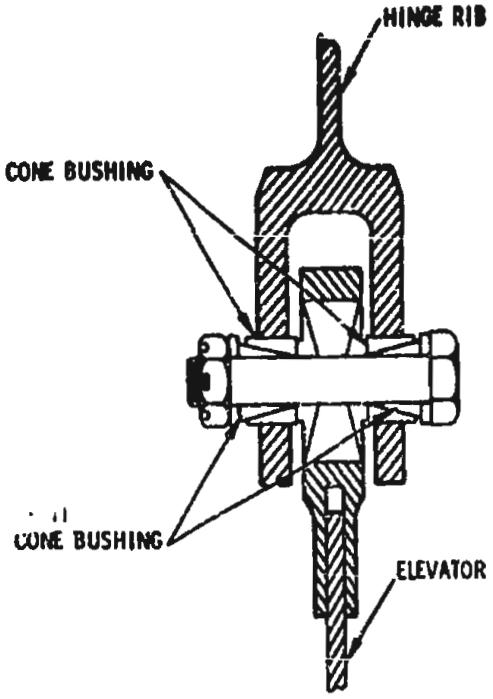


VIEW LOOKING UP AT LEFT STABILIZER
RIGHT STABILIZER OPPOSITE

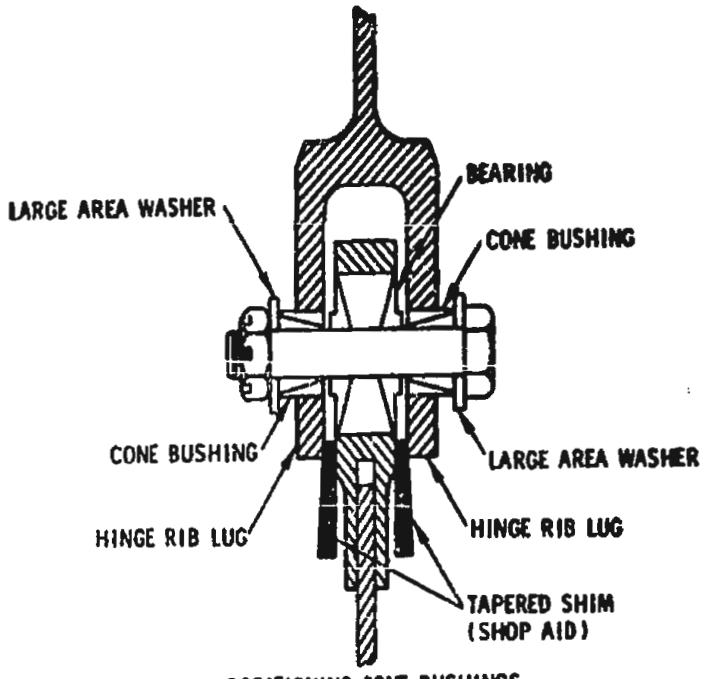


M1-0103-27-167

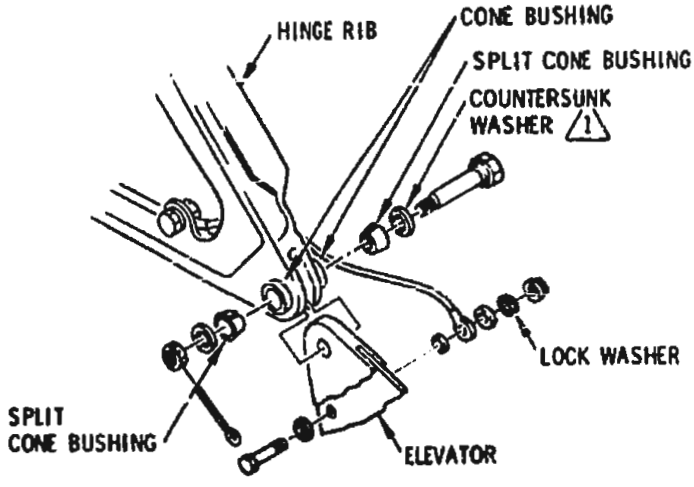
Elevator - Removal and Installation
Figure 401 (Sheet 2)



TYPICAL INSTALLATION

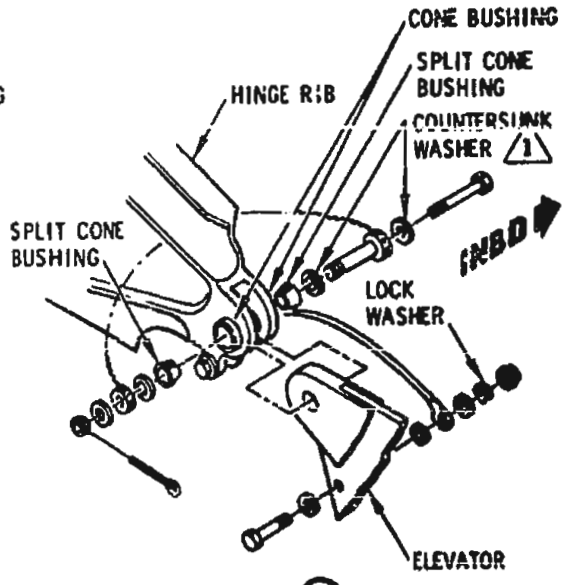


POSITIONING CONE BUSHINGS AGAINST BEARING



(D)

2 NO. 2, 3, 4, 5, 6, 7 HINGE



(E)

2 NO. 8 HINGE

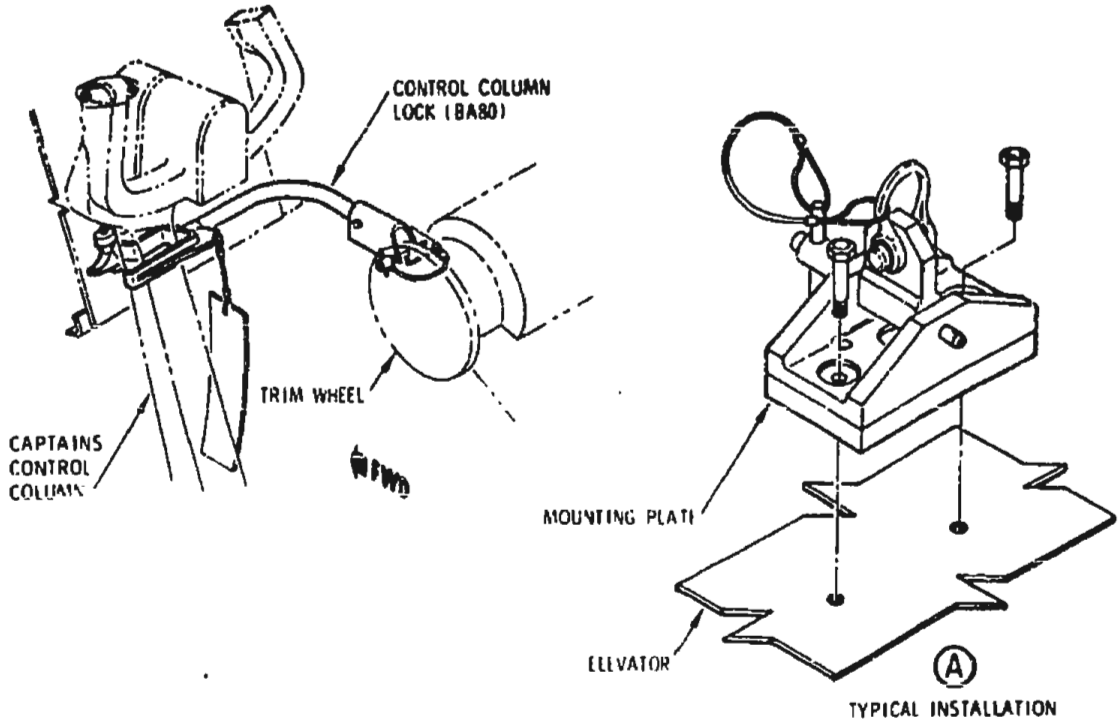
NOTE

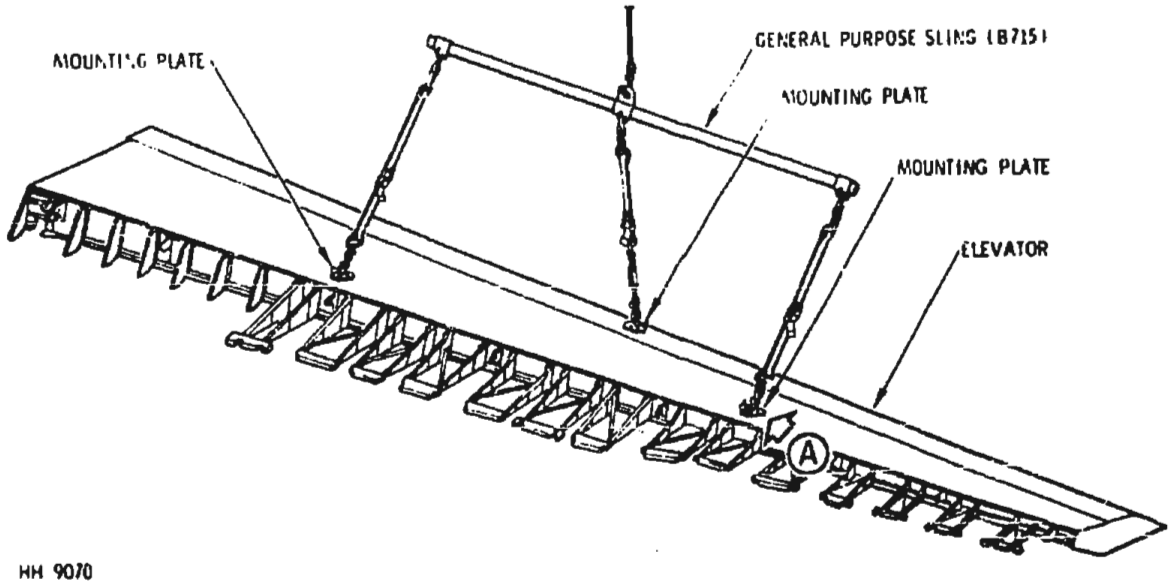
1 INSTALL WASHER WITH COUNTERSINK AGAINST BOLTHEAD

2 THE INSTALLATION ORIENTATION FOR HINGE NOS. 3, 4, 5 AND 6 BOLT HEADS IS OUTBOARD. THE INSTALLATION ORIENTATION FOR HINGE NOS. 2, 7 AND 8 BOLT HEADS IS INBOARD

M1-0104-27-168

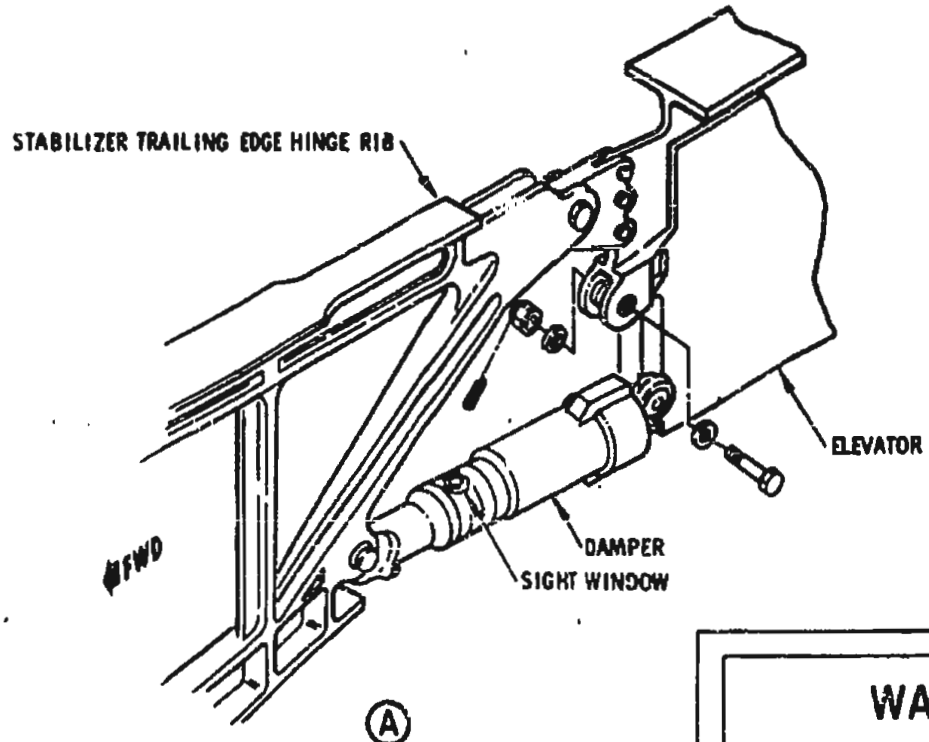
R Elevator - Removal and Installation
R Figure 401 (Sheet 3)





HH 9070
M1-0101-27-169

Elevator - Removal and Installation
Figure 401 (Sheet 4)



(A)

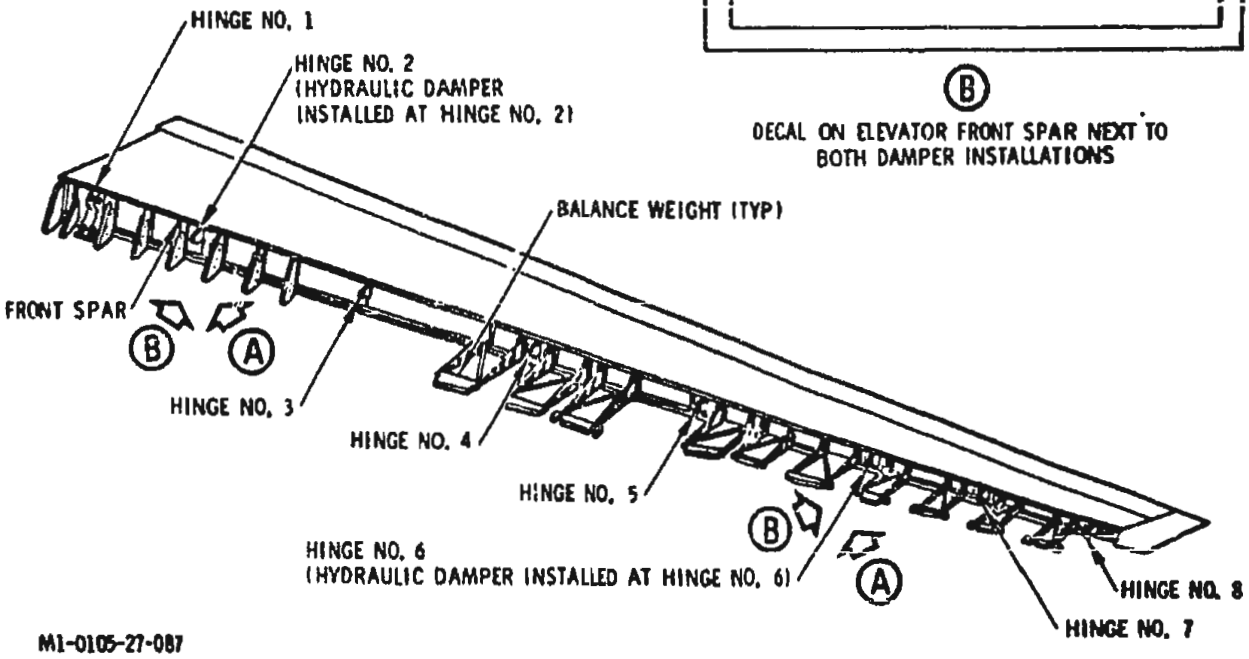
HYDRAULIC DAMPER INSTALLATION
(AFT HINGE NO. 2 AND 6 ON EACH ELEVATOR)

WARNING

ELEV DAMPER, PART
NO. 672470-~~355~~
MUST BE INSTALLED
PRIOR TO FLIGHT

(B)

DECAL ON ELEVATOR FRONT SPAR NEXT TO
BOTH DAMPER INSTALLATIONS



M1-0105-27-087

Hydraulic Damper Installation (Improved Elevator)
Figure 402

(9) Slack up on hoist cable. Disconnect mounting plates from elevator. Install plugs in mounting plate fittings.

(10) On hinge number 1, torque hollow bolt nut 700 to 750 lb in. and lock-wire.

(11) On hinge number 1, torque inner bolt 290 to 315 lb in. and install cotter pin (MS24665-153).

(12) Position hinge rib lug cone bushings on hinges 2, 3, 5, 6, 7, and 8 as follows:

(a) At each of the above hinges, in turn, install a hinge bolt and nut, with a large area washer under bolt head and nut, then install a tapered shim (shop aid) between each of the two hinge rib lugs and bearing housing to support the rib lugs. Tighten nut to press cone bushings against bearing inner race (Ref. Fig. 401).

NOTE: Do not install split cone bushings while positioning cone bushings.

(b) Remove bolt, large area washer, and nut from hinges after positioning cone bushing.

(13) Install split cone bushings, bolt, washers, and nuts on hinges 2, 3, 5, 6, and 7.

(14) Install split cone bushings, dual bolts, washers and nuts on hinge number 8.

(15) Remove hinge number 4 split cone bushings and bolt temporarily installed in Step 3B(7).

(16) Position hinge number 4 cone bushings per Step 3B(12).

(17) Install split cone bushings, bolt, washers, and nut on hinge number 4.

(18) Torque hinge number 2 nut 175 to 190 lb in. Install cotter pin (MS24665-302).

(19) Torque nut on hinges number 3 through 7, 40 to 50 lb in. Install cotter pins (MS24665-300).

(20) Torque hinge number 8 large nut 175 to 190 lb in. and lock-wire. Torque small nut 70 to 80 lb in. Install cotter pin (MS24665-153).

C (21) Connect elevator aft cable quadrant pushrod to elevator
C as follows:

C (a) Hand pack pivot pin internal cavity with
C MIL-C-23827 grease.

(b) Install pivot pin, laminated washer, retainer, bolt and nut.

(c) Adjust laminated washer to maintain 0.001 to 0.005-inch gap between retainer and hinge rib lug (Ref. Fig. 401).

(d) Torque nut 185 to 205 lb in.

C (e) Apply a coat of PR1435 sealing compound over nut,
C bolthead and washer, and around edges of pin head
C and retainer.

(22) Install bonding jumpers on hinges 1 through 8 and on aft cable quadrant elevator pushrod. Electrically bond and seal (Ref. 20-24-04 and 20-51-04).

(23) If hydraulic dampers are installed (improved elevator), connect damper piston rod to elevator (at hinges 2 and 6) with bolt, washer, and nut; tighten nut and install cotter pin (Ref. Fig. 402) .

WARNING: IF IMPROVED ELEVATOR [PN 1524058-111 (LH) or -112 (RH)] IS INSTALLED, VERIFY THAT BOTH HYDRAULIC DAMPERS ARE INSTALLED.

NOTE: Installing the hydraulic dampers for the first time will require removing some material from the damper attach lugs on the stabilizer hinge rib to provide clearance between the damper and the lugs (Ref. SB 55-011).

(24) Check elevator actuation pushrod adjustment as follows:

(a) Install 9/16-inch diameter rig pin in aft cable quadrant. If rig pin cannot be inserted, check elevator cable rigging (Ref. 27-31-00).

(b) With rig pin installed, verify that elevator is in neutral (use elevator rig tool BF79). If not, adjust length of elevator actuation pushrod. (If elevator actuation pushrod is adjusted, verify that the locking washer offset tab is properly engaged in pushrod slot. Torque rod-end locking nut 1600 to 1800 lb in.)

NOTE: An alternate method of verifying elevator neutral is with the use of a 10-foot straight-edge. Use straight-edge on top and bottom of stabilizer and elevator. Adjust elevator pushrod to obtain equal measurements between straight-edge and upper and lower surfaces of elevator.

(c) Remove rig pin.

NOTE: After rod end adjustment and jam nut tightening, clean thread and keyway slot area around jam nut, then brush overcoat with MIL-C-16173 corrosion preventative compound, making certain that keyway slots are filled (or use Parker O-Lube).

(25) Lubricate all elevator hinge bearings and elevator aft cable quadrant pushrod rod-end (Ref. 12-23-15).

(26) Check elevator seal (Ref. Fig. 403).

(27) Remove placards from hydraulic control panels.

(28) Remove control column lock.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

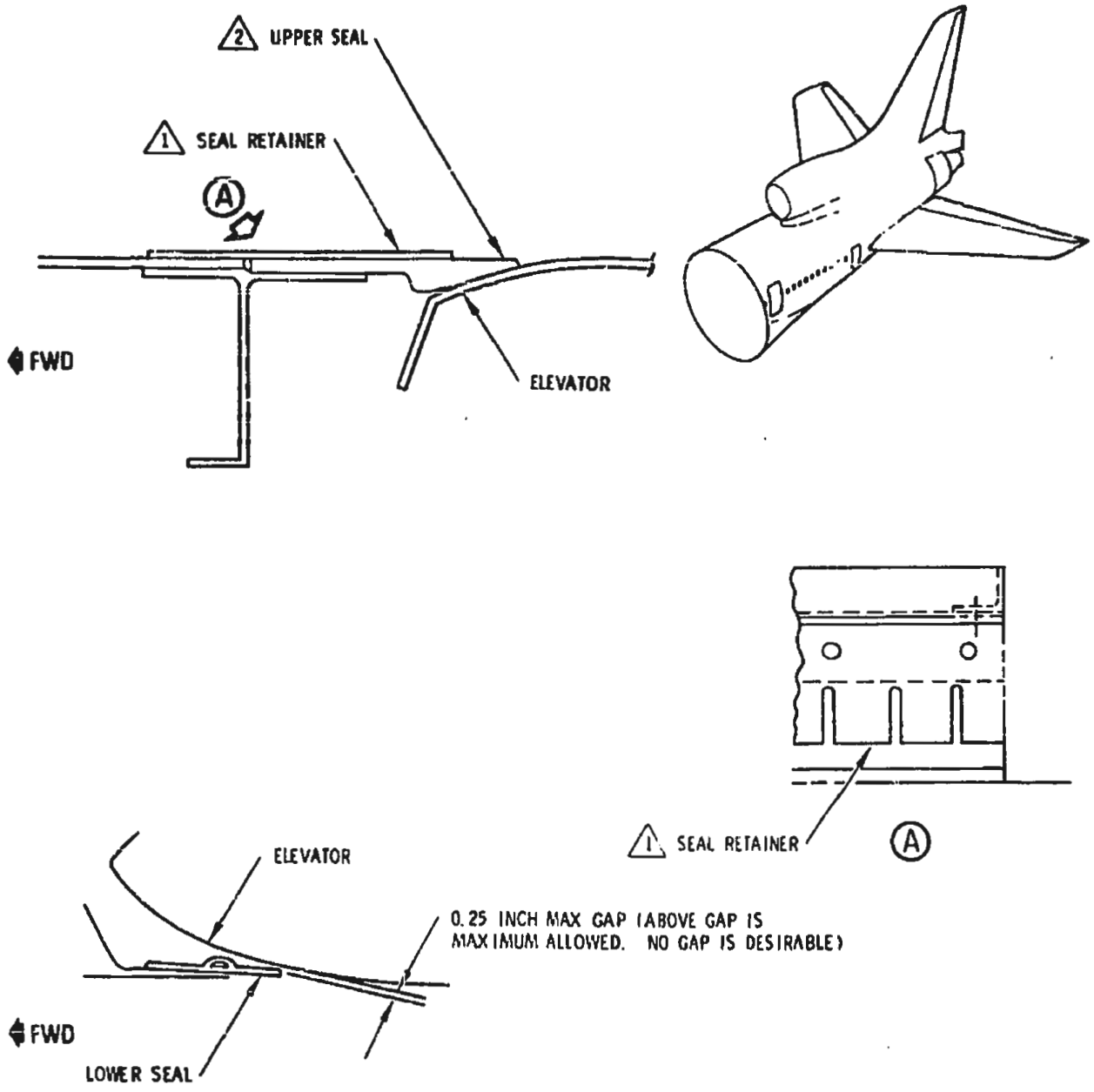
PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: VERIFY THAT NO. 2 ENGINE UPPER COWLS ARE EITHER FULLY OPEN, OR FULLY CLOSED WITH ALL LATCHES LATCHED.

(29) Turn on hydraulic systems AC pumps B3 and C3 (Ref. 29-11-00).

CAUTION: RAPID CYCLING OF ELEVATOR CAN DAMAGE ELEVATOR DAMPER SEALS. IF HYDRAULIC DAMPERS INSTALLED, CYCLE CONTROL COLUMN SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

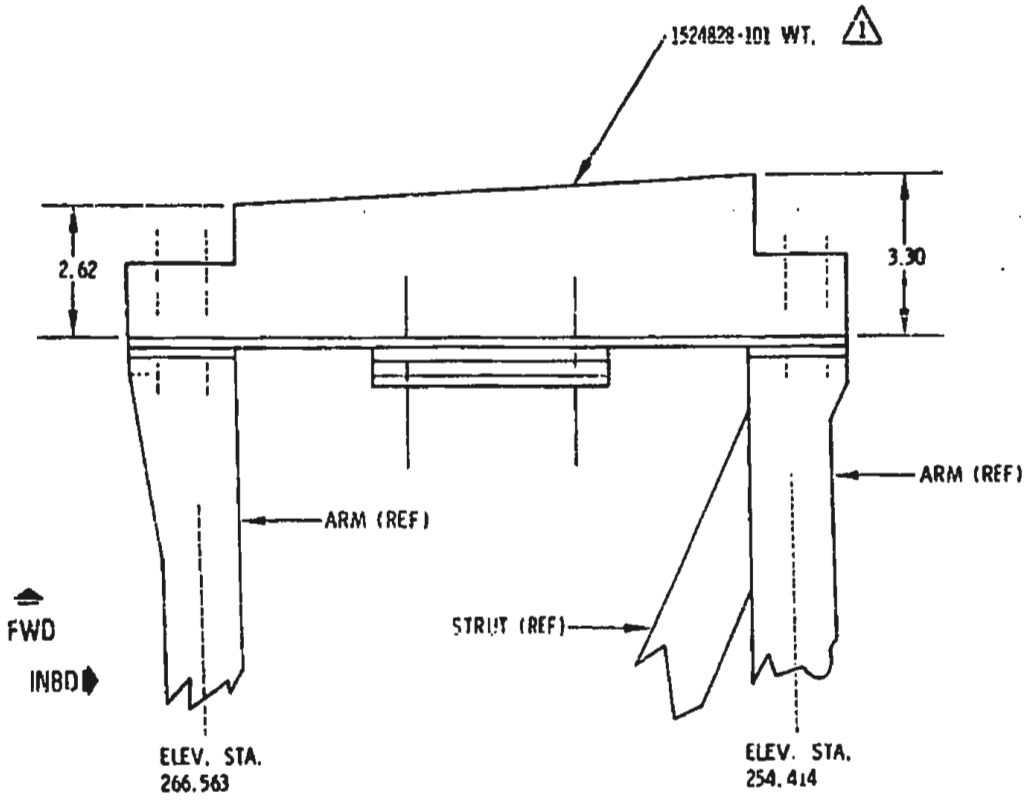


NOTE

1. BEND TABS ON SEAL RETAINERS AS REQUIRED TO ENSURE CONTACT OF SEAL ELEVATOR SKIN
2. NO GAPS ALLOWED, SEAL MUST CONTACT 100% OF ELEVATOR SPAN

MI-0000-27-719

Elevator Seals, Permissible Gaps
Figure 403



1 **NOTE**
THIS (AND SIMILAR WEIGHTS) CAN BE INCORRECTLY INSTALLED WITH THE WIDE END OUTBOARD AND WILL INTERFERE WITH STABILIZER STRUCTURE WHEN ELEVATOR OPERATES. ASSURE CORRECT INSTALLATION OF ALL SUCH WEIGHTS BEFORE INSTALLING ELEVATOR.

M1-0000-27-807

C C Elevator Weight - (Typ)
Figure 404

R R 001B EFFECTIVITY: ALL

(30) Move the control column through full travel forward and aft a minimum of three complete cycles. The elevator must operate smoothly without binding or hesitation through full control range. Visually verify normal operation of the aft cable quadrant and elevator pushrod.

NOTE: *If the elevator is replaced with an early configuration elevator, verify that a minimum 0.25 inch clearance exists between inboard end of elevator and number 2 engine center fixed cowling. If clearance is less than minimum, trim end of elevator.*

(31) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(32) Close all access openings (Ref. 6-40-00).

DEPLETED URANIUM ELEVATOR COUNTERBALANCE WEIGHTS - REMOVAL AND INSTALLATION

1. General

The balance weights installed on the elevators are made from depleted uranium. Each elevator has a series of 13 [PN1524058-107 and -108] or 10 [PN1524058-111 and -112] balance weights.

The weights are coated with a phosphate ester resistant epoxy primer at Lockheed prior to installation. The latest configuration has an additional white high gloss polyurethane enamel top coat.

Handling of undamaged depleted uranium counterbalance weights does not require use of protective gloves or clothing.

2. Equipment and Materials

Control Column and Trim Wheel Lock, PN BA80-101, or equivalent.

Integralfuel tank sealing compound,PR 1422.

1,1,1 Trichlorethane.

Lint - free cleaning rags.

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

A. Removal

(1) Install control column and trim wheel lock.

(2) Open appropriate access panels to gain access to elevator counterbalance weights (Ref. 6-40-00):

Left Elevator:

334 HB, 334JB, 334KB, 334LB, 334MB, 334NB, 334PB, 334QB, 334RB, 334SB, 334TB, 334UB, 334VB, 334WB.

Right Elevator:

344HB, 344UB, 344KB, 344LB, 344MB, 344NB, 344PB, 344QB, 344RB, 344SB, 344TB, 344UB, 344VB, 344WB.

WARNING: DEPLETED URANIUM IS A HIGH DENSITY MATERIAL WITH A NEGLIGIBLE AMOUNT OF RESIDUAL RADIATION. HOWEVER, GRINDING, DRILLING, SANDING, FILING, OR MACHINING OF ANY DEPLETED URANIUM SURFACE BY ANYONE NOT HOLDING AN NRC LICENSE IS PROHIBITED BY GOVERNMENT REGULATION.

DEPLETED URANIUM OXIDE, YELLOW AND BLACK CORROSION PARTICLES, IS TOXIC.

ALTERATION OF DEPLETED URANIUM MATERIAL BY MECHANICAL METHODS IS PROHIBITED BECAUSE FINELY DIVIDED URANIUM PARTICLES SUCH AS MIGHT CONSEQUENTLY BE PRODUCED AND INGESTED POSE THE SAME HEALTH HAZARD COMMON TO ALL HEAVY METALS (I.E. LEAD AND CADMIUM).

HANDLING OF OXIDIZED COUNTERBALANCE WEIGHTS SHOULD BE HELD TO A MINIMUM TO PREVENT BROADCASTING OXIDE TO SURROUNDING PERSONNEL AND WORK AREAS.

EATING AND SMOKING IN IMMEDIATE WORK AREA IS FORBIDDEN WHILE PERFORMING REPAIR WORK.

PERSONNEL PERFORMING WORK ON OXIDIZED DEPLETED URANIUM WEIGHTS MUST WEAR DISPOSABLE PROTECTIVE GLOVES AND CLOTHES.

DISPOSE OF ALL POTENTIALLY CONTAMINATED PROTECTIVE CLOTHING PER LOCAL, STATE OR FEDERAL REGULATIONS REGARDING RADIOACTIVE CONTAMINATED MATERIALS.

PERSONNEL HANDLING OXIDIZED DEPLETED URANIUM MUST THOROUGHLY WASH PRIOR TO EATING, SMOKING, ETC.

(3) Remove four nuts, bolts, and washers attaching counterbalance weight to support arms.

NOTE: It is permissible to press out bolts which are locked in the counterweight due to corrosion. Use all possible precautions to protect counterbalance against damage. Review Warnings

preceding Step 4A(3) above, and adhere to all Warnings concerning depleted uranium weights.

(4) Remove the weight and weight support.

NOTE: Record the number of thin weights attached to the weight support.

(5) All oxidized depleted uranium weights removed from the aircraft should be placed in plastic bags.

NOTE: Depleted uranium balance weights that are either damaged or surplus should be wrapped in metal foil and packaged and shipped in accordance with Code of Federal Regulations Title 49 - Transportation Chapter 1 Parts 173.389 through 173.393. Ship to Nuclear Metals, Inc., 2229 Main St., Concord, MA 01724, USA. The shipping container shall be tightly-lidded and labeled in accordance with ICC regulations.

B. Installation

(1) Verify that weight support contains the same number of thin weights as the weight support removed from aircraft.

(2) Verify all hydraulic systems are off and tagged against operation.

WARNING: ENSURE ALL HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICER'S HYDRAULIC SYSTEM PANEL AND HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

(3) Clean following surfaces with 1,1,1 trichloroethane and wipe dry with clean rags:

(a) All surfaces of counterbalance weight.

(b) Counterbalance weight support structure that will contact weight.

(c) Counterbalance weight attaching hardware.

(d) Working surfaces of tools used to install weights.

(4) Apply sealing compound PR 1422 to the following surfaces:

(a) All surfaces of counterbalance weights.

(b) Grip of counterbalance weight attaching bolts.

NOTE: Complete installation operation before sealing compound cures.

(5) Attach weight and weight support to support arms using four bolts, nuts and washers.

(6) Coat bolt heads, nuts and washers with sealing compound PR 1422.

(7) Remove placards from hydraulic control panels.

(8) Remove control column lock.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: VERIFY THAT NO. 2 ENGINE UPPER COWLS ARE EITHER FULLY OPEN, OR FULLY CLOSED WITH ALL LATCHES LATCHED.

(9) Turn on hydraulic systems AC pumps B3 and C3 (Ref. 29-11-00).

CAUTION: RAPID CYCLING OF ELEVATOR CAN DAMAGE ELEVATOR DAMPER SEALS. IF HYDRAULIC DAMPERS INSTALLED, CYCLE CONTROL COLUMN SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(10) Move the control column through full travel forward and aft a minimum of three complete cycles. The elevator must operate smoothly without binding or hesitation through full control range. Visually verify that replaced counterbalance weights clears all structure.

(11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(12) Close all access openings.

(13) Dispose of all cloths, gloves, etc., thatE come into contact with the uranium oxide, and carefully wash hands.

ELEVATOR HINGE BEARING - REMOVAL AND INSTALLATION

1. General

This procedure covers the removal and installation of any one of the eight elevator hinge bearings.

2. Equipment and Materials

Lock-wire, Fed Spec. QQ-W-390, Cond A, 0-020-inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-00	Flight Controls Lubrication
24-41-00	External Power/Ground Service Systems - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

R A. Removal (Ref. Fig. 401)

(1) Open applicable horizontal stabilizer lower trailing edge access panels (Ref. 6-40-00).

(2) Disconnect bonding jumper by removing attaching bolt, washers and nuts.

(3) Remove lock-wire, nut, split cone bushings and bolt from hinge fitting.

(4) Disconnect the hinge bearing from the elevator structure by removing attaching bolts, washers and nuts.

(5) Remove hinge bearing from mounting position.

B. Installation (Ref. Fig. 401)

(1) Place hinge bearing in mounting position and install attaching bolts, washers and nuts. Verify that bushings are installed in hinge bearing fitting.
R Tighten bolts to following torques: hinges 2 through
R 7, 90 to 100 lb in; hinge No. 8, 110 to 125 lb in.

NOTE: Properly torqued hinge bearing attach bolts may rotate with wrench pressure. If bolts rotate easily, check for nut bottomming on thread and add washer under nut.

(2) Install hinge fitting bolt, split cone bushings, nut, cotter pin, and lock-wire (where required). Use the following torques:

(a) Hinge No. 1: torque large nut 700 to 750 lb in; torque small nut 290 to 315 lb in.

(b) Hinge No. 2: torque nut 175 to 190 lb in.

(c) Hinge No. 3 through 7: torque nut 40 to 50 lb in.

(d) Hinge No. 8: torque large nut 175 to 190 lb in: torque small nut 70 to 80 lb in.

(3) Connect bonding jumper by installing attaching bolt washers and nut.

(4) Lubricate the elevator hinge bearing (Ref. 12-23-00).

(5) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

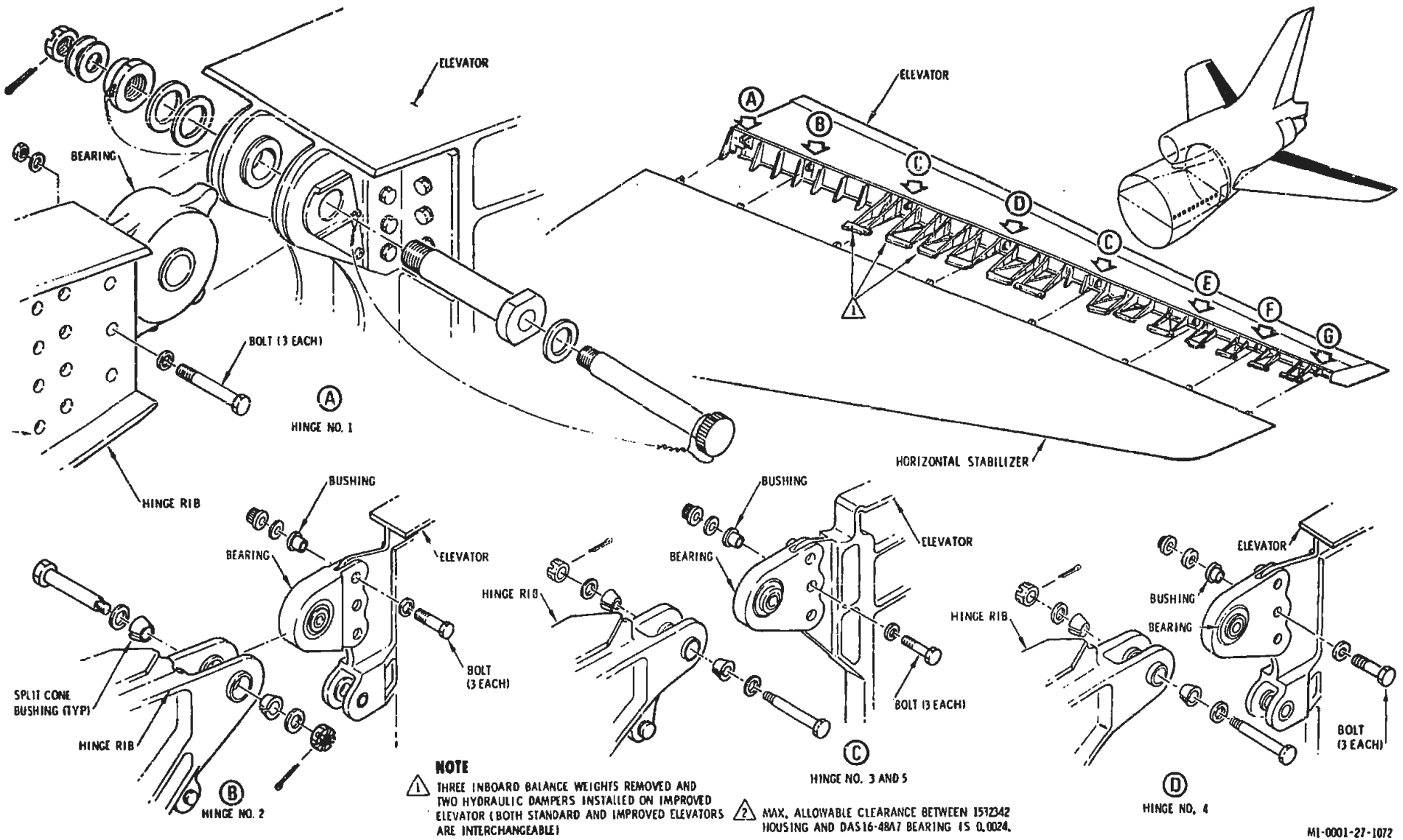
PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

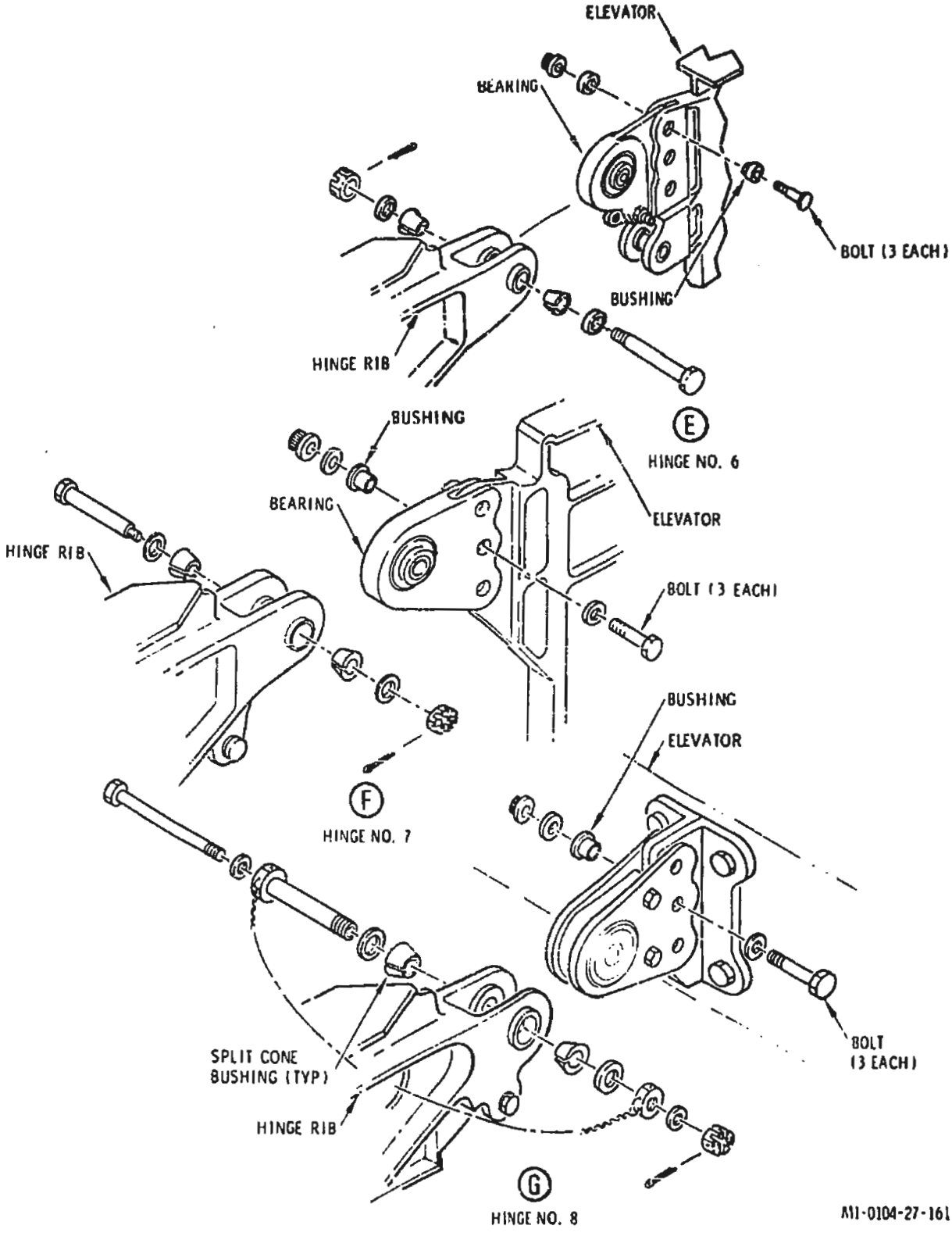
(6) Turn on electrical power (Ref. 24-41-00).



CR Elevator Hinge Bearing - Removal and Installation
CR Figure 401 (Sheet 1)

EFFECTIVITY: ALL

001B



R Elevator Hinge Bearing - Removal and Installation
R Figure 401 (Sheet 2)

(7) Turn on either one of four hydraulic systems (A, B, C, or D) (Ref. 29-11-00).

(8) Slowly position the control column full forward and full aft three complete cycles. The elevator must move smoothly with no binding or hesitation. Visually verify replacement bearing installation for proper operation.

(9) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(10) Turn off electrical power if no longer required (Ref. 24-41-00).

(11) Close all access openings.

ELEVATOR SURFACE DAMPER - SERVICING

1. General

Two elevator dampers are installed on each elevator. The dampers are installed at the No. 2 and 6 hinges.

2. Equipment and Materials

Lock-wire, Fed Spec QQ-W-423, Cond A, 0.032-inch diameter, or equivalent

Cleaning Solvent, Fed Spec P-P-560, Type 1 (Permatex 403-D, Glaze Cote by Michalan)

Hydraulic pressure source of 70 to 100 psi, supplied with either MIL-H-5606 or MIL-H-6083 hydraulic fluid, filtered to minimum allowable filtration of ten microns (Malabar Dispenser PN 54058 or 54124) (G/ITEL 27-11-78)

Container, one-gallon

Damper filler line with adapter fitting (5/16-24 UNF thread)

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power System - Maintenance Practices

4. Servicing (Ref. Fig. 301)

R Servicing of the elevator damper consists of adding fluid to
R damper.

R NOTE: On -101 through -105 dampers, do not add fluid to damper
R if reservoir piston indicator is below REFILL mark. If
R indicator is below REFILL mark, replace damper as there
R is a strong possibility that air is entrapped in damper.
R If damper piston indicator is not visible in sight
R window, and reservoir piston spring coils are visible,
R reservoir is empty and damper should be replaced.

A. Elevator Damper

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open associated access panel (Ref. 6-40-00): inboard damper - 334EB left elevator, 344EB right elevator; outboard damper - 334SB left elevator, 344SB right elevator.

(2) Check damper piston rod seals area for leakage (area wet with fluid). Replace damper if hydraulic leakage is indicated.

(3) Check damper sight window for oil level. See Figure 301 oil level chart for action to be taken.

(4) If fluid must be added to damper, proceed as follows:

(a) Remove filler plug.

NOTE: The filler plug and bleed plug are similar. Do not remove bleed plug as air might be introduced into damper. The filler port contains a check valve similar to a tire air valve. The fill and bleed ports are identified on damper.

(b) Connect filler line to damper FILL port (verify that filler line is full of oil before connecting to damper).

(c) Using hydraulic pressure source, apply pressurized fluid (70 to 100 psi) to damper and fill to following level:

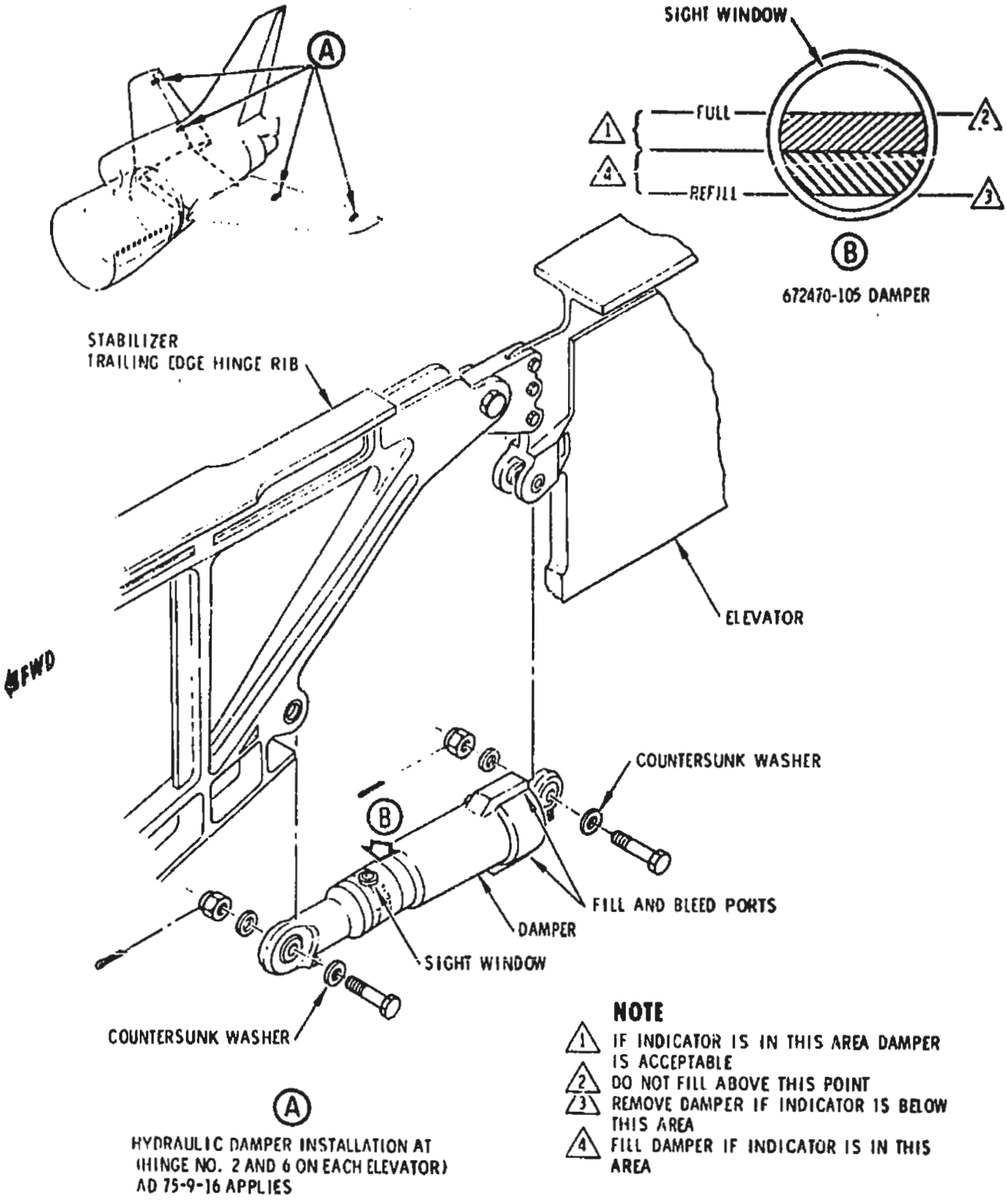
R • On -101 through -105 dampers, fill until
R indicator reaches FULL level in the sight window (+0.00 to 0.10 inch) (Ref. Fig. 301).

• On -107 damper, fill until intersection of blue- and red-stripped bands is opposite appropriate temperature arrow.

CAUTION: NEVER FILL PAST FULL MARK. OVERFILLED RESERVOIR CAN PRODUCE EXCESSIVE PRESSURES DURING OPERATION AND DAMAGE DAMPER.

NOTE: Damper indicator window is plexiglass. Use only approved cleaners or solvents to clean window (Fed Spec P-P-560, Type 1).

(d) Remove filler line.



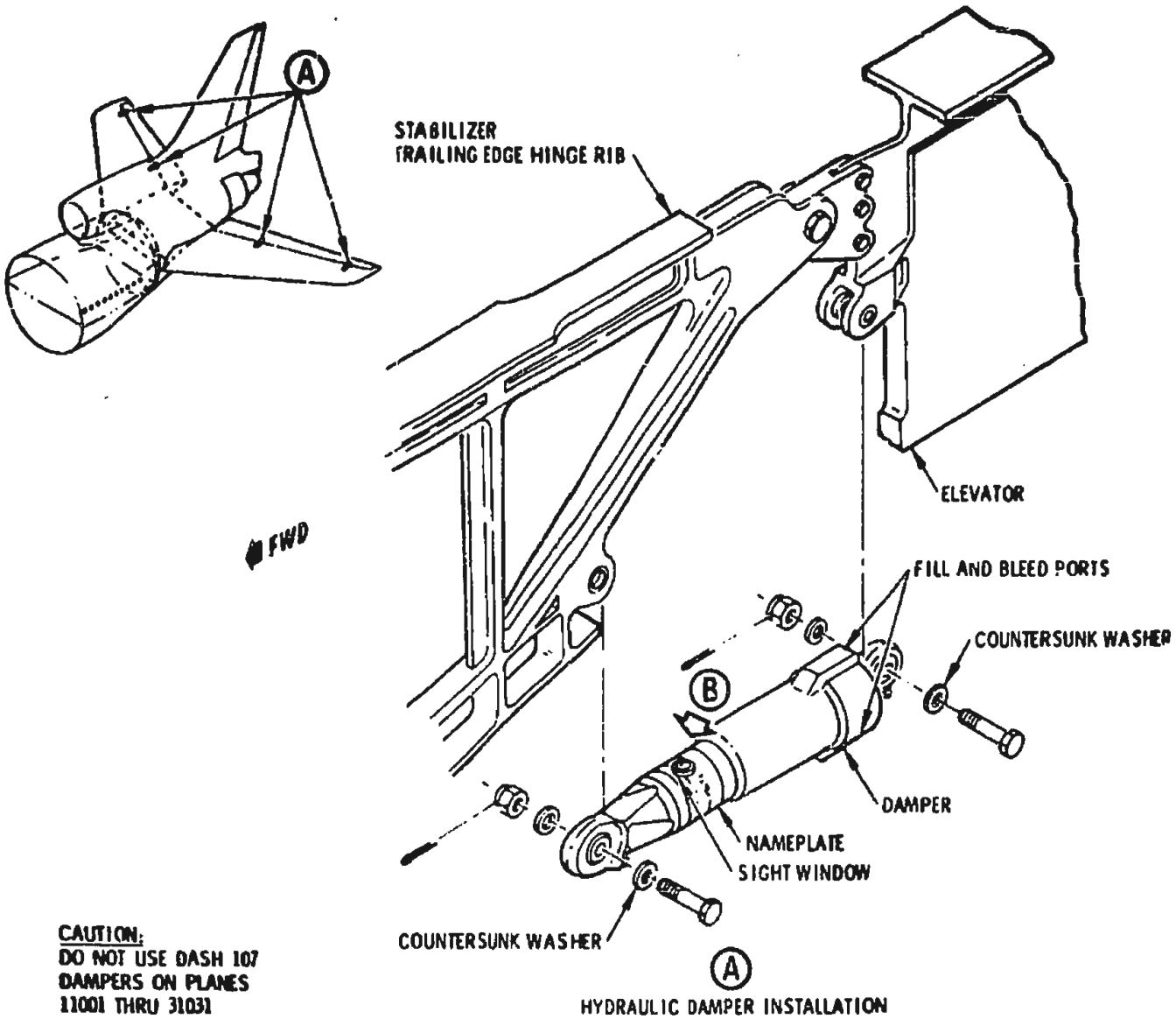
HYDRAULIC DAMPER INSTALLATION AT (HINGE NO. 2 AND 6 ON EACH ELEVATOR) AD 75-9-16 APPLIES

NOTE

1. IF INDICATOR IS IN THIS AREA DAMPER IS ACCEPTABLE
2. DO NOT FILL ABOVE THIS POINT
3. REMOVE DAMPER IF INDICATOR IS BELOW THIS AREA
4. FILL DAMPER IF INDICATOR IS IN THIS AREA

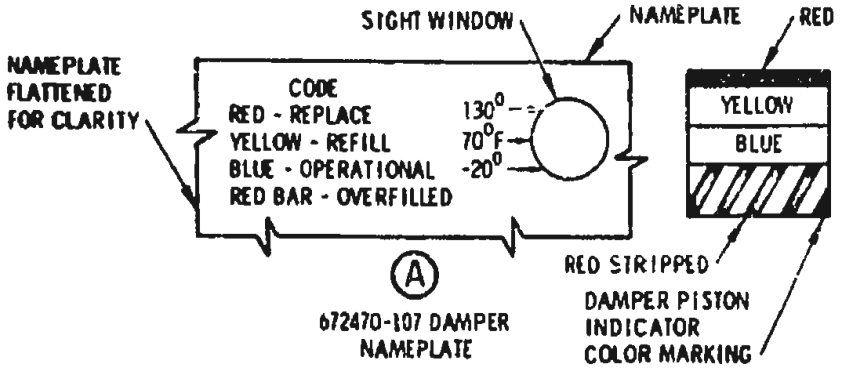
M1-0000-27-1211

CR CR Elevator Surface Damper - Servicing
Figure 301



CAUTION:
DO NOT USE DASH 107 DAMPERS ON PLANES 11001 THRU 31031

HYDRAULIC DAMPER INSTALLATION (HINGE NO. 2 AND 6 ON EACH ELEVATOR)



DO NOT ADD FLUID TO DAMPER IF FULL RED LINE IS IN VIEW; REPLACE DAMPER AS THERE IS STRONG POSSIBILITY OF AIR ENTRAPPED IN DAMPER. YELLOW TO RED LINE INDICATES MARGINAL, BLUE TO RED LINE INDICATES OPERATIONAL, AND RED STRIP INDICATES OVERFILLED. ALLOW TIME FOR TEMPERATURE TO STABILIZE BEFORE CHECKING POSITION OF LINES.

M1-0000-27-981

CR Elevator Surface Damper - Servicing
CR Figure 301

(e) Install filler plug and safety.

(f) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(g) Turn on any one of four hydraulic systems (Ref. 29-11-00).

R R R CAUTION: CYCLING ELEVATOR AT A HIGH RATE CAN DAMAGE ELEVATOR DAMPER SEALS. CYCLE ELEVATORS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(h) Slowly cycle control column from full up to full down several times. Verify that damper operation is smooth without any chatter.

(i) Check damper sight window. Verify indicator still shows FULL.

NOTE: At high ambient temperatures, or after operating dampers, indicator can show slightly above FULL and is acceptable.

(j) If damper operation is suspect for any reason, remove damper and return it to shop for functional test.

(k) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(5) Close access panel.

ELEVATOR SURFACE DAMPER - REMOVAL AND INSTALLATION

1. General

Two elevator dampers are installed on each elevator. The dampers are installed at the No. 2 and No. 6 hinges.

2. Referenced Procedures

6-40-00	External Access Doors and Panels
12-23-00	Flight Controls Lubrication
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) Open applicable access doors and panels on lower trailing edge of horizontal stabilizer (Ref. 6-40-00):

(a) Left inboard damper - 334EB and 334FB.

(b) Right inboard damper - 344EB and 344FB.

(c) Left outboard damper - 334SB, 334TB, and 335AB.

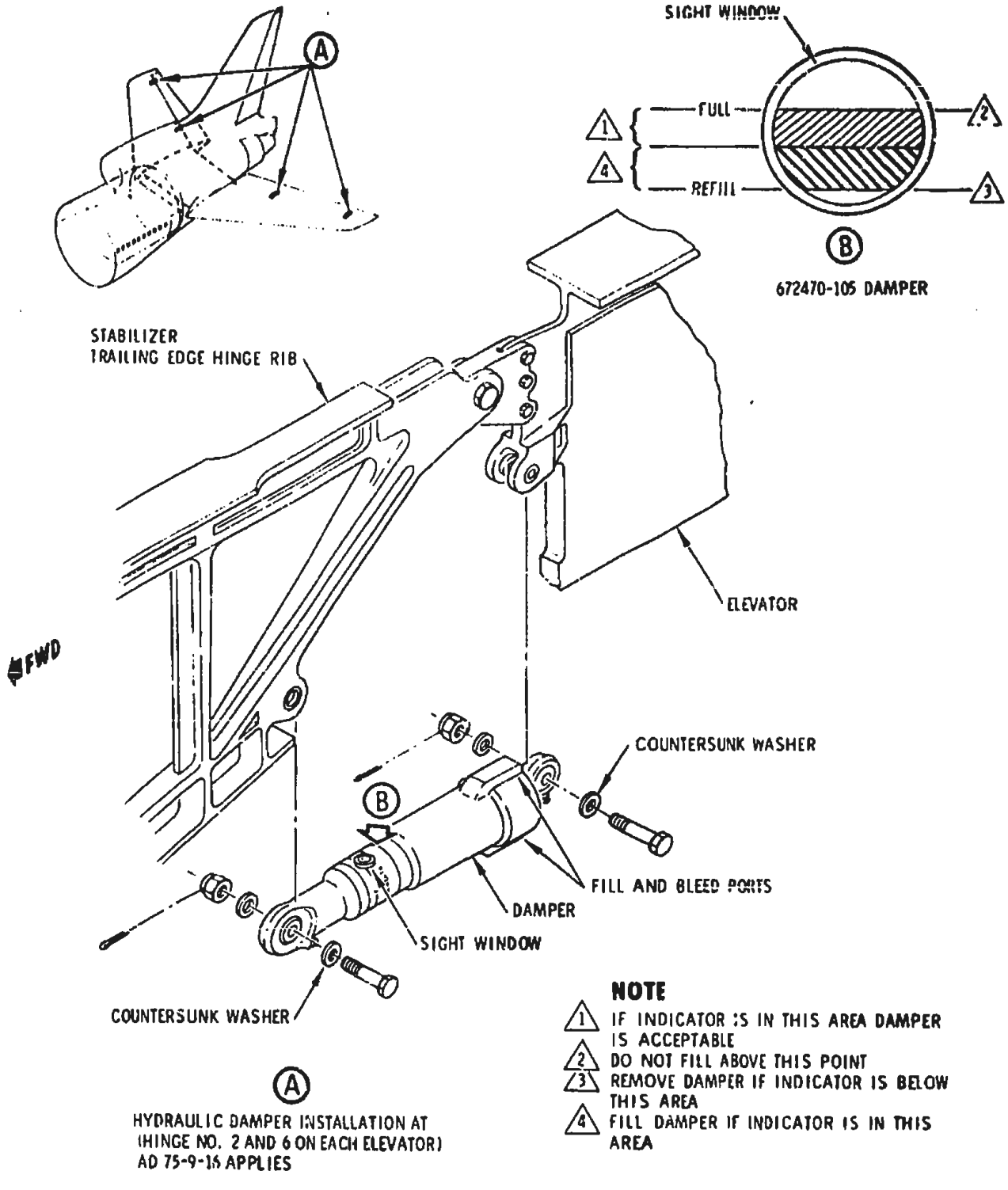
(d) Right outboard damper - 344SB, 344TB, and 345AB.

(2) Remove damper cylinder and piston rod attaching bolts. Remove damper.

(3) If replacement damper not immediately available for installation, install red warning flag (or streamer) to stabilizer rib to prevent release of aircraft without damper installed.

B. Installation (Ref. Fig. 401)

CR
C
C NOTE: AD 75-9-16 applies. Planes 31032 and on were delivered with dash 107 dampers (large barrel). If dash 105 damper must be used to avoid flight delay,



A

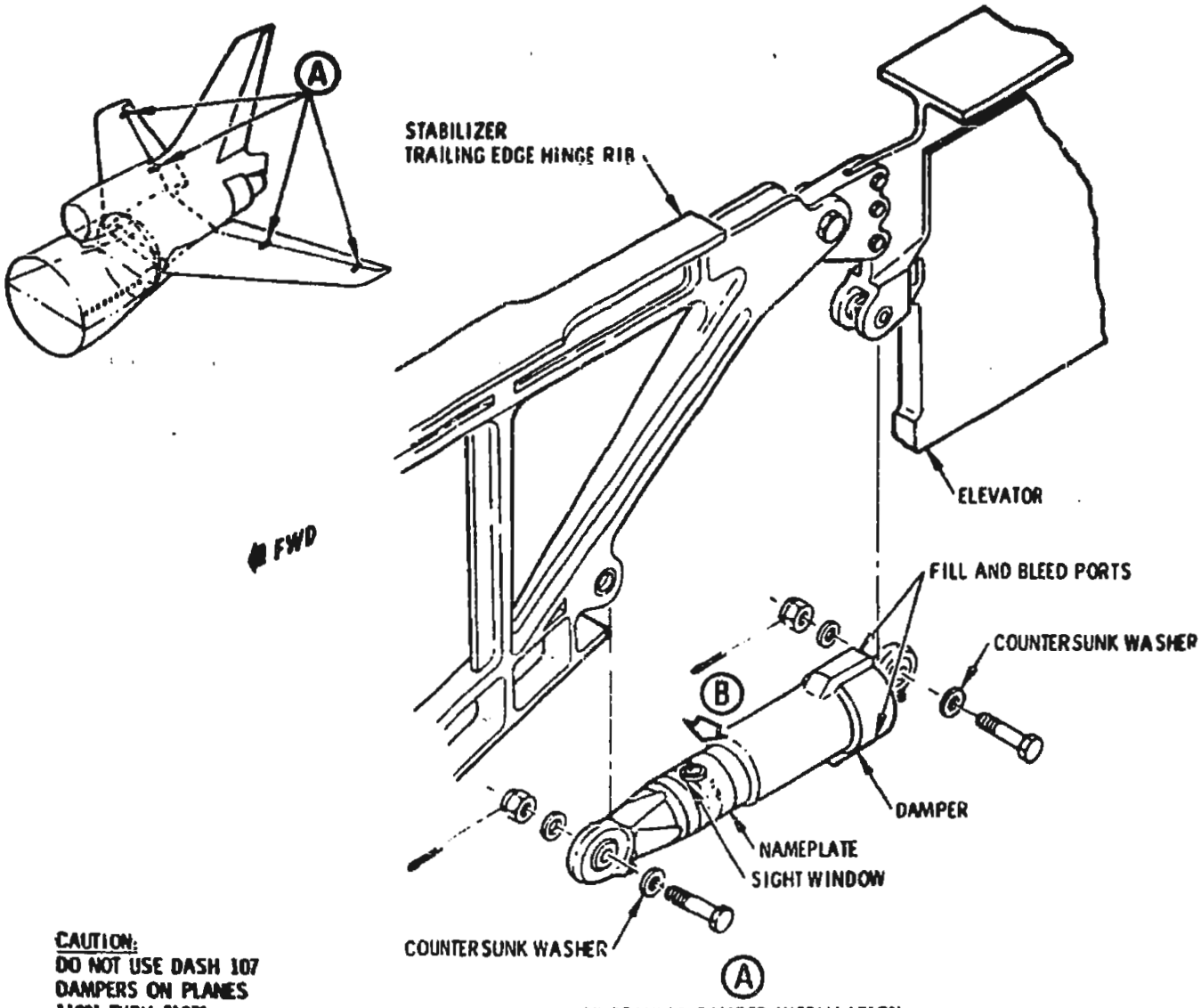
HYDRAULIC DAMPER INSTALLATION AT (HINGE NO. 2 AND 6 ON EACH ELEVATOR) AD 75-9-16 APPLIES

NOTE

1. IF INDICATOR IS IN THIS AREA DAMPER IS ACCEPTABLE
2. DO NOT FILL ABOVE THIS POINT
3. REMOVE DAMPER IF INDICATOR IS BELOW THIS AREA
4. FILL DAMPER IF INDICATOR IS IN THIS AREA

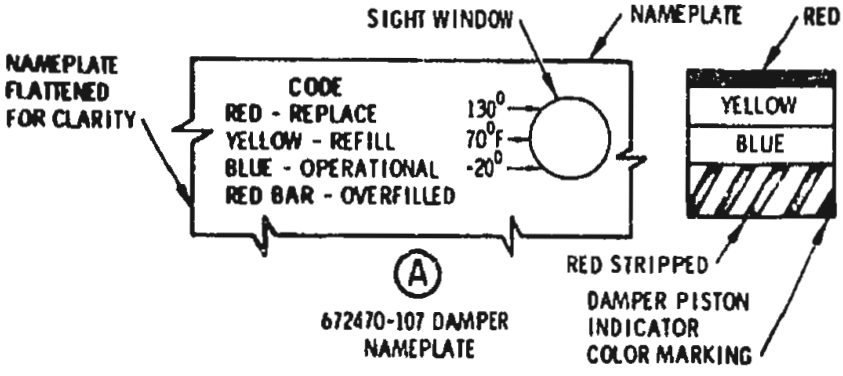
M1-0000-27-1211

CR Elevator Surface Damper - Removal and Installation
CR Figure 401



CAUTION:
DO NOT USE DASH 107 DAMPERS ON PLANES 11001 THRU 31031

HYDRAULIC DAMPER INSTALLATION
(HINGE NO. 2 AND 6 ON EACH ELEVATOR)



DO NOT ADD FLUID TO DAMPER IF FULL RED LINE IS IN VIEW; REPLACE DAMPER AS THERE IS STRONG POSSIBILITY OF AIR ENTRAPPED IN DAMPER. YELLOW TO RED LINE INDICATES MARGINAL, BLUE TO RED LINE INDICATES OPERATIONAL, AND RED STRIP INDICATES OVERFILLED. ALLOW TIME FOR TEMPERATURE TO STABILIZE BEFORE CHECKING POSITION OF LINES.

MI-0000-27-981

CR CR Elevator Surface Damper - Removal and Installation
Figure 401

C set up to replace with dash 107 within 500 flight
C hours. Dash 105 dampers are subject to A.D. 75-9-16
C (see M11-AD-03). Dash 105 dampers are used on planes
C 11001 thru 31031.

(1) Verify that all hydraulic power is turned off.

(2) Verify that replacement damper is properly filled. (On -101 through -105 dampers, indicator in sight window should be close to but not past full mark (Ref. Fig. 401). On -107 damper, intersection of blue- and red-stripped bands should be opposite appropriate temperature arrow.)

(3) Connect damper piston rod to elevator clevis fitting (with lube fitting on the bottom) by installing bolt, washers, and nut. Tighten nut and install cotter pin.

NOTE: Countersunk washer should be under the bolt head with countersink facing bolt head.

(4) Connect damper cylinder to the stabilizer clevis fitting (with lube fitting on the bottom) by installing the bolt, washers, and nut. Tighten nut and install cotter pin.

(5) Lubricate damper lube fittings (Ref. 12-23-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Remove placards from hydraulic control panels.

(7) Turn on any one of the four hydraulic systems (Ref. 29-11-00).

CAUTION: CYCLING STABILIZER AT HIGH RATE CAN DAMAGE DAMPER SEALS. CYCLE CONTROLS SLOWLY (MINIMUM 4 SECONDS STOP-TO-STOP).

(8) Slowly cycle control column from full forward to full aft at least three cycles.

(9) Visually verify that hydraulic damper operates smoothly with no chatter.

(10) Check damper piston rod for signs of external leakage.

(11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(12) Close access doors and install access panel opened in Step A(1).

R ELEVATOR SURFACE DAMPER - ADJUSTMENT AND TEST

R 1. Adjustment/Test

R A. Functional Check

R (1) The elevator surface damper must be removed and
R returned to the shop for a functional check.

C ELEVATOR AFT CABLE QUADRANT - REMOVAL AND INSTALLATION

C 1. Equipment and Materials

C Control Column and Trim Wheel Lock, PN BA80-101, or equivalent

C Elevator Neutral Rigging Tool, LAC BF79, or equivalent

C Compound, Corrosion Preventive, MIL-C-16173 (LPS-3)

C Sealing Compound, PR 7401K, or equivalent (PR 1435)

CR MIL-G-23827 Grease, or equivalent

C Rig Pin, 9/16-inch diameter by 7 inches long (part of B734 rig
C pin kit)

C 2. Referenced Procedures

C 6-40-00 Exterior Access Doors and Panels

C 12-23-15 Elevator Drive System Lubrication

C 24-41-00 External Power/Ground Service Systems - Maintenance
C Practices

C 29-11-00 Hydraulic Power System - Maintenance Practices

C 3. Removal/Installation

C A. Removal (Ref. Fig. 401, 403).

C (1) Turn off all hydraulic power (Ref. 29-11-00).

C WARNING: VERIFY THAT ALL HYDRAULIC POWER IS SHUT OFF (REF.
C 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
C HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
C HYDRAULIC SERVICE PANEL, ZONE 147.

CR (2) Install control column and trim wheel lock.

C (3) Open following access doors tc gain access to elevator
CR cables in the afterbody and elevator aft cable quadrant
C in the stabilizer trailing edge:

CR (a) 334CB (left elevator); 344CB (right elevator)

C (b) 317BB for left and right elevator cable
C turnbuckles.

C (4) Disconnect LH elevator aft quadrant control cables and
C remove cables from quadrant (Ref. Chapter/Section
C 27-31-00).

C (5) Disconnect hockey stick at the elevator. (Figure 403).

C (6) Remove bolt from aft end of lower strut to lower pivot
C rib attach point.

C (7) Remove lower pivot rib fitting forward attach bolt.

C (8) Disconnect control rod at hockey stick (Figure 402
C Sheet 1. E).

C (9) Remove keeper and axle and retain for reinstallation.
C Save chamfered washer.

C (10) Remove quadrant and hockey stick assembly.

C (11) Remove bearings from quadrant. Save journal bearing
C for reinstallation. Save hockey stick if satisfactory
CR for re-use. If re-used, pack rod end cavity with
CR Parker-O-Lube and reinstall rod end.

C (12) Assemble replacement quadrant as follows:

C NOTE: On aircraft 001-032 SB27-166 and 033-999,
C the pivot pin has been reworked. On top of push
C rod pivot pin is a plug that has been installed
C into recess and sealed with sealing compound.
C Butterlube pushrod pivot pin with grease and
C install pivot pin thru quadrant and pushrod
C journals from above. Engage hole in pivot pin
C head flange with retension pin. Install thru
C bolt, washer, copper seal, collar, and nut.
C Tighten nut to a torque value between 185-205 lb
C in. until slot in nut aligns with hole in bolt.
C Install cotter pin. Lubricate collar lube
C fitting (Ref. 12-23-15). Install washer and nut
C on pivot pin retention pin, and tighten nut.

C (a) Reinstall hockey stick on quadrant assembly. Use
C new seals, torque to 10 - 1000 in-lbs and safety.

C (b) Install new bearings as follows:

C 1) Coat bearing bores with MIL-C-16173 (LPS-3).

C 2) Install new lower DAL22-52AI-501 bearing.

C NOTE: If pressure is required, apply only to outer raceof bearing.

C 3) Coat the P/N 1615925-101 journal bearing with grease on the inside and outside, and install in shaft cavity (hub).

C 4) Install new upper DAL22-52AI-501 bearing.

C NOTE: If pressure is required, apply only to outer raceof bearing.

C B. Installation (Ref. Figure 401, 402).

C NOTE: Prior to installation verify that thrust washer is installed up against hinge rib and that the gap between thrust washer and hinge rib is filled with PR 1435 sealing compound (Ref. Figure 401, Sheet 2).

C (1) Verify that all hydraulic power is turned off (Ref. 29-11-00).

C (2) Verify that control column and trim wheel lock is installed.

C (3) Position the replacement quadrant and pivot rib fitting in mounted position. Install washer on axle with chamfer facing head of axle. Butter lube axle with grease. Install axle and torque to 300 to 1200 inch-lbs. Install keeper.

CR NOTE: Allowable vertical movement of the quadrant can be 0.000 to 0.028 inch, measured from the hub to the upper bearing outer race.

C (4) Connect hockey stick to elevator. See Figure 403.

C (5) Connect control rod to hockey stick and adjust for 0.22 to 0.25 clearance as shown on Figure 402, Sheet 1, E. If adjustment results in open witness holes in rod, install 2024-alum shim between clevis fitting and push rod. Use minimum thickness required to result in covered witness holes. Use skydrol resistant primer on shim and allow to dry. Install shim using PR 1435 sealant both sides of shim.

C (6) Call inspector to check installation per (3) through (5) prior to sealing.

C (7) Apply sealant PR 1435 around entire axle hex head, washer, and upper barrel nut hole.

C (8) Position small-diameter cable roller guard in the C installed position. Install attaching bolt through C link assembly and support bracket. Install washer and C nut. Check and adjust the clearance between the cable C guard and quadrant as follows (Ref. Figure 401, Sheet C 1).

C (a) The large roller must overlap cable with minimum C half cable diameter through full quadrant travel. C A maximum of two washers may be added between the C large roller and arm as required to accomplish C above.

C (b) A minimum clearance of 0.020 inch must be C maintained between top surface of quadrant track C and the arm through full quadrant travel after C adjustment per (a).

C (c) With both small rollers in contact with track, a C minimum of 0.030 inch clearance must be maintained C between small roller pins and cable quadrant C through full quadrant travel. To accomplish C above, position washers between arm and link C assembly and above link assembly. To obtain C maximum clearance, the small rollers should be at C 0.090 inch minimum flat surface overlap with track C on quadrant through normal quadrant travel.

C A maximum of two washers may be added between the C small rollers and arm as required to meet overlap C minimums. If washers are added between arm and C link assembly, recheck per Step (a).

C (9) Disconnect P/N SL21251B-14 turnbarrel on upper elevator C drive cable and tierod and lubricate with (LPS3) prior C to reinstallation.

C (10) Reinstall, rig and safety quadrant control cables.

C (a) Tighten load turnbuckle (1) on elevator down-cable C and turnbuckle (3) on elevator up-cable until the C following conditions are met:

C The set screw gap in the load turnbuckle is within C adjustment range limits of the temperature C compensation chart.

C The 9/16 rig pin fits freeley through bracket and C cable, quadrant (2).

C CAUTION: VERIFY THAT LOCKING WASHERS ON BOTH ENDS OF LOAD TURNBUCKLE ARE PROPERLY INSTALLED BEFORE TIGHTENING JAM NUT. LOCKING WASHER OFFSET TANG MUST FACE AWAY FROM JAMNUT AND MUST ENGAGE SLOT IN TURNBUCKLE. LOCK-WIRE JAMNUT (Ref. Figure 402).

NOTE: If upper or lower turnbuckle runs out of adjustment (cable and tie-rod threads bottomed in turnbarrel) before proper cable tension is reached, loosen turnbarrel, remove bolt connecting rod end fitting to elevator drive attachment, and thread rod end fitting into tie-rod. Install attach bolt, tighten and lock-wire jamnut; then adjust turnbuckle (Ref. Figure 402).

C (11) Remove rig pin from elevator quadrant.

C (12) Remove control column and trim wheel lock.

C (13) Remove tags from hydraulic control panels.

C WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

C PITCH TRIM WHEEL IS AT ZERO DEGREES.

C LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

C PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

C THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

C (14) Turn on electrical power (Ref. 24-41-00).

C (15) Turn on any one of four hydraulic systems (Ref. 29-11-00).

C (16) Slowly cycle control column for a minimum of three cycles to stabilize elevator cables. While cycling stabilizer/elevator, visually verify normal operation of aft cable quadrant and elevator pushrod.

C (17) After cycling stabilizer/elevator, check all pulleys and fairleads to verify that cables are properly seated in the pulley, fairleads and quadrant grooves.

C (18) Recheck cable roller guard for proper clearance between C roller guard and cable quadrant Ref. Step (8).

C (19) Turn off hydraulic power (Ref. 29-11-00).

C NOTE: Allow a minimum of 5 minutes after hydraulic C shutdown to allow stabilizer actuator pistons to C bottom ±1 degree stabilizer position).

C (20) Recheck cable rig Ref. Step (10). Make minor C adjustment if necessary.

C (21) Check elevator rigging as follows:

C (a) With rig pin installed in cable quadrant (2), C verify that elevator is in neutral. Use elevator C neutral rigging tool (Ref. Figure 402). If C elevator neutral is out of tolerance, adjust C elevator actuation pushrod (4). (If elevator C actuation pushrod is adjusted, verify that locking C washer offset tab is properly engaged in pushrod C slot. Torque rod-end locking nut 1600 to 1800 lb C in. and lock-wire locking nut to locking washer).

C NOTE: An alternate method of verifying elevator C neutral is with the use of a 10-foot C straight-edge. Use straight-edge on top C and bottom of stabilizer and elevator. C Adjust elevator pushrod to obtain equal C measurements between straight-edge and C upper and lower surfaces of elevator.

C After rod end adjustment and jam nut C tightening, clean thread and keyway slot C area around jam nut, then brush overcoat C with MIL-C-16173 corrosion preventive C compound, making certain that keyway slots C are filled, (or use Parker O-Lube).

C (22) Remove rig pin from cable quadrant.

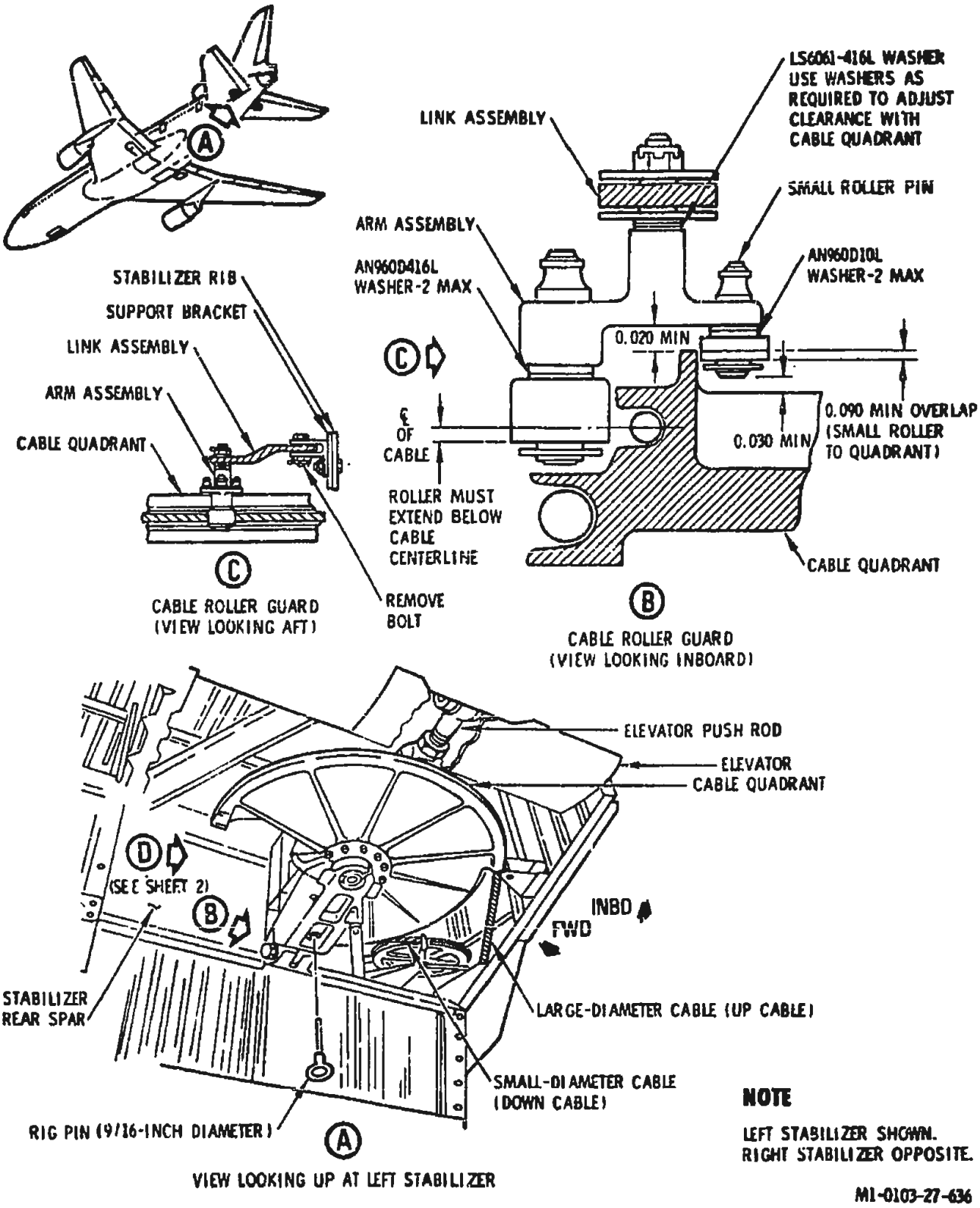
C (23) Turn on hydraulic power (Ref. 29-11-00).

C (24) Slowly cycle control column through several cycles and C verify normal operation of the elevator control cables, C aft cable quadrant, cable roller guard and elevator C pushrod.

C (25) Turn off hydraulic power if no longer required (Ref. C 29-11-00).

C (26) Check all elevator control components to verify that
C all necessary cotter pins and lock-wire are installed.
C Verify that cable turnbuckles are properly safetied.

C (27) Close access panels.

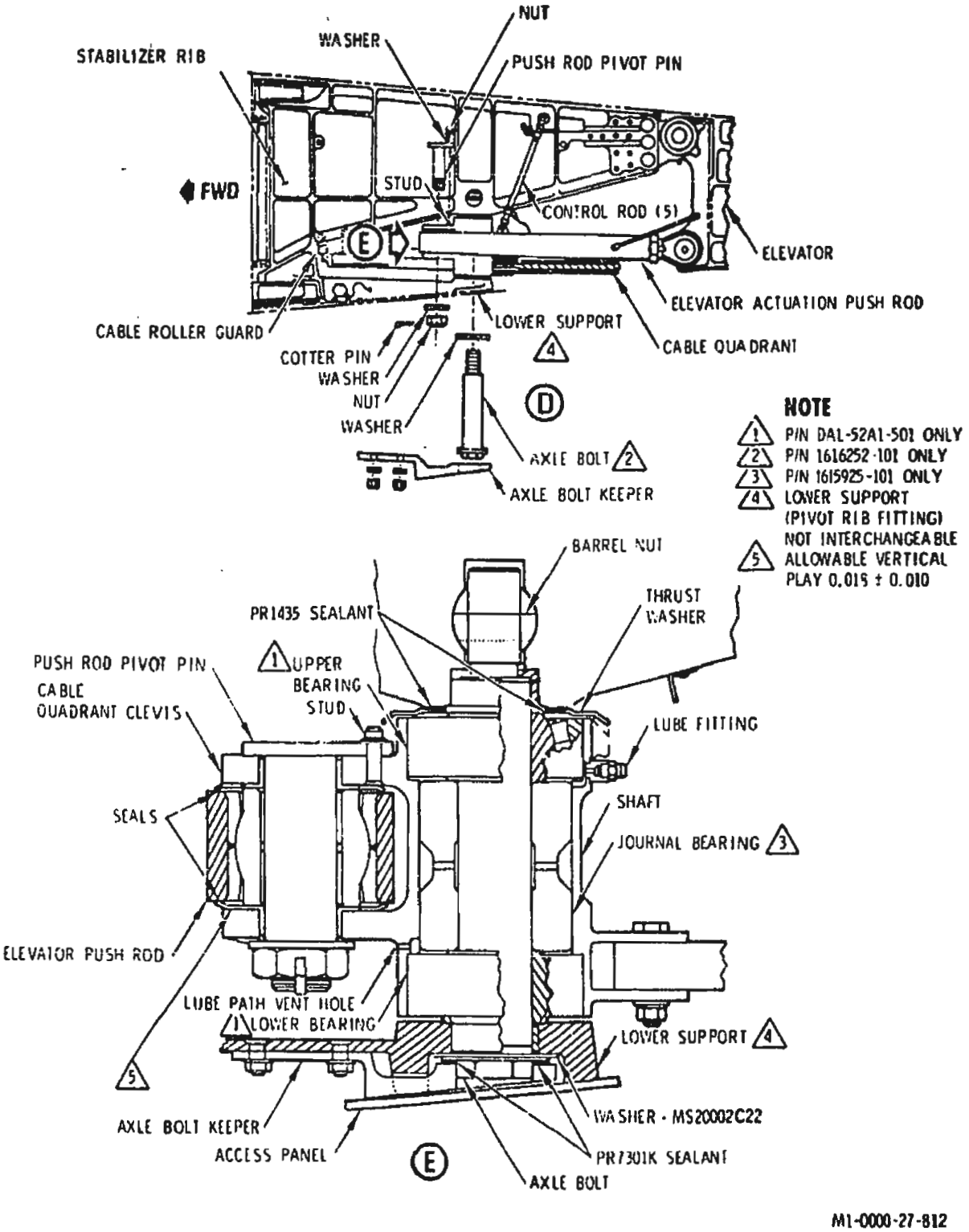


NOTE

LEFT STABILIZER SHOWN.
RIGHT STABILIZER OPPOSITE.

M1-0103-27-636

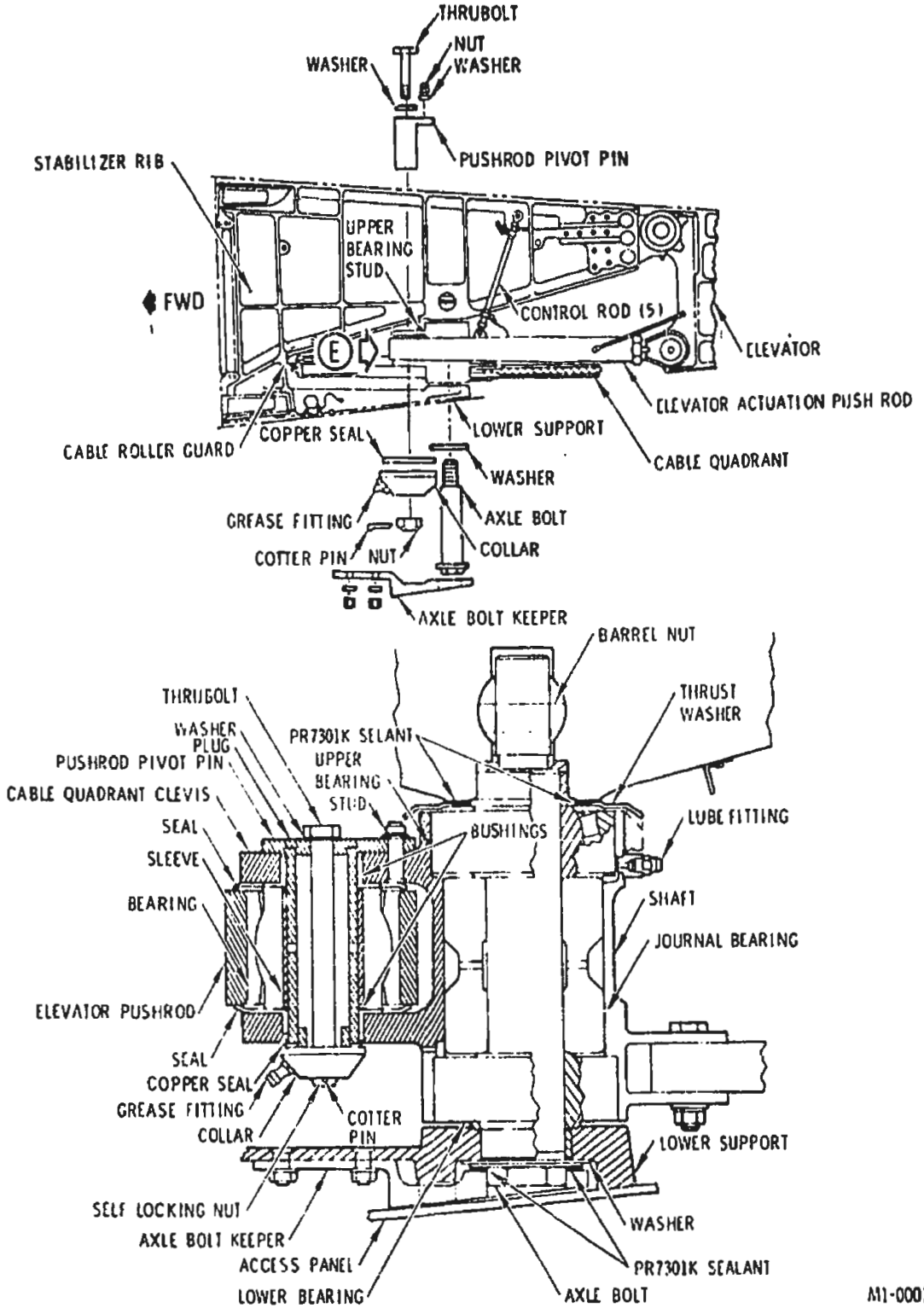
C Elevator Aft Cable Quadrant - Removal and Installation
C Figure 401 (Sheet 1)



M1-0000-27-812

C Elevator Aft Cable Quadrant - Removal and Installation
C Figure 401 (Sheet 2)

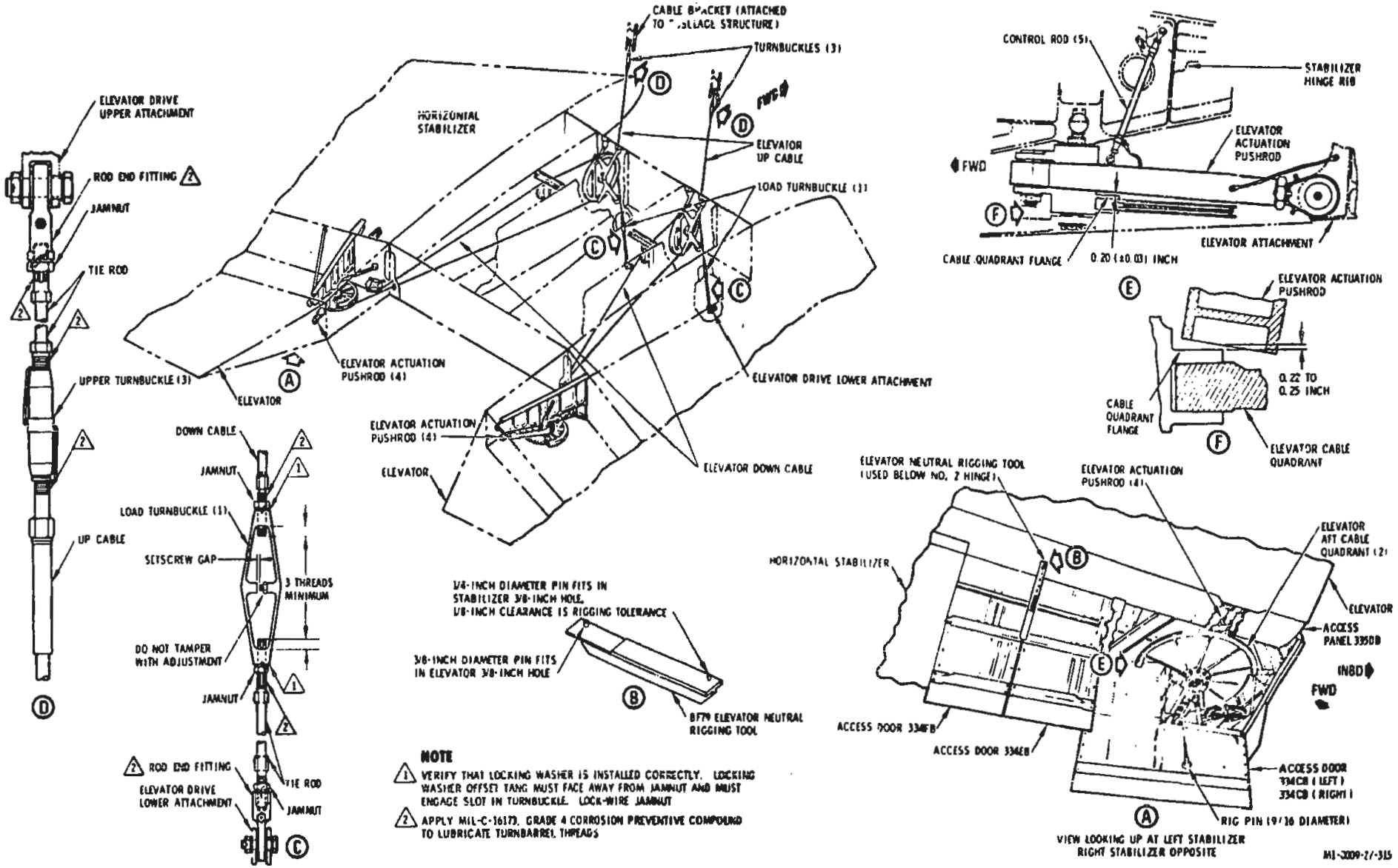
R EFFECTIVITY: 001-032 WITHOUT SB27-166
R
0028



R Elevator Aft Cable Quadrant - Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: 001-032 WITH SB27-166 AND 033-999

002B

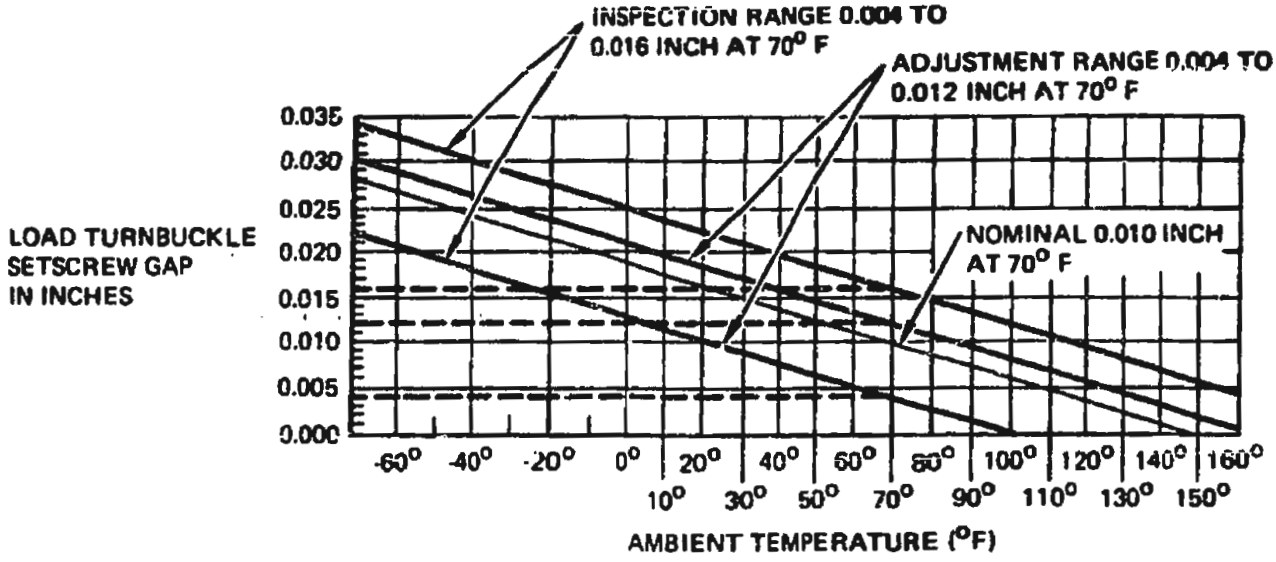


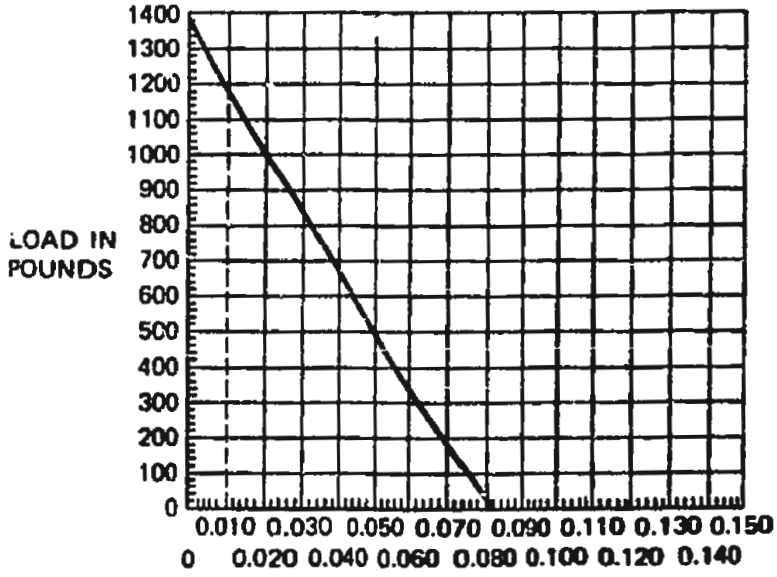
NOTE

1. VERIFY THAT LOCKING WASHER IS INSTALLED CORRECTLY. LOCKING WASHER OFFSET TANG MUST FACE AWAY FROM JAMNUT AND MUST ENGAGE SLOT IN TURNBUCKLE. LOCK-WIRE JAMNUT
2. APPLY MIL-C-16173, GRADE 4 CORROSION PREVENTIVE COMPOUND TO LUBRICATE TURNBARREL THREADS

C C Elevator Aft Cable Quadrant Rigging
Figure 402 (Sheet 1)

R R 0028 EFFECTIVITY: ALL


INSPECTION RANGE 0.004 TO 0.016 INCH AT 70° F
ADJUSTMENT RANGE 0.004 TO 0.012 INCH AT 70° F
NOMINAL 0.010 INCH AT 70° F
LOAD TURNBUCKLE SETSCREW GAP IN INCHES
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-60° -40° -20° 0° 20° 40° 60° 80° 100° 120° 140° 160°
10° 30° 50° 70° 90° 110° 130° 150°
AMBIENT TEMPERATURE (°F)
(TEMPERATURE MEASURED AT STABILIZER CENTER SECTION LEADING EDGE)
TEMPERATURE COMPENSATIONS SCALE



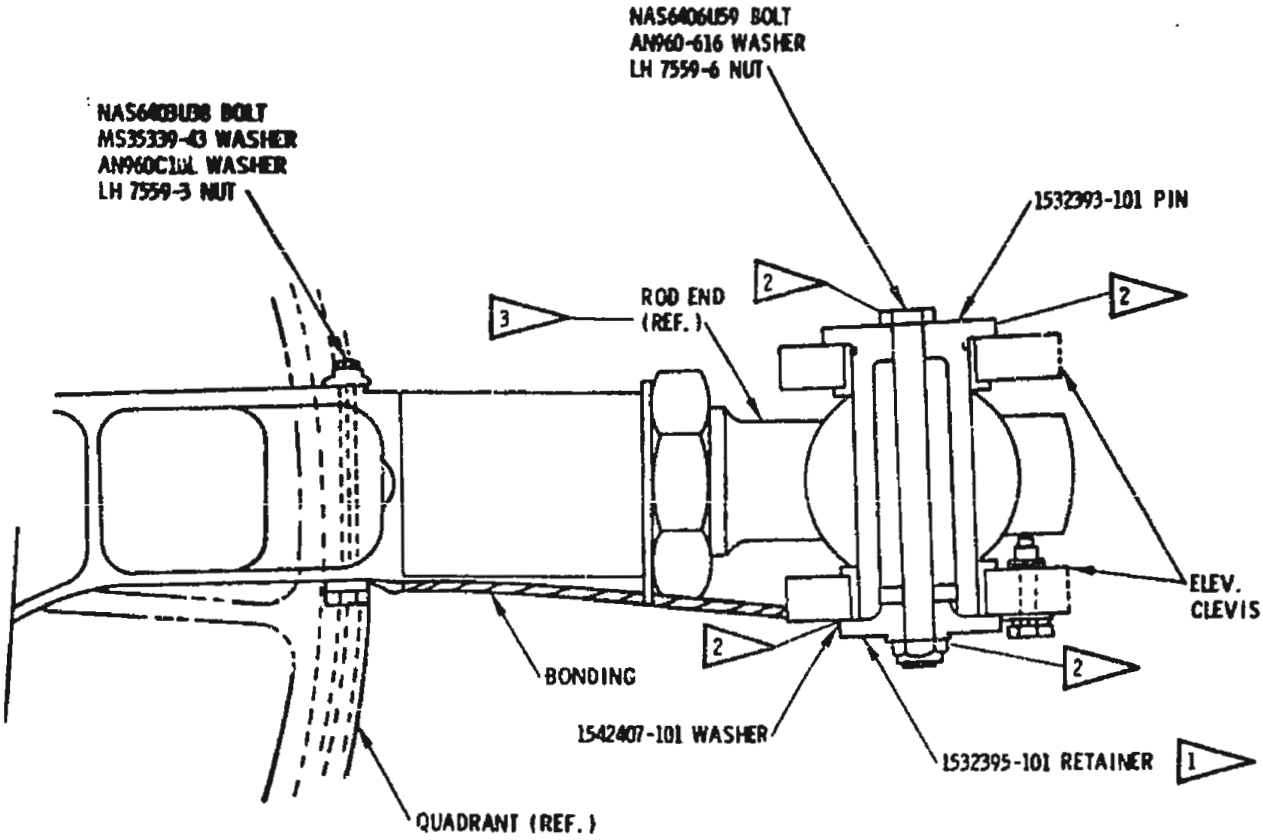
M1-0100-27-640

C
C

Elevator Aft Cable Quadrant Rigging
Figure 402 (Sheet 2)

R
R
002B

EFFECTIVITY: ALL



3 PACK ROD END CAVITY WITH PARKER O-LUBE.

2 APPLY A COAT OF PR1435 TO SEAL OUT MOISTURE.

1 PRIOR TO INSTALLING RETAINER, HAND PACK PIVOT PIN INTERNAL CAVITY WITH MIL-C-23827 GREASE.

M1-0001-27-808

CR CR Elevator Actuation Pushrod "HOCKEY STICK" Installation
Figure 403

EFFECTIVITY: ALL

0028

R ELEVATOR AFT CABLE QUADRANT - INSPECTION AND CHECK

R 1. General

R This procedure should be used to determine if the elevator aft cable quadrant bearings are worn to the point of requiring replacement.

R 2. Equipment and Materials

R Control Column and Trim Wheel Lock, P/N BA80-101, or equivalent

R 3. Reference Procedures

R	6-40-00	Exterior Access Doors and Panels
R	27-31-10	Elevator Aft Cable Quadrant - Removal and Installation
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	55-10-01	Horizontal Stabilizer Assembly, Overhaul Manual

R 4. Inspection/Check

R A. Elevator Aft Cable Quadrant Bearing Wear Check (Ref. Fig. 601)

R WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R (1) Install the control column and trim wheel lock.

R (2) Open the following access doors:

R (a) 334CB and 344CB for access to the left and right elevator drive quadrant.

R (b) 317BB for access to the elevator cable turnbuckles.

R (3) At load turnbuckle, remove jamnut lock-wire and loosen jamnuts. Loosen load turnbuckle until elevator cable load is reduced to minimum.

R CAUTION: DO NOT LOOSEN ELEVATOR CABLES SO THAT EXCESSIVE SLACK IS PRESENT. IF CHECK IS DONE OUTDOORS, WITH EXCESSIVE SLACK IN CABLES, A WIND GUST COULD MOVE THE ELEVATOR AND BE A HAZARD TO PERSONNEL. TO PREVENT EXCESSIVE SLACK, LOOSEN LOAD TURNBUCKLE UNTIL LOAD TURNBUCKLE SETSCREW GAP IS 0.070 INCH.

R (4) Standing beneath elevator quadrant assembly, reach up and grasp rim of quadrant with both hands pushing up on one side and down on the other side for several cycles with forces of approximately 100 pounds in order to wobble the quadrant assembly about its axis. (This is accomplished to center the bearing rollers.)

R (5) Install dial indicator on left or right stabilizer hinge rib as shown in Figure 601 by clamping plate (approximate size 0.25 X 1.0 X 4.0 inches) to hinge rib and clamping dial indicator base to plate.

R (6) Position dial indicator pointer on side of upper quadrant hub 0.50 inch down from top. Measure deflection perpendicular to axis of hub and on the same side and in line with the hub. Reference Figure 601.

R (7) Apply 180-200 pounds down-load at quadrant rim opposite the quadrant's large cable termination point, as shown in Figure 601 to establish baseline for next step [Step (8)] down-load test. Set dial indicator at zero while load is applied.

R (8) Remove 180-200 pound down-load from installed position and apply 180-200 pounds down-load at quadrant's large cable termination point, reference Figure 601.

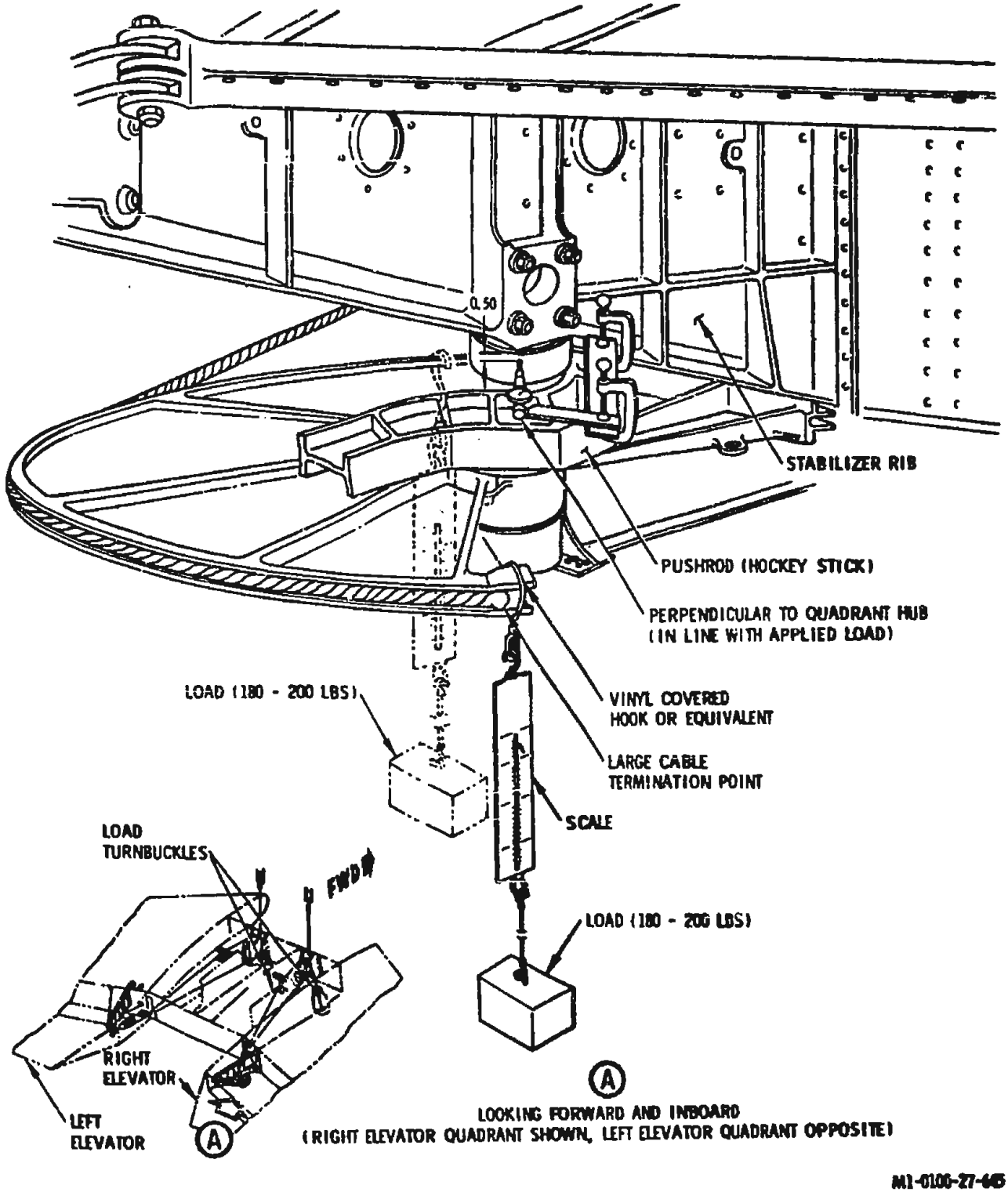
R (9) Measure total deflection of quadrant hub by recording dial movement. After check, remove plate and dial indicator.

R (10) If the total deflection of the quadrant hub equals or exceeds 0.006 inch, replace the aft cable quadrant, or remove the aft cable quadrant and replace the quadrant bearings.

R NOTE: Remove and replace the aft cable quadrant per Maintenance Manual 27-31-10. Remove quadrant bearings and replace with new bearings per Overhaul Manual 55-10-01, Repair Section, 401.

R (11) If the total deflection of the quadrant hub is less than .006 inch, then the quadrant bearings are within

R tolerance. Rig the elevator cables per 27-31-00,
R Adjustment and Test, Paragraph 5.



R R Elevator Aft Cable Quadrant Bearing Wear Check
Figure 601

R EFFECTIVITY: ALL
R R
001B

ELEVATOR DRIVE CABLE TIE-ROD/BRAKE LINK ASSEMBLY MAINTENANCE PRACTICES

1. General

The following procedure outlines the steps that must be taken to deactivate the elevator drive failure warning system.

Two maintenance deactivation procedures are provided. The normal deactivation procedure removes a relay from the system which results in the UNSAFE TAKEOFF AURAL WARNING TEST function being deactivated. The alternate deactivation procedure involves the installation of jumper wires but does not affect the TEST function of the UNSAFE TAKEOFF AURAL WARNING system. The alternate procedure may be used at the operators discretion.

2. Deactivation

A. Normal Deactivation (Relay Removed)

(1) On pilots overhead circuit breaker panel, CB1, open and tag NO. 1 AFT COUPLER (B9) circuit breaker.

(2) On aft right rack in FESC remove elevator warning relay 2799-K2.

CAUTION: REMOVAL OF THE ELEVATOR WARNING RELAY DEACTIVATES THE UNSAFE TAKEOFF AURAL WARNING TEST FUNCTION. THIS FUNCTION MUST BE CHECKED PRIOR TO TAKEOFF REF. STEP 2A(7).

(3) Remove tag and close circuit breaker opened in Step (1).

(4) Make appropriate entry in aircraft log book.

(5) Prior to each takeoff, conduct an exterior visual check of the elevator/stabilizer surface positions after positioning the control column full aft and then full forward to assure there is no obvious discrepancy between elevator positions. The pilot-in-command shall be informed of the results of this check. Return control column to neutral after check.

NOTE: This check can be accomplished with any one single hydraulic system pressurized from any main hydraulic system pump (engine pump or ATM).

(6) If obvious discrepancy is noted, correct prior to flight.

CAUTION: AFTER EXTERIOR VISUAL CHECK OF ELEVATOR/STABILIZER SURFACE HAS BEEN PERFORMED, DO NOT MOVE CONTROL COLUMN TO FULL AFT POSITION PRIOR TO TAKEOFF.

(7) Prior to each takecff, conduct an UNSAFE TAKEOFF AURAL WARNING TEST and verify the AURAL WARNING HORN is operational. With any two of three throttles forward (TAKEOFF position), test the warning system with either of the following procedres:

(a) With flaps 0° or stabilizer trim out of takeoff range:

- Verify horn sounds.
- Retard throttles aft to ZERO (GROUND IDLE).
- Verify horn silent.

(b) With flaps and stabiiizer trim in takeoff range:

- Pull back on speedbrake handle; verify horn sounds.
- Push speedbrake handle full forward; verify horn silent.
- Retard throttles aft to ZERO (GROUND IDLE).

(8) A placard must be installed in the flight station in full view of the pilot. This placard shall alert the pilot that after the exterior visual check is performed, further movement of the control column to a full aft position prior to takeoff is prohibited.

B. Alternate Deactivation (Jumper wires)

(1) On pilots overhead circuit breaker panel, CB1, open and tag No. 1 AFT COUPLER (B9) and AURAL WARN-TEST AND RESET (L-6) circuit breakers.

(2) On Second Officers/Flight Engineer overhead circuit breaker panel, open and tag T/O AURAL WRNG (H-7) circuit breaker.

(3) Remove and cap wire 2799-37A20 from terminal B of diode module 9811-TB465 row 38.

(4) Remove and cap wire 3318-14E22 from terminal A of diode module 3317-TB6 row 32.

(5) Add a jumper wire (22 gage with each end terminated in terminal module pins P/N YHMM22-20B8) from terminal B of diode module 9811-TB465 row 38 and terminal A of diode module 3317-TB6 row 32.

(6) Remove tags and close circuit breakers opened in Steps (1) and (2).

(7) Position the rotary switch on the Flight Engineers Aural Warning Test Panel to UNSAFE TAKEOFF. Depress the TEST switch. Verify that the intermittent horn aural warning sounds and that the ELEVATOR indicator light on the Flight Engineers annunciator panel comes on when the TEST switch is depressed.

(8) Prior to each takeoff, conduct an exterior visual check of the elevator/stabilizer surface positions after positioning the control column full aft and then full forward to assure that there is no obvious discrepancy between elevator positions. The pilot-in-command must be informed of the results of this check. Return control column to neutral after check.

NOTE: This check can be accomplished with any one hydraulic system pressurized from any hydraulic system pump (engine pump or ATM).

(9) If a discrepancy is noted, correct prior to flight.

CAUTION: AFTER EXTERIOR VISUAL CHECK OF ELEVATOR/STABILIZER SURFACE HAS BEEN PERFORMED, DO NOT MOVE CONTROL TO FULL AFT POSITION PRIOR TO TAKEOFF.

(10) Make appropriate entry in aircraft log book.

(11) A placard must be installed in the flight station in full view of the pilot. This placard must alert the pilot that after the exterior visual check is completed, further movement of the control to a full aft position prior to takeoff is prohibited.

ELEVATOR DRIVE CABLE TIE-ROD/BREAK LINK ASSEMBLY - REMOVAL AND INSTALLATION

1. General

In the event of fractured break link, the following procedure will be used. This procedure will change both the cable and tie-rod break detector assembly, regardless of whether or not the cable is broken.

2. Equipment and Materials

Control Column and Trim Wheel Lock PN BA80-101, or equivalent

Lock-wire, Fed. Spec. QQ-W-390 TEMP A 0.032 inch-diameter, or equivalent

MIL-C-1673 Grade 4 Corrosion Preventive Compound

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	27-31-00	Elevator Control System - Adjustment and Test
R R	27-31-12	Elevator Drive Cable Break Link - Removal and Installation
R	29-11-00	Hydraulic Power System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal (Ref. Fig. 401)

(1) Verify that all hydraulic systems are turned off. Tag Flight Engineer/Second Officers hydraulic control panel (Ref. 29-11-00).

(2) With control column full forward, install control column and trim wheel lock.

NOTE: In order to secure trim wheel, it may be necessary to rotate the trim wheel to align trim wheel hole with lock pin.

(3) Gain access to the cable tie-rod assembly and break link assembly through access doors 317AB for the left hand side, or 317CB for the right (Ref. 6-40-00).

(4) Identify elevator down cable load turnbuckle and loosen until cable becomes slack.

(5) Disconnect break link electrical connections from the respective terminal block.

(6) Disconnect cable tie-rod assembly by removing bolt connecting tie-rod to the FS 1860 cable lower attachment (Ref. Fig. 401).

(7) Gain access to elevator aft drive quadrant through access doors 334AB for the left hand side, or 344AB for the right hand side (Ref. 6-40-00).

(8) At the small diameter cable, remove the cotter pin that retains the cable ball in the quadrant slot. Disengage cable from cable quadrant.

(9) At the cable roller guard, remove the bolt that attaches the cable roller guard link to the support bracket.

(10) At the small cable pulley just inboard of the cable quadrant, remove the two cable guards.

(11) Gain access to the stabilizer center section by removing the outboard stablilizer lower access panel 333AB for left elevator cable or 343AB for right elevator cable. (Ref. 6-40-00).

(12) Enter stabilizer and crawl inboard through the truss ribs to the elevator cable bay.

(13) Remove the cable guard over the elevator down cable idler pulley and the cableguard over the front spar main pulley.

(14) Remove elevator down cable by pulling forward from stabilizer front spar. Remove elevator down cable, cable tie-rod assembly, break link assembly, and rod end.

(15) Remove and save the load turnbuckle for reinstallation.

CAUTION: THE TIE-ROD LUG AND TIE-ROD CLEVIS ARE A MATCHED SET. DO NOT SEPARATE. IF LUG AND CLEVIS ARE SEPARATED, TAG TO INDICATE MATCHED SET.

IF SHEAR RIVET SHEARED, REPLACE RIVET PER OHM 27-31-11.

B. Installation

(1) Verify that all hydraulic power is turned off and that the control column lock is installed.

(2) Install new elevator down cable by feeding ball end of cable through stabilizer front spar and over the main pulley, over the idler pulley and out through the rear spar cable openings.

(3) Install the cable guard over the front spar main pulley and the idler pulley.

(4) At the aft cable quadrant, route the cable around the small pulley and engage the cable ball end in the cable quadrant slot.

(5) Install cotter pin in the cable quadrant to safety the cable ball in the slot.

(6) Install the two cable guards on the small pulley.

(7) Engage the cable roller guard over the quadrant cable and install the bolt connecting the cable guard link to the support bracket. Torque bolt 20 to 32 lb in. and install cotter pin.

(8) Lubricate cable terminal at tie-rod end and thread the cable into the load turnbuckle.

NOTE: Use MIL-C-1673 Grade 4 corrosion preventive compound to lubricate threads.

R Verify locking washers are properly installed
R between jam nut and load turnbuckle. Locking
R washer must be against jam nut and tab locking
R washer must be against turnbuckle.

R (9) Lubricate tie-rod threads and thread tie-rod into the
R other end of the turnbuckle, noting proper installation
R of locking washers. Tab locking washer must be against
R turnbuckle and locking washer must be against jam nut.

R (10) Lubricate tie-rod threads and connect rod-end, noting
R proper installation of locking washers. Locking washer

R must be against jam nut and tab locking washer must be
R against rod-end.

NOTE: Verify that threads extend past the witness hole.

Tie-rod may be turned to ensure spacer bushings face aft.

(11) Connect rod-end to elevator lower attach fitting of the FS 1860 bulkhead (Ref. Fig. 401).

NOTE: Prior to insertion of connecting bolt, lubricate using MIL-C-1673 Grade 4 corrosion preventive compound.

Verify that rod-end lub fitting, faces aft.

(12) Hand tighten turnbuckle to remove slack.

(13) Tighten nut connecting tie-rod to rod end and secure with lockwire.

(14) If break link not installed on tie-rod, install break link in accordance with 27-31-12.

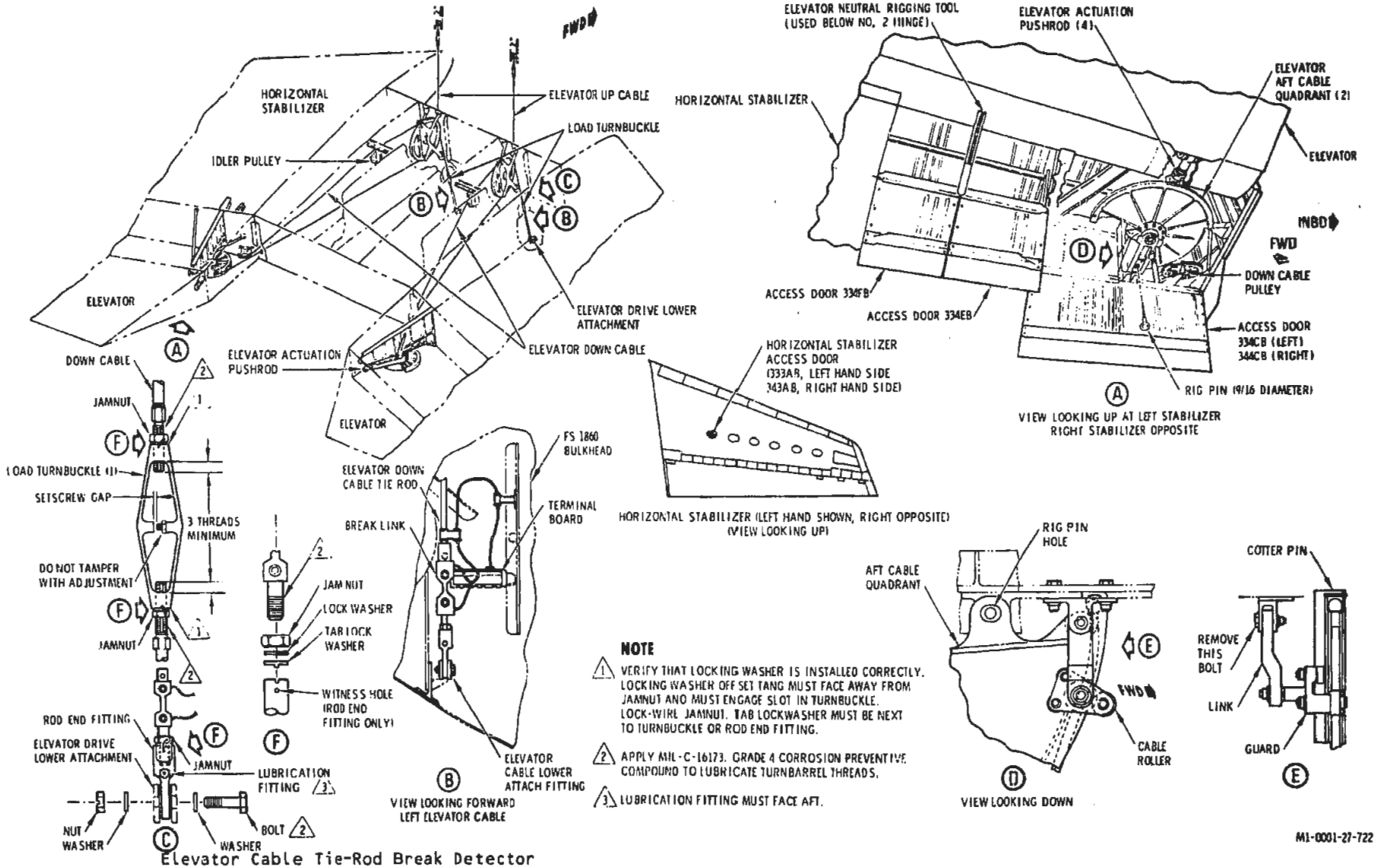
(15) If break link installed, connect wires as follows: For left break link, blue wire to 2799-TB1 terminal 1A, red wire to 2A. For right break link, blue wire to 2799-TB2 terminal 1A, red wire to 2A.

(16) Rig the elevator cables in accordance with Paragraph 5A of 27-31-00, Adjustment and Test.

(17) Verify that all locknuts are torqued and safetied, and that all necessary cotter pins are installed where required.

(18) Check all pulleys to ensure that cables are properly seated in the pulley grooves and that all pulley cable guards are installed, including the two pulleys in the stabilizer center section.

(19) Install stabilizer access panel and close all access doors (Ref. 6-40-00).



R
R
R Elevator Cable Tie-Rod Break Detector
Removal and Installations
Figure 401

EFFECTIVITY: 001-031 WITH SB27-174 AND 032-999

001B

ELEVATOR DRIVE CABLE TIE-ROD/BREAK LINK ASSEMBLY ADJUSTMENT AND TEST

1. General

An operational test of the elevator fail indicator, aural warning system must be conducted each time an elevator drive cable break link is replaced.

2. Referenced Procedure

24-41-00 External Power/Ground Service System - Maintenance Practices

3. Adjustment/Test

A. Adjustment

(1) There is no adjustment that may be performed on the elevator fail indicator system with the exception of replacement of the break link assemblies.

B. Test

(1) On PFCS panel, verify stabilizer servo switches A, B, C and D are depressed (flush with panel).

(2) Turn on electrical power (Ref. 24-41-00).

CR (3) Position all three throttles to idle setting.

CR (4) Verify that the following aural warning circuit
CR breakers are closed:
CR (Aural Warning should not be sounding)

CR	No. 1 AFT COUPLER	CB1-B9
CR	AURAL WARN TEST and RESET	CB1-L6
CR	AURAL WARN MULT SND	CB1-L8
CR	T/O AURAL WRN	CB2-H7
CR	MLG GND SENSE	CB2-L8

CR (5) On pilots overhead circuit breaker panel, CB-1, open circuit breaker B-9, AFT COUPLER NO. 1.

(a) Verify intermittent sounding of aural warning horn.

R (b) Verify the Flight Engineer/Second Officers ELEVATOR indicator light comes on.

R (6) On pilots overhead circuit breaker panel CB-1, close circuit breaker B-9, AFT COUPLER NO. 1.

(a) Verify that aural warning horn becomes silent.

(b) Verify ELEVATOR indicator light as referred to in Step 3B(5)(b) goes out.

R (7) Position throttle No. 1 fully forward.

R (8) Verify that the rotary switch on the aural warning test panel is in the UNSAFE T/O position.

R (a) Momentarily depress the test switch on the panel.

R (b) Verify no warning while test switch is held depressed.

R (9) Position throttle No. 1 full aft.

R (10) Verify that the rotary switch on the aural warning test panel is in the UNSAFE T/O position.

Momentarily depress the test switch on the panel.

(a) Verify intermittent sounding of aural warning horn.

(b) Verify the Flight Engineer/Second Officers ELEVATOR indicator light comes on.

NOTE: This indication will remain on while test switch remains depressed.

R (11) Repeat Steps 3B (7, 8, 9 and 10) for throttles No. 2
R and 3.

R (12) Verify throttle in use returned to idle.

R (13) On Flight Engineer/Second Officers circuit breaker panel CB-2, open circuit breaker L-8, MLG, GND SENSE.

R (14) Verify that the rotary switch on the aural warning test panel is in the UNSAFE T/O position.

Momentarily depress the test switch on the panel.

(a) Verify no warning while test switch is held depressed.

R (15) On circuit breaker panel CB-2, close circuit breaker L-8, MLG GND SENSE.

CR (16) Assure A, B, C and D stabilizer switchlites are latched
CR in depressed. Elevator warning horn should not sound.

CR (17) Release A and B stabilizer switchlites to the out
CR unlatched position. Horn should not sound and adjacent
CR aft coupler open lite should illuminate.

CR (18) Push in A and B stabilizer switchlites. Aft coupler
CR open lite shall extinguish.

CR (19) Release C and D stabilizer switchlites to the out
CR unlatched position. Horn should not sound and adjacent
CR aft coupler open lite should illuminate.

CR (20) Push in C and D stabilizer switchlites. Aft coupler
CR open lite shall extinguish.

CR (21) Release A and C stabilizer switchlites. Intermittent
CR horn should sound.

CR (22) Push in A and C stabilizer switchlites. Horn should
CR stop.

CR (23) Open Nbr 1 aft coupler CB-1-B9. Intermittent horn
CR should sound. Close CB and horn should stop.

CR (24) Turn off electrical power if no longer required (Ref.
CR 24-41-00).

ELEVATOR DRIVE CABLE TIE-ROD/BREAK LINK ASSEMBLY INSPECTION AND CHECK

1. General

This inspection and check must be used whenever an elevator drive cable jam or break is suspected as indicated by the
R elevator warning system. An open break link will alert the flight crew by illuminating an ELEVATOR fail light located on the Flight Engineers annunciator panel, and will be accompanied by an intermittent sounding of the aural warning system.

2. Referenced Procedure

R 6-40-00 Exterior Access Doors and Panels

29-11-00 Hydraulic Power System - Maintenance Procedure

3. Inspection/Check

A. Inspection

(1) Verify that all hydraulic systems are off (Ref. 29-11-00).

R (2) Gain access to break link assembly, located just
R outboard of each stabilizer servo, by opening access
R door 317AB for left detector, access door 317CB for
R right detector (Ref. 6-40-00).

R (3) Check break link assembly for a fractured condition (open break)(Ref. Fig. 601).

(4) If the break link is open, replace the tie-rod break link assembly and the elevator down cable (Ref. 27-31-11, Removal and Installation).

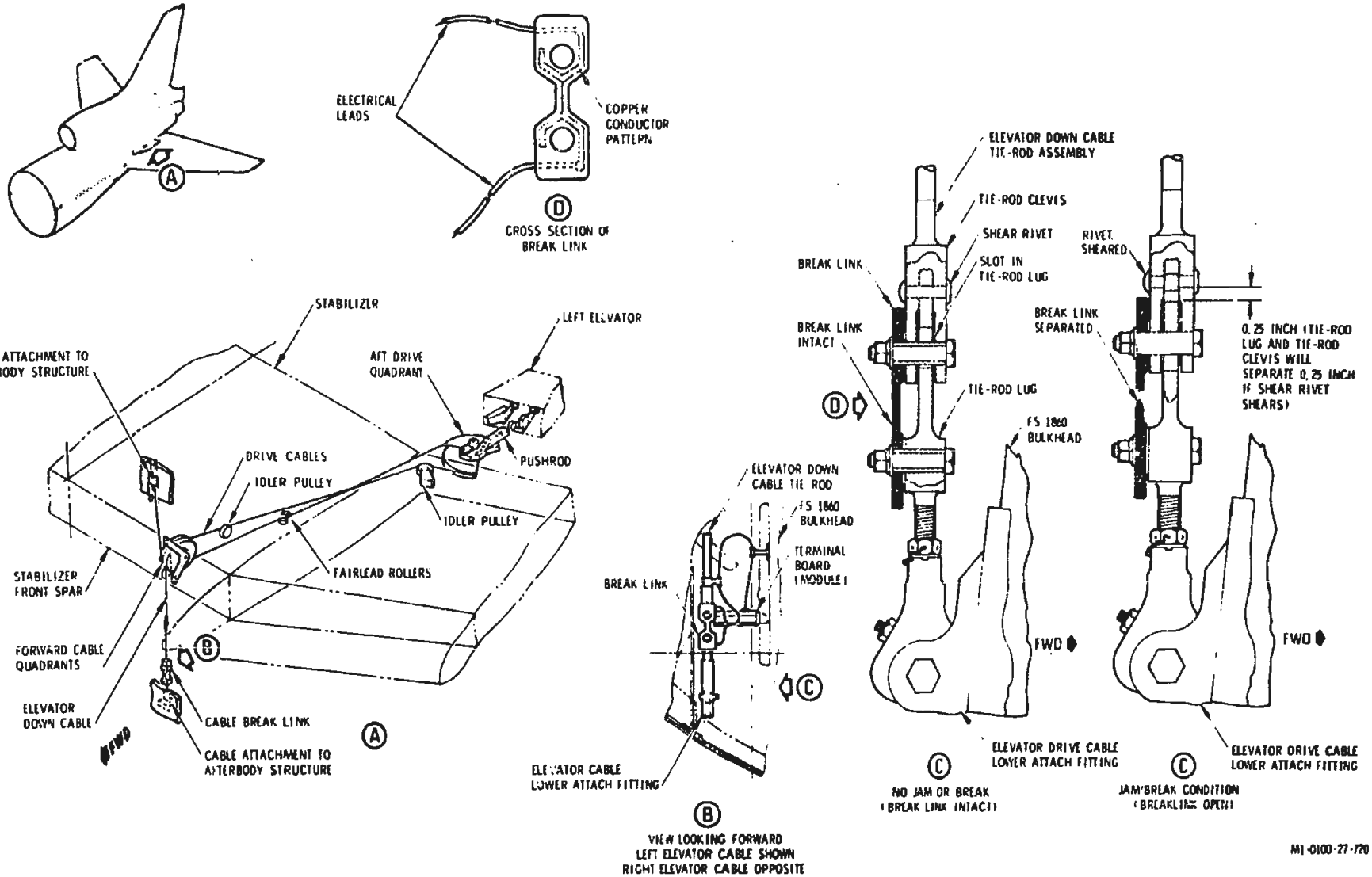
(5) If break link is intact, check for continuity across each of the two break links as follows:

R (a) Checking one break link assembly, then the other;
R disconnect left break link assembly blue wire from 2799-TB1 point 1A. Check for continuity between disconnected wire and 2799-TB1 point 2A (red wire). If continuity does not exist, replace faulty break link (Ref. 27-31-12, Removal and Installation).

R (b) Proceed to check for continuity for right break link assembly using 2799-TB2. Procedure is identical to Step 2A(4)a.

(c) Reconnect wires disconnected in Steps 3A(5)(a) and (b).

(6) If continuity exists for both break links, troubleshoot elevator warning system electrical circuit (Ref. 31-22-00, Section 101).



R Elevator Drive System Cable Tie-Rod/Break Detector System
R Inspection and Check
R Figure 601

EFFECTIVITY: 001-031 WITH SB27-174 AND 032-999

ELEVATOR DRIVE CABLE BREAK LINK - REMOVAL AND INSTALLATION

R 1. General

R Removal of elevator drive cable break link is required when
R there is an elevator jam light on pilots warning and caution
R annunciator panel. A shear rivet going through clevis and tie
R rod assembly will break causing a shift in position and send a
R signal to annunciator panel. Complete inspection of elevator
R control system will be required and repair of elevator drive
R cable break link assembly before installation can be
R accomplished.

R 2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power Systems - Maintenance Practices

R 3. Equipment and Materials

R Rivet, MS20615-6M16

R Squeeze Riveter

R 4. Removal/Installation

A. Removal

(1) Verify all hydraulic systems are off (Ref. 29-11-00).

(2) On Flight Engineer/Second Officers circuit breaker panel CB2, open circuit breaker H7, T/O AURAL WARN IND.

(3) Open access door 317AB, left hand, or 317CB right hand to gain access to break link assembly.

(4) Remove failed break link as follows:

(a) At terminal board 2799-TB1 for the left hand and 2799-TB2 for the right hand unit, disconnect the break link wires.

(b) At cable break detector assembly, loosen and remove the two securing nuts and flat washers which secure break link to the tie-rod assembly.

R CAUTION: DO NOT ATTEMPT TO REMOVE CLEVIS BOLTS THROUGH TIE-ROD ASSEMBLY.

(c) Remove break link, flat washer, and spring washer from tie-rod clevis bolt bushing-spacer.

B. Installation

(1) Verify all hydraulic systems are off (Ref. 29-11-00).

(2) Verify circuit breaker opened in Step 2A(2) is opened.

(3) Install break link to tie-rod assembly (Ref. Fig. 401) as follows:

(a) Place spring washer over clevis bushing, followed by a large area flat washer.

NOTE: Concave surface, (cupped portion) of washer must face the break link.

(b) Install break link so that electrical wires, (red and blue) always face their respective terminal boards.

(c) Secure break link using a small area flat washer and selflocking nut, for each bolt.

NOTE: Break link does not receive torque load of nut, rather it is secured by the force exerted by the spring washer. Torque is absorbed by the extended clevis bushing.

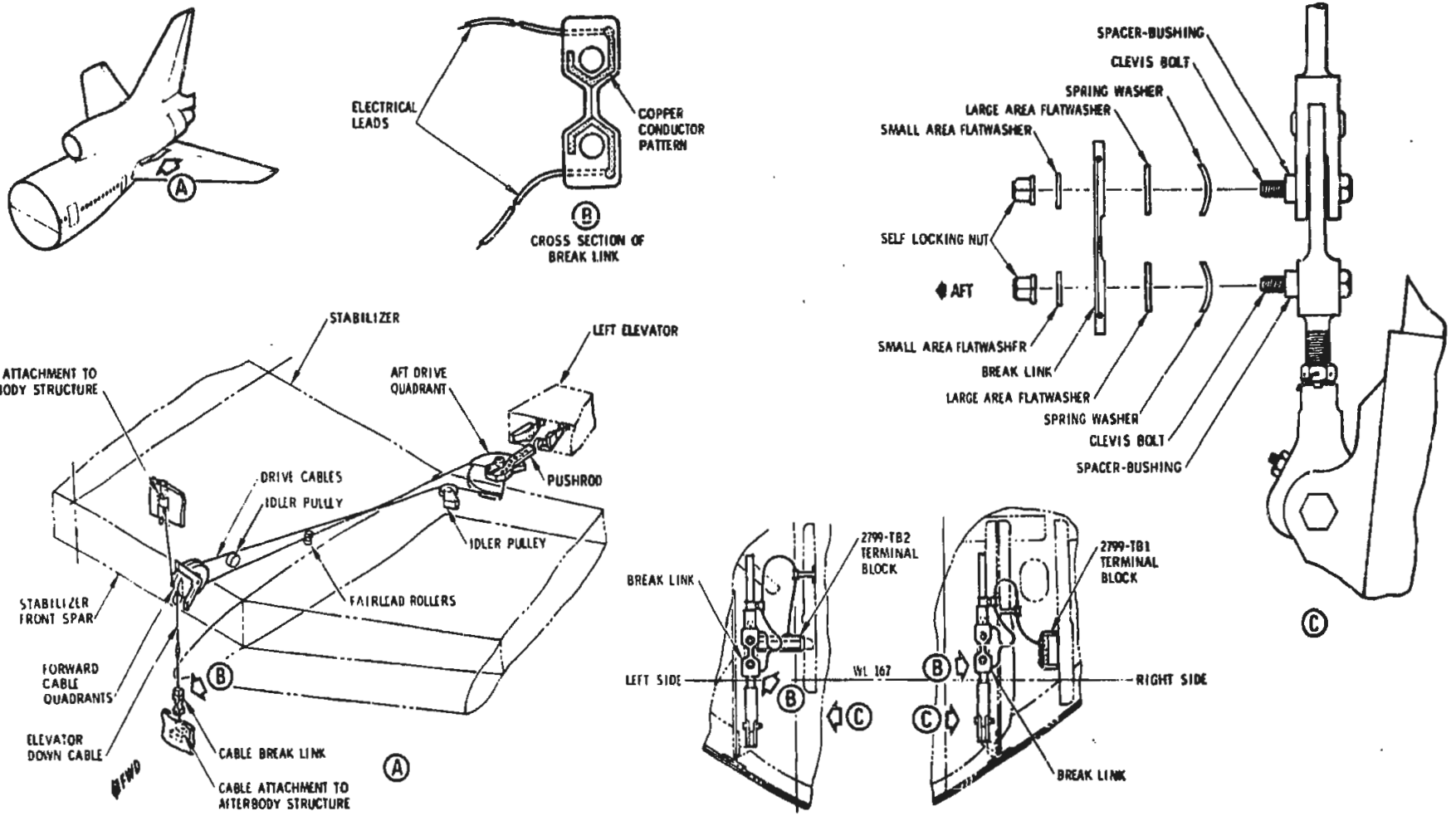
R R (d) Install rivet through break link assembly and tie rod using medium pressure.

R (e) Connect break link electrical wires to their respective terminal block.

(4) Close access doors opened in Step 2A(3).

(5) Perform operational test of the elevator fail indicating system (Ref. 27-31-11, Adjustment and Test).

(6) Turn off electrical power if no longer required (Ref. 24-41-00).



VIEW LOOKING FORWARD AT FS 1860 BULKHEAD

MA-0100-27-721

Elevator Drive System Cable Break Detector
Figure 401

EFFECTIVITY: 001-031 WITH SB27-174 AND 032-999

CR ELEVATOR JAM WARNING SYSTEM DEACTIVATION - MAINTENANCE PRACTICES

C 1. General

C The following procedure outlines the steps that must be taken to C deactivate the elevator jam warning system.

C NOTE: This deactivation procedure applies only when an aircraft C is to be dispatched in accordance with the MEL.

C 2. Deactivation

C A. Elevator jam warning system inoperative.

C (1) On pilots overhead circuit breaker panel, CB1, open and C tag No. 1 aft coupler (B9) circuit breaker.

C (2) On aft right rack in FESC remove elevator warning relay C 2799-K2.

C NOTE: Removal of this relay deactivates the unsafe C takeoff aural warning test function. To check C unsafe takeoff aural warning test function C accomplish paragraph B. Unsafe Takeoff Aural C Warning Test.

C (3) Remove tag and close circuit breaker opened in step C (1).

C (4) Make appropriate entry in aircraft log book.

C (5) Prior to each takeoff, conduct an exterior visual check C of the elevator/stabilizer surface positions after C positioning control column full aft and then full C forward to assure there is no obvious discrepancy C between elevator positions. The pilot-in-command shall C be informed of the results of this check. Return C control column to neutral after check.

C NOTE: This check can be accomplished with any one C single hydraulic system pressurized i.e. engine C pump or ATM.

C (6) If obvious discrepancy is noted, correct prior to C flight.

C CAUTION: NO FURTHER FULL AFT CONTROL COLUMN MOVEMENT SHOULD C BE PERFORMED PRIOR TO TAKEOFF.

C (7) A placard must be installed in the flight station in
C full view of the pilot. This placard shall alert the
C pilot that after the exterior visual check is completed
C that further movement of the control column to full aft
CR position prior to takeoff is prohibited (Ref. Fig.
CR 201).

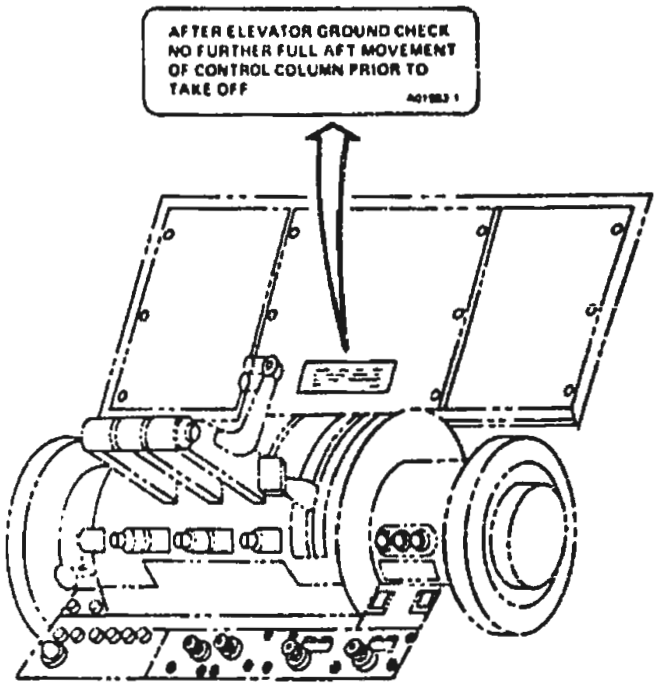
C B. Unsafe Takeoff Aural Warning Test

C (1) Prior to each takeoff conduct an unsafe takeoff aural
C warning test and verify the aural warning horn is
C operational as follows:

C (a) Verify flaps are fully retracted.

C (b) Advance any two of the three throttles and verify
C aural warning horn sounds.

C (c) Retard throttles and verify horn is silent.



M1-0000-27-982

CR Control Column Warning Placard
CR Figure 201

HORIZONTAL STABILIZER CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

Longitudinal (pitch) control of the aircraft is provided by an all-movable horizontal stabilizer (flying tail) that is used for both maneuvering and trim. The control system is a fully powered irreversible hydro-mechanical system. Conventional flight station control columns drive two cable systems that control two dual hydraulic servo modules mounted in the afterbody area (Ref. Fig. 1 and 2). The servo modules in turn control four hydraulic piston actuators, any one of which can provide complete control of the aircraft. The two dual servos are supplied by four independent hydraulic systems (A, B, C, and D), providing maximum protection against possible multiple hydraulic failures.

Mechanical fail safety of the stabilizer control system is assured by using two separate control paths from the control column to the stabilizer servos. In addition, dual pushrods are used extensively in the stabilizer control linkages located in the aferbody (Ref. Fig. 3). The two stabilizer control paths are coupled together by an interconnecting torque tube in the flight station and interconnecting linkage in the afterbody. Override bungees are installed in both control column output linkages to provide continuous control of the stabilizer in the remote event of a control jam. Separation of the Captains and First Officers control paths is provided by a mechanically actuated disconnect which separates the control column interconnecting torque tube and an electrically operated aft pitch coupler in the afterbody that separates the stabilizer control interconnecting linkage. Actuation of the aft coupler effectively separates the two stabilizer servo input control linkages.

R The aerodynamic effectiveness of the stabilizer is significantly improved by incorporating "geared" elevators. The two elevators are hinged to the stabilizer trailing edge and the elevator control cable system is grounded (connected) to fuselage structure. The elevators are positioned as a function of stabilizer deflection, which produces an up elevator movement when the stabilizer is driven in a leading edge down direction.

At the low stabilizer deflections associated with high Mach number cruise, the elevator is essentially faired; at the higher stabilizer deflections utilized for low speed operations, especially the landing flare, the elevator produces larger deflections to provide maximum control effectiveness. The stabilizer and elevator deflection ratios are: stabilizer leading edge one degree up from neutral, elevator essentially

faired to stabilizer; stabilizer leading edge 14 degrees down from neutral, elevator trailing edge 25 degrees up from faired to stabilizer.

R WARNING: WITH HYDRAULIC POWER OFF AND ONE OR BOTH ELEVATORS
R REMOVED, THE STABILIZER MAY MOVE WITHOUT WARNING.

R With hydraulic power off, the stabilizer normally assumes a
R trailing edge down position. With both elevators installed, a
R substantial load is required on the leading edge of the
R stabilizer to move the stabilizer to the leading edge down
R position.

R With one elevator removed, the leading edge load required to
R move the stabilizer leading edge down is significantly reduced.

R With both elevators removed, the stabilizer may move at any time
R to the leading edge down position with little or no load applied
R to the stabilizer.

In a fully powered servo system the pilot forces necessary to position the servo control valves are very low; consequently, artificial feel and centering forces are provided. The pilot feel forces are produced by springs through two feel units. Each feel unit generates half the pitch feel forces as a function of control column deflection, trim position, and Mach number. Each of the feel units is combined in one housing with one of the two trim units to form two feel/trim assemblies.

The left feel/trim assembly contains one of the feel units and the electrical trim command system; the right feel/trim assembly contains the second feel unit and the mechanical trim actuator. The two pitch feel/trim assemblies are installed in the afterbody just aft of the pressure bulkhead with the other major components of the stabilizer control system (Ref. Fig. 3). The electrical trim commands are processed in the left assembly and the mechanical trim commands in the right. Two shafts couple the feel/trim assemblies together to assure that all mechanical and electrical pitch trim commands are applied to both feel/trim assemblies equally.

Stabilizer trim is provided by parallel outputs from both feel/trim assemblies. The outputs represent the sum of mechanical, electrical, and Mach trim commands, from both assemblies. The feel spring force of each feel/trim assembly is coupled into the pilots stabilizer servo control paths between the tension regulator and the stabilizer servo. The right feel/trim assembly coupled to the First Officers control path, and the left feel/trim assembly is coupled to the Captains control path.

faired to stabilizer; stabilizer leading edge 14 degrees down from neutral, elevator trailing edge 25 degrees up from faired to stabilizer.

R WARNING: WITH HYDRAULIC POWER OFF AND ONE OR BOTH ELEVATORS
R REMOVED, THE STABILIZER MAY MOVE WITHOUT WARNING.

R With hydraulic power off, the stabilizer normally assumes a
R trailing edge down position. With both elevators installed, a
R substantial load is required on the leading edge of the
R stabilizer to move the stabilizer to the leading edge down
R position.

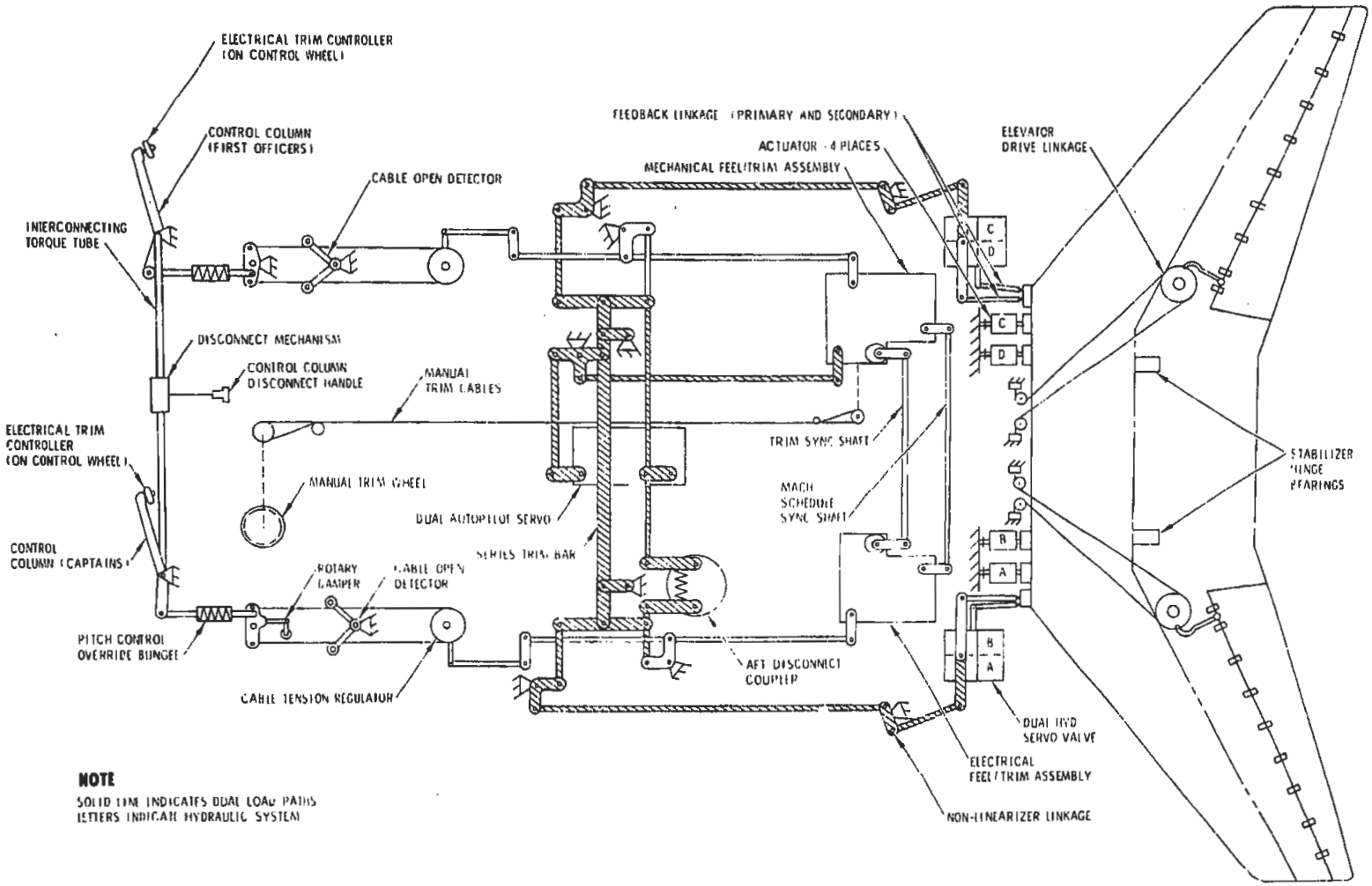
R With one elevator removed, the leading edge load required to
R move the stabilizer leading edge down is significantly reduced.

R With both elevators removed, the stabilizer may move at any time
R to the leading edge down position with little or no load applied
R to the stabilizer.

In a fully powered servo system the pilot forces necessary to position the servo control valves are very low; consequently, artificial feel and centering forces are provided. The pilot feel forces are produced by springs through two feel units. Each feel unit generates half the pitch feel forces as a function of control column deflection, trim position, and Mach number. Each of the feel units is combined in one housing with one of the two trim units to form two feel/trim assemblies.

The left feel/trim assembly contains one of the feel units and the electrical trim command system; the right feel/trim assembly contains the second feel unit and the mechanical trim actuator. The two pitch feel/trim assemblies are installed in the afterbody just aft of the pressure bulkhead with the other major components of the stabilizer control system (Ref. Fig. 3). The electrical trim commands are processed in the left assembly and the mechanical trim commands in the right. Two shafts couple the feel/trim assemblies together to assure that all mechanical and electrical pitch trim commands are applied to both feel/trim assemblies equally.

Stabilizer trim is provided by parallel outputs from both feel/trim assemblies. The outputs represent the sum of mechanical, electrical, and Mach trim commands, from both assemblies. The feel spring force of each feel/trim assembly is coupled into the pilots stabilizer servo control paths between the tension regulator and the stabilizer servo. The right feel/trim assembly coupled to the First Officers control path, and the left feel/trim assembly is coupled to the Captains control path.



NOTE

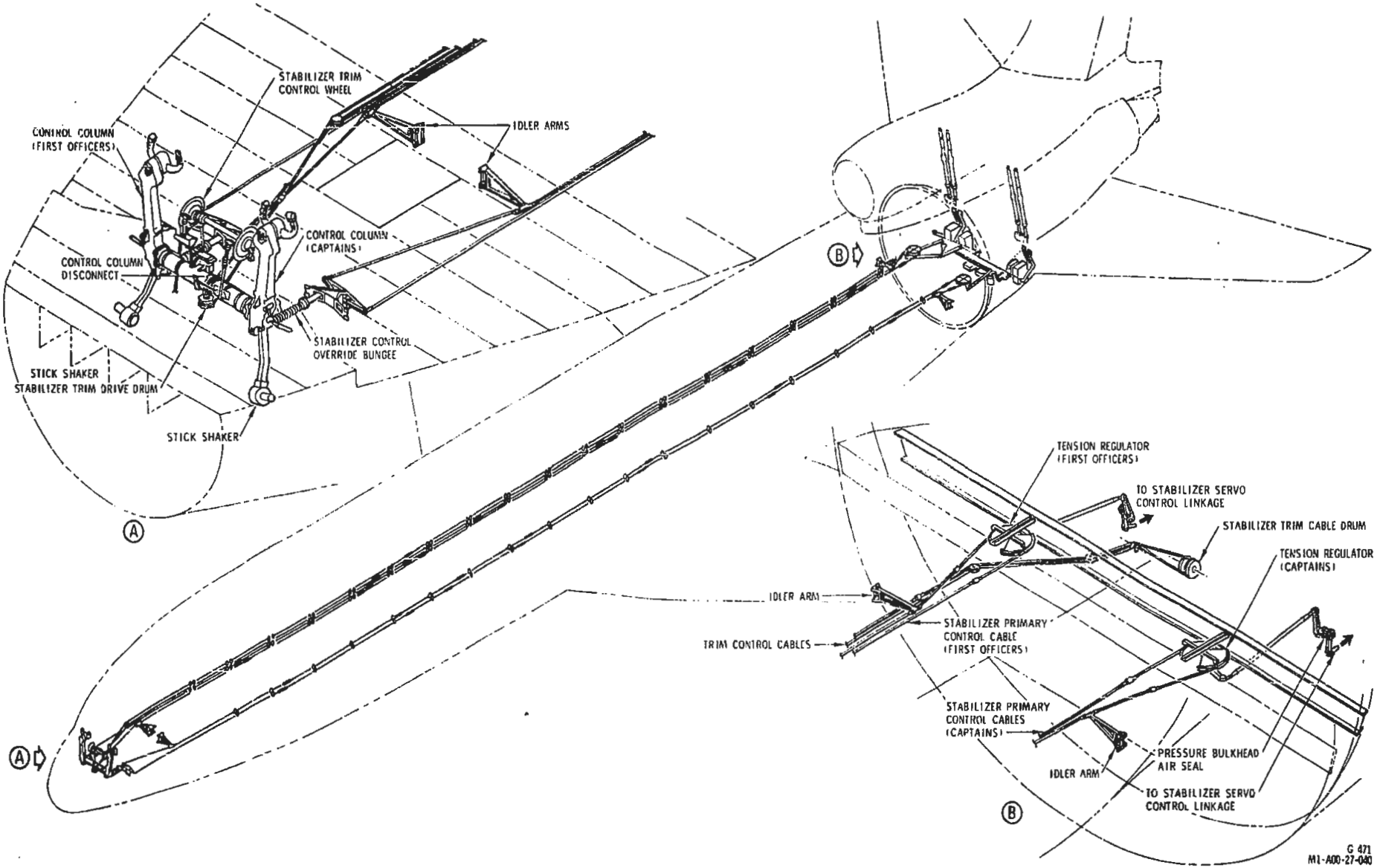
SOLID LINE INDICATES DUAL LOAD PATHS
LETTERS INDICATE HYDRAULIC SYSTEM

MI-0101-27-007

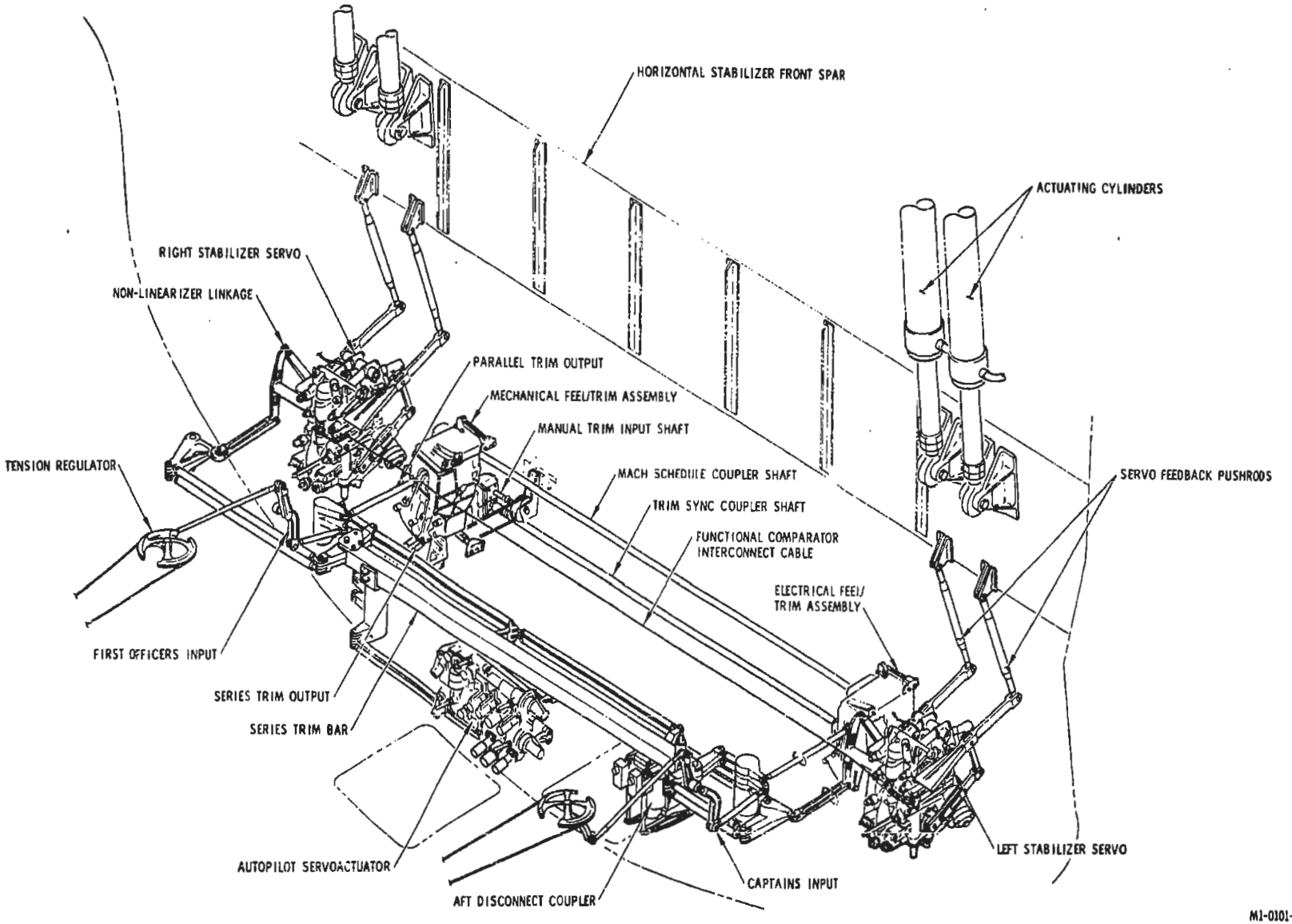
R Horizontal Stabilizer Control System Schematic
R Figure 1

EFFECTIVITY: ALL

001E



Horizontal Stabilizer Control System Component Location
Figure 2



G 484
M1-0101-27-041

Pitch Control Components in Afterbody
Figure 3

Autopilot input into the stabilizer system is provided by a stabilizer autopilot servo located in the afterbody area (Ref. Fig. 3). A single autopilot servo output is coupled to the stabilizer servo control linkage and drives the inputs of both stabilizer servos.

An aft pitch coupler assembly is installed in the afterbody linkage that couples the Captains and First Officers stabilizer servo input linkage. The coupler assembly allows the separation of the Captains and First Officers control paths in the event of a control path jam. The coupler is electrically uncoupled at the same time an action is taken to shut down the hydraulic supply to a malfunctioning system servo.

2. Operation

A. Manual Operation

Movement of either control column applies an input into both dual stabilizer servos through the dual loadpaths, which consist of cables, pushrods and bellcranks. Control column movement is resisted by the feel springs in the two feel/trim assemblies. The feel spring force is a function of mechanical trim, electrical trim, and Mach trim.

The mechanical input into the two servos positions the dual control valve spools in each servo and ports hydraulic flow to the four parallel acting actuators. Hydraulic flow is proportional to control valve displacement. The four actuators respond to the load induced differential pressures and position the stabilizer against the aerodynamic load. Stabilizer displacement is mechanically fed back to the two servos through four feedback linkages and compared with the input command through the internal servo summing linkage. The feedback nulls the control valves when the stabilizer reaches the command position.

Mechanical or electrical trim inputs shift the neutral force position of the feel springs in the two feel/trim units. This spring force is applied into the servo input pushrod system and positions the two control valve spools, causing the stabilizer to move to the new neutral force position of the feel springs.

The pitch control monitoring system consists of contact switches on the two control column output spring bungees, the open pitch control cable detectors, and the aft pitch coupler. The switches on the spring bungees actuate when a force in excess of the bungee breakout has caused the spring to compress. The cable detector switches detect a slack or breakage in the pitch control cable system. The switches in

the aft coupler detect a jam of a stabilizer control path with respect to the other.

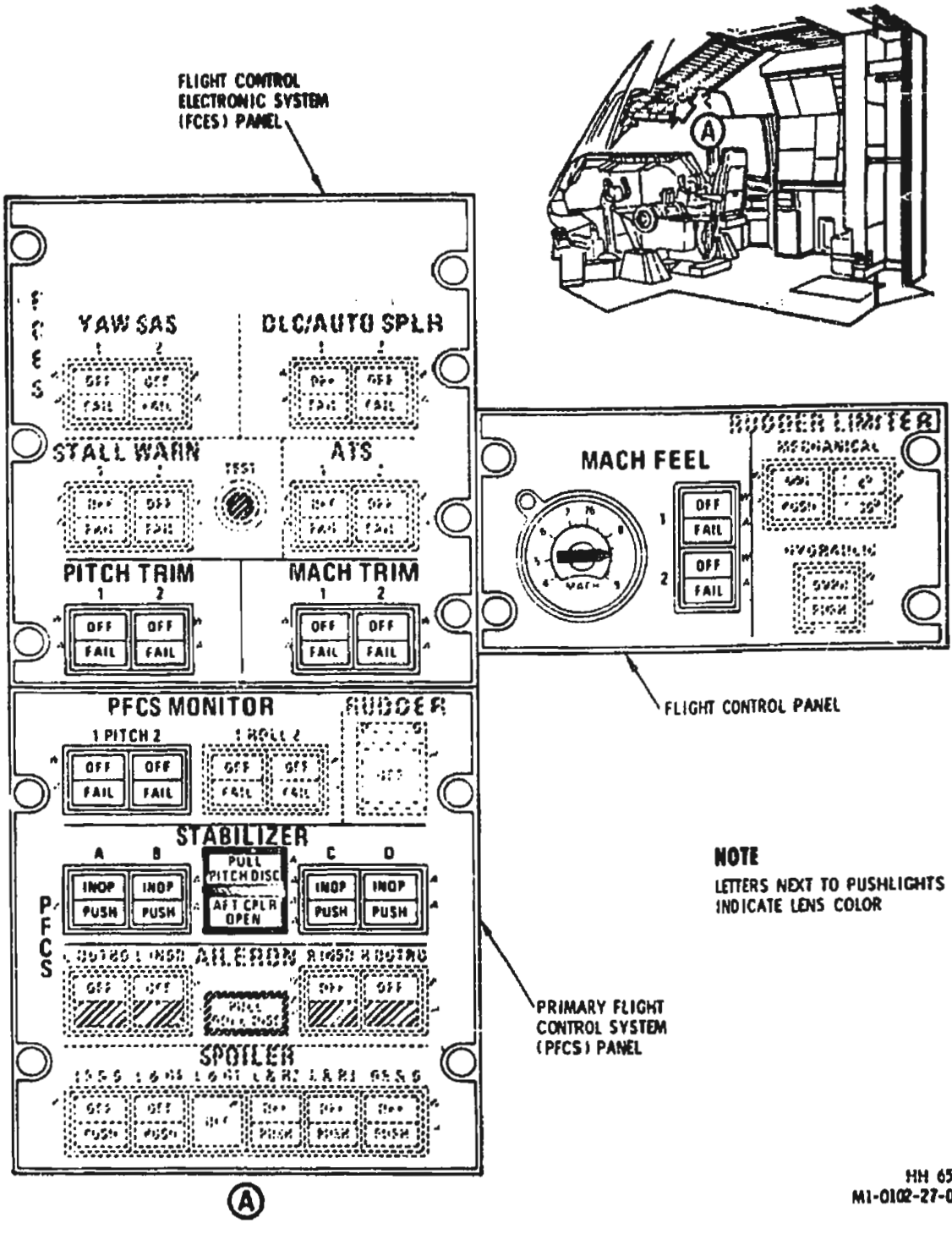
Malfunctions detected by these switches are transmitted to the FCES (flight control electronics system) computer (Ref. 22-17-00) which determines what part of the system has malfunctioned and what action must be taken. The FCES computer then provides action commands to the appropriate pair of STABILIZER switchlights on the PFCS (primary flight control system) monitor/control panel (Ref. Fig. 4). The FCES computer also actuates the FLT CONT PANELS indicator on the pilots caution and warning panel for alerting the pilots the existence of indications on the PFCS panel.

The illuminated STABILIZER switchlights command the pilots to shut down that side of the stabilizer control system. By depressing the switchlights as commanded, the hydraulic power to the malfunctioned system servo is shut down and at the same time, the aft pitch coupler is uncoupled. This results in an additional command on the PFCS panel, through the FCES computer logic, to pull the pitch disconnect handle. By pulling the PITCH DISC handle on the pilots center console as commanded, the two control columns are uncoupled. This completes the shutdown and isolation of the malfunctioned control system from the other.

B. Autopilot Operation

Autopilot electrical inputs (Ref. 22-11-00) are applied to the stabilizer autopilot servo located just forward of and between the two stabilizer servos. The electrical input is converted into a hydraulic actuator output, in the autopilot servo, and applied to both of the stabilizer servo input linkages through the interconnecting push rod system. The stabilizer servo input linkage positions the two control valve spools in the stabilizer servos which hydraulically position the stabilizer. Since the autopilot output is applied to the stabilizer mechanical control system, the control columns will also move to reflect autopilot command inputs.

When the autopilot is engaged the pilot is prevented from applying mechanical pitch inputs into the stabilizer control system by an engage and override force limiter in the autopilot servo. However, if a malfunction occurs in the autopilot system, or in an emergency situation, the pilot can take immediate command of the stabilizer by applying enough force on the control column to override the force limiter.



Flight Station Pitch Control Panels
Figure 4

3. Control Column

A. Description and Operation

The control column provides the pilots with the mechanisms to introduce roll and pitch control inputs into the aileron and stabilizer control system. The columns are hollow cast aluminum housings. The Captains and First Officers columns are functionally identical but are not interchangeable as the column assemblies are mirror images of each other (Ref. Fig. 5).

Aileron inputs are applied from the control wheel shaft through a sector gear, bellcrank, and pushrod to an output arm near the base of the column. The base of each column contains an integral flange for bolting the columns to an interconnecting torque tube. The torque tube is mounted to structure by two ball bearings which provides the control column pivot. The control column extends below the torque tube pivot and contains a machined clevis for attaching the override bungee. Two integral stops are provided near the base of the columns to limit the movement of the columns in the pitch axis. The rear stop (pitch up) is adjustable; the forward stop (pitch down) is fixed.

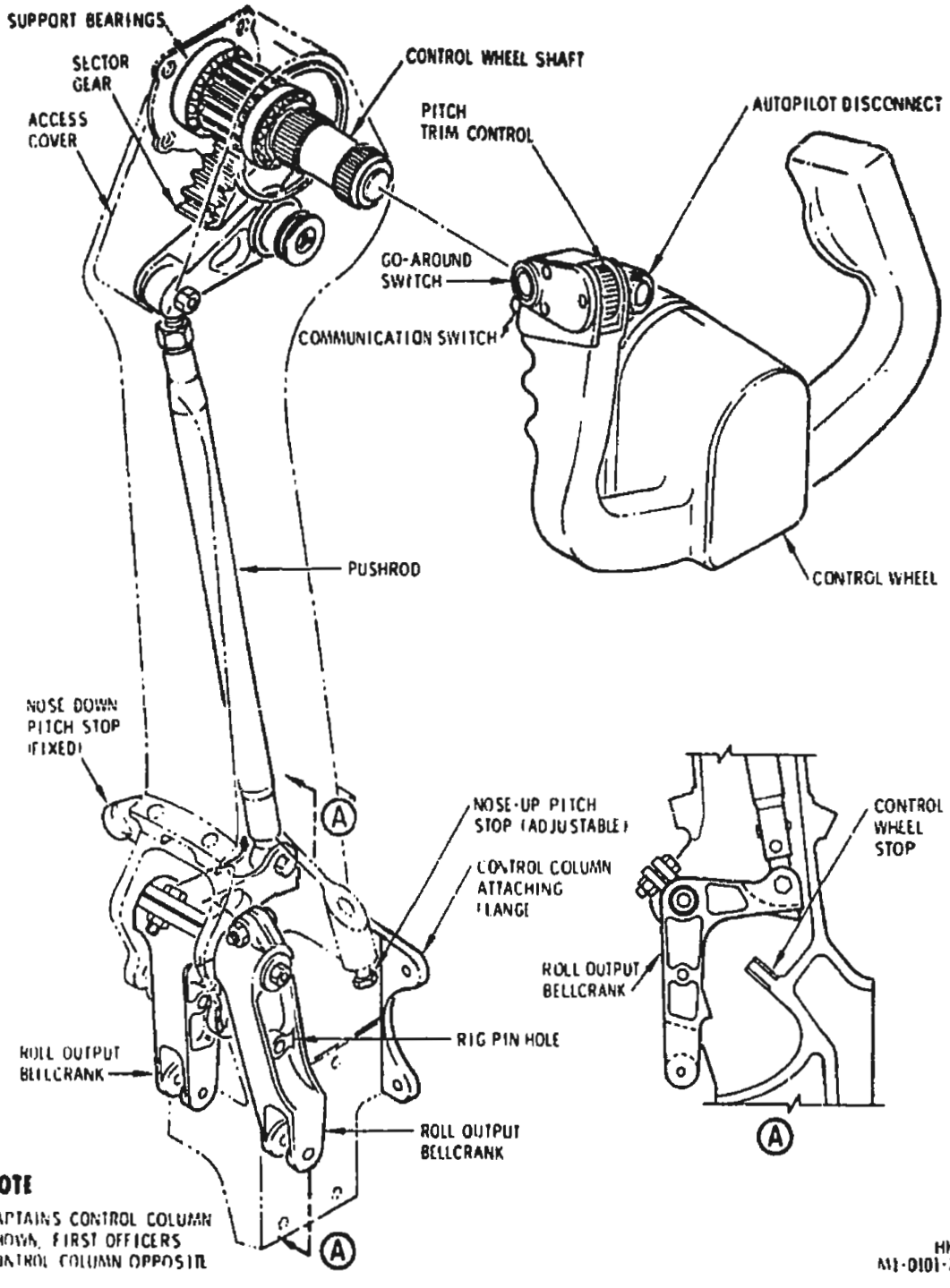
4. Control Column Rotary Damper

A. Description and Operation

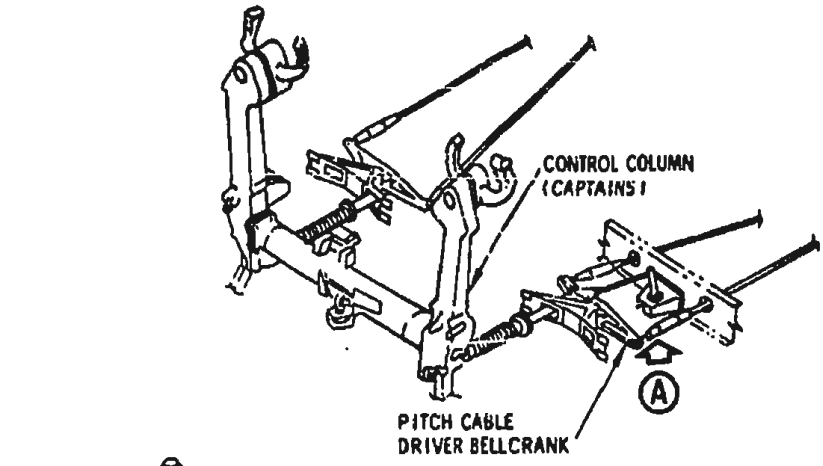
A rotary damper is connected to the Captains control column output linkage to stabilize control column movement (Ref. Fig. 6). The damper is mounted to flight station floor structure, and is pushrod-connected to the Captains pitch cable driver bellcrank.

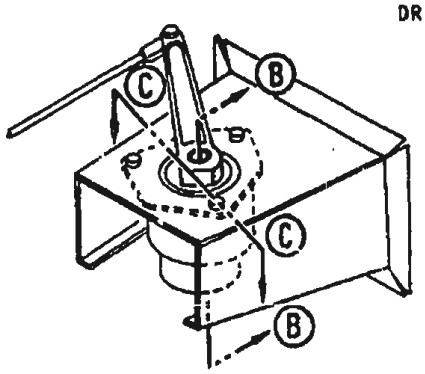
The damper consists of a double paddle vane that rotates within a cylindrical housing. The housing is divided into two chambers by two bulkheads and is filled with a viscous fluid. A reservoir cavity and a spring-loaded diaphram maintain a solid fluid supply to the paddle chambers. A pin attached to the diaphram protrudes through the reservoir cover on the bottom of the damper, and indicates viscous fluid supply. The fluid supply is acceptable when the pin is flush with cover (±1/8 inch) with fluid at 70°F. A filler plug is provided to fill the damper. The damper can only be filled in the shop.

Rotary velocity of the vanes is controlled by four ball check valves in the housing and a temperature-compensated orifice in the hollow vane shaft.

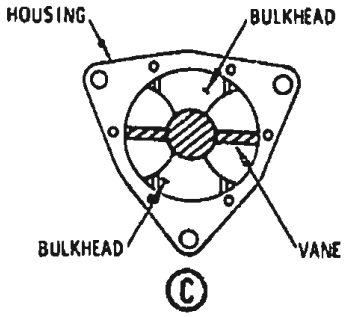


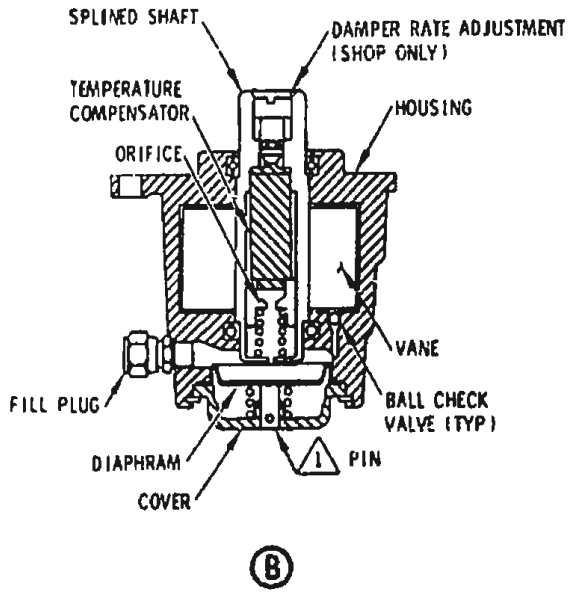
Control Column Assembly
Figure 5





(A) DAMPER INSTALLATION





NOTE

1. PIN INDICATES DAMPER FLUID SUPPLY. WITH DAMPER AT 70°F. PIN SHOULD BE FLUSH WITH COVER (± 1/8 INCH)

M1-0101-27-064

R
R

Control Column Damper
Figure 6

Movement of the control column causes the vanes to rotate within the housing. Vane rotation is dampened by restricting fluid flow from the chambers to the reservoir. This is done by the temperature compensating orifice. This action dampens rapid movement and stabilizes the control column.

5. Control Column Disconnect Mechanism

A. Description and Operation

The pitch disconnect mechanism allows the pilot to separate the control columns if a jam occurs in the Captains or First Officers control path. The disconnect mechanism is part of the torque tube that couples both control columns (Ref. Fig. 7). The disconnect is mechanically actuated by the PITCH DISC handle on the left side of the center console.

The disconnect is a spring loaded dog clutch mechanism. The fixed clutch plate is mounted to the right torque tube; the sliding clutch plate is coupled to the left torque tube by a ball bearing spline arrangement. The left and right torque tubes are coupled together by two double race ball bearings to maintain torque tube alignment and control column support.

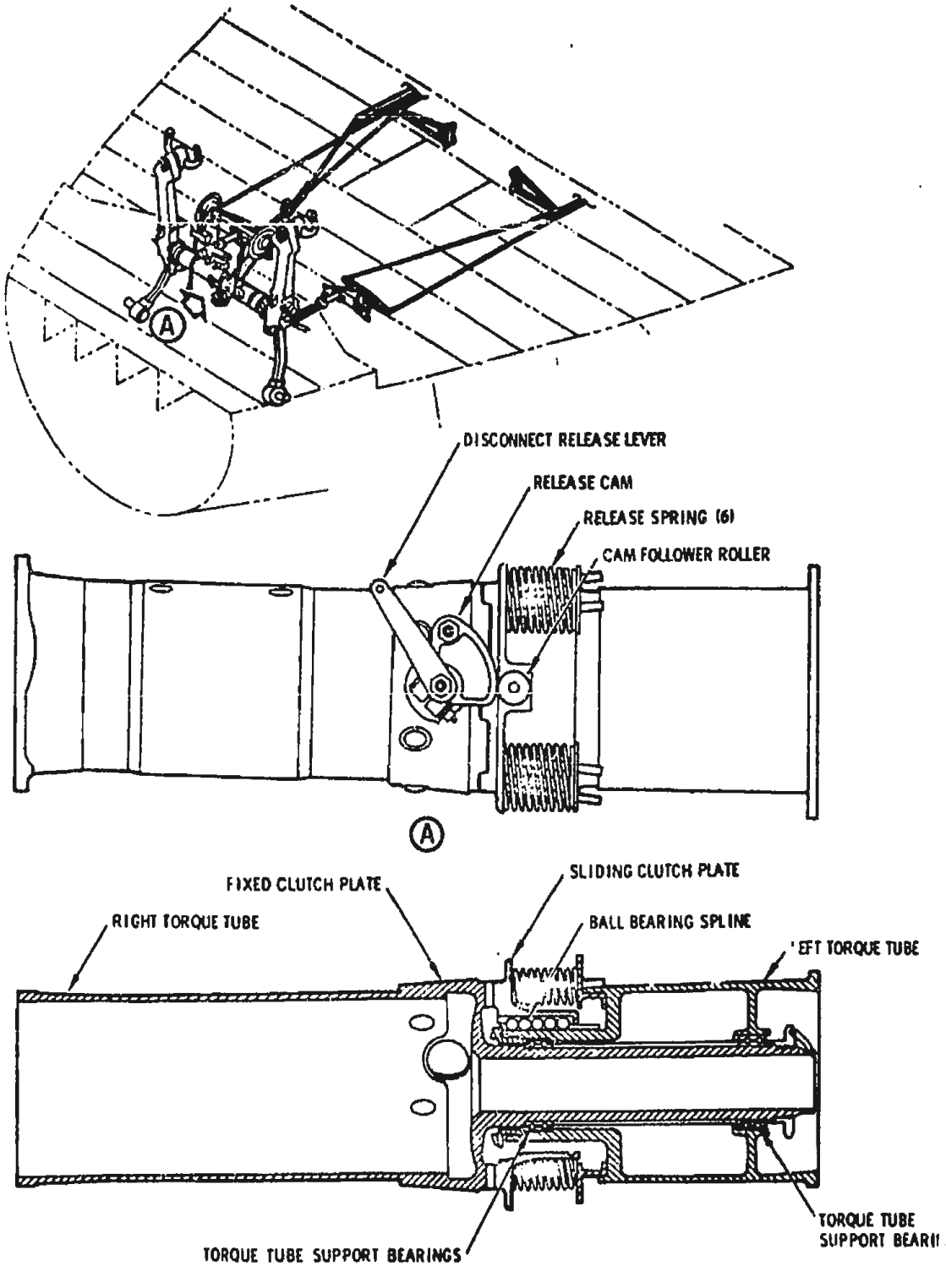
Actuation of the disconnect is accomplished by a cable system that rotates two cams mounted on a bearing supported shaft. The sliding clutch plate mounts two cam follower rollers which are contacted by the cams during actuation. Pulling up on the PITCH DISC handle rotates the cams against the two rollers, driving the sliding clutch plate out of engagement with the fixed clutch plate. The disconnect is held in the actuated (uncoupled) position by a bayonet lock on the pitch disconnect handle. After pulling up on the disconnect handle, the handle is rotated 90 degrees to lock.

Releasing the PITCH DISC handle by rotating the handle counterclockwise 90 degrees and allowing the handle to retract into its housing will allow the spring loaded dog clutch to reengage. Dog clutch reengagement will occur only when the control columns are synchronized.

6. Control Column Disconnect Mechanism Cable System

A. Description and Operation

The control column disconnect mechanism cable system provides the means for the pilot to decouple the control columns in the event of a pitch control path jam. The cable



PITCH DISCONNECT CROSS SECTION

HH 6580
M1-A00-27-042

Pitch Disconnect Mechanism
Figure 7

control system consists of a T handle mounted on the left side of the center console and a short cable run that extends to the disconnect release lever (Ref. Fig. 8). The cable is a one-sixteenth inch diameter carbon steel cable that contains a swaged ball on the handle end and a cable terminal strap on the release lever end.

The T handle contains a bayonet locking mechanism and an adjusting nut on the lower end to adjust the cable tension. Actuation and locking of the disconnect is accomplished by pulling up on the T handle and rotating it 90 degrees clockwise. Rigging and adjusting of the cable is accomplished by rotating the cable adjusting nut on the lower end of the T handle until a specific clearance is obtained between the adjusting nut and the cable fitting.

7. Override Bungee

A. Description and Operation

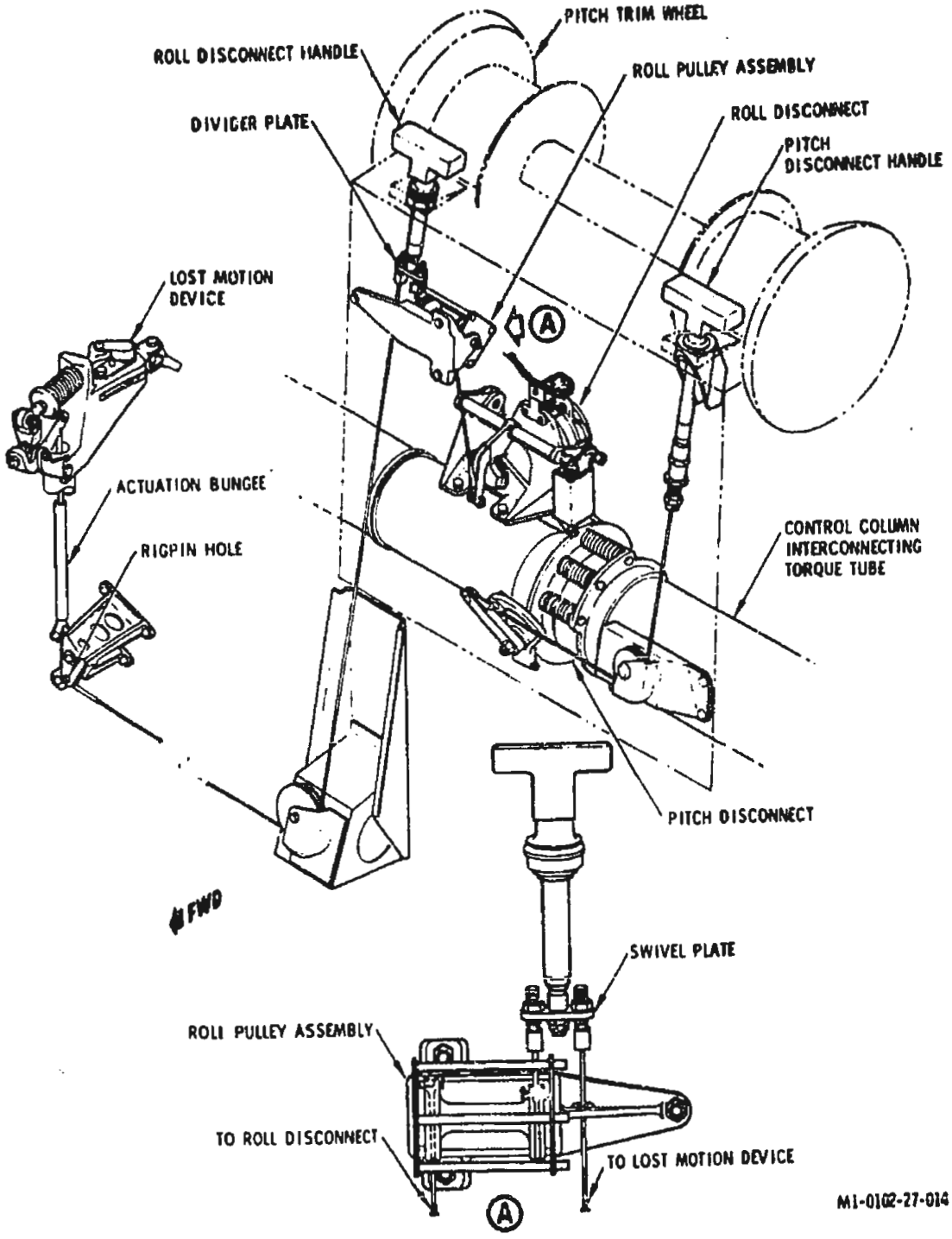
An override bungee is installed in the pitch control system between the Captains and First Officers control columns and their respective cable driver bellcrank (Ref. Fig. 2). The override bungee allows either pilot to maintain control of the pitch system, in the event of a control path jam, by overriding the jammed control path.

The override bungee consists of a caged double acting spring cartridge (Ref. Fig. 9). The cartridge is designed so that either a compression or tension load will cause the coil spring to compress. Four mechanically actuated switches are installed on the cartridge to determine if the cartridge spring is being compressed (indicating a restriction in the cable control path), and what kind of a load (compression or tension) is causing its actuation. The switch signals are directed to the FCES computer which actuates the affected stabilizer servo switchlights on the PFCS monitor/control panel (Ref. Fig. 4). The override bungee is adjusted to "break out" (compress spring) when a 274 pound load is applied to the cartridge or 60 pounds is applied at the control column wheel.

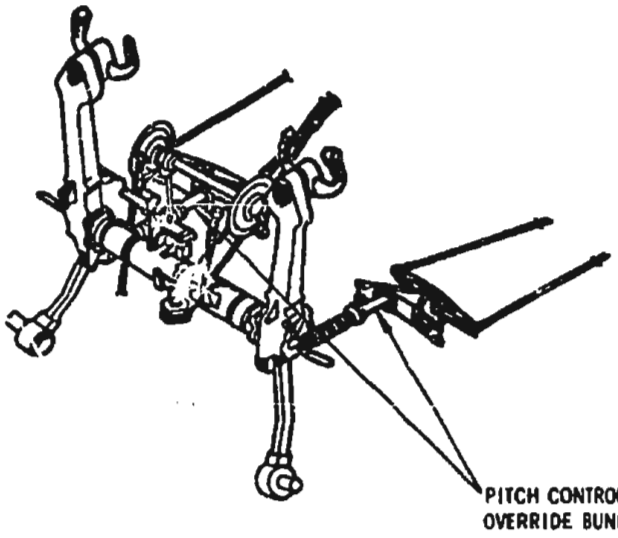
The override bungee is approximately 27 inches long. One end contains a machined fork; the other end an adjustable rod end bearing to allow for rigging the cartridge length.

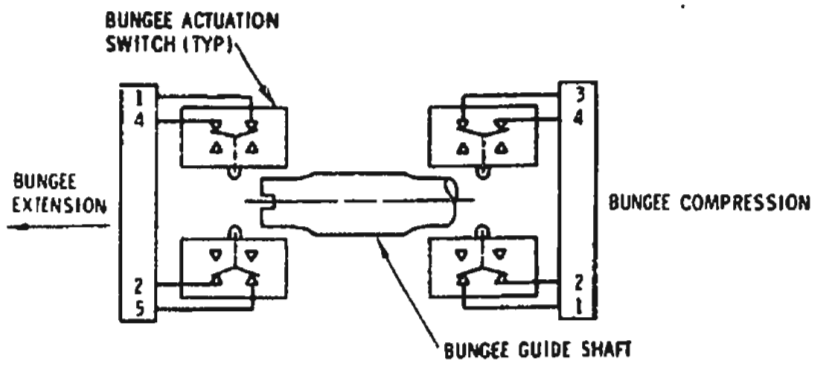
8. Stabilizer Control System Cables

A. Description

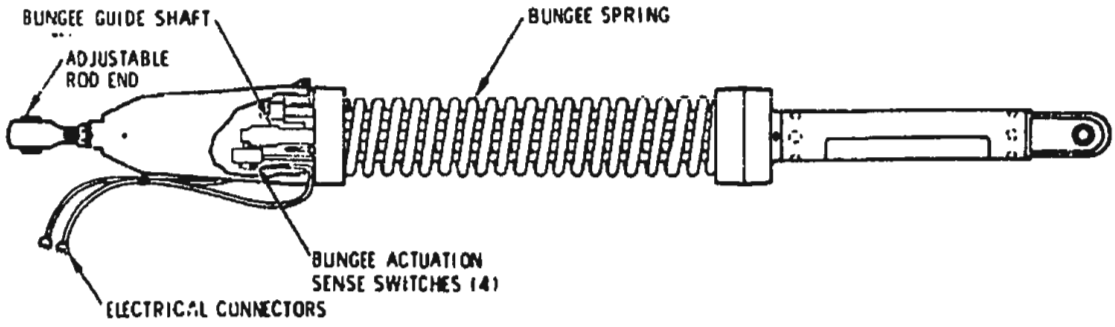


Control Column Disconnect Mechanism Cable System
Figure 8





SENSE SWITCHES SCHEMATIC



M1-A00-27-043

Pitch Control Override Bungee
Figure 9

The stabilizer control cables are used to transmit pitch inputs from the Captains and First Officers control columns to their respective tension regulators located below the floor just forward of the rear pressure bulkhead (Ref. Fig. 2). The control cables are one-eighth inch diameter 7 by 19 cables fabricated from tinned carbon steel wire. Cable friction is reduced by using idler bellcranks to change cable direction instead of pulleys. Idler bellcranks are located in the forward electronic service center area and tension regulator area. The pitch control cables are all straight runs that travel through openings in the cabin floor beams. The cables are supported every 80 inches by fairlead rollers.

Control cable performance is much improved by the use of Lockclad cables. Lockclad cable consists of normal flexible cable that is put in tension when an aluminum tube is swaged around the cable along its entire length. The result is that normal control system operating loads are lower than the prestretched loads so that no elastic stretching of the cables takes place during control operation. The Lockclad process also produces a cable system with a coefficient of expansion similar to that of the airframe structure, and the effect of ambient temperature changes on the flight controls is considerably reduced.

Cable terminal fittings are swaged over the Lockclad and cable to produce a completely enclosed cable. The cable assemblies are made in approximately 22 foot lengths and are coupled together by a shear pin arrangement (Ref. Fig. 10).

Corrosion protection of the cables, where the cables are exposed to lavatory or galley spillage, is accomplished by utilizing clear plastic shrink tubing over the Lockclad cable.

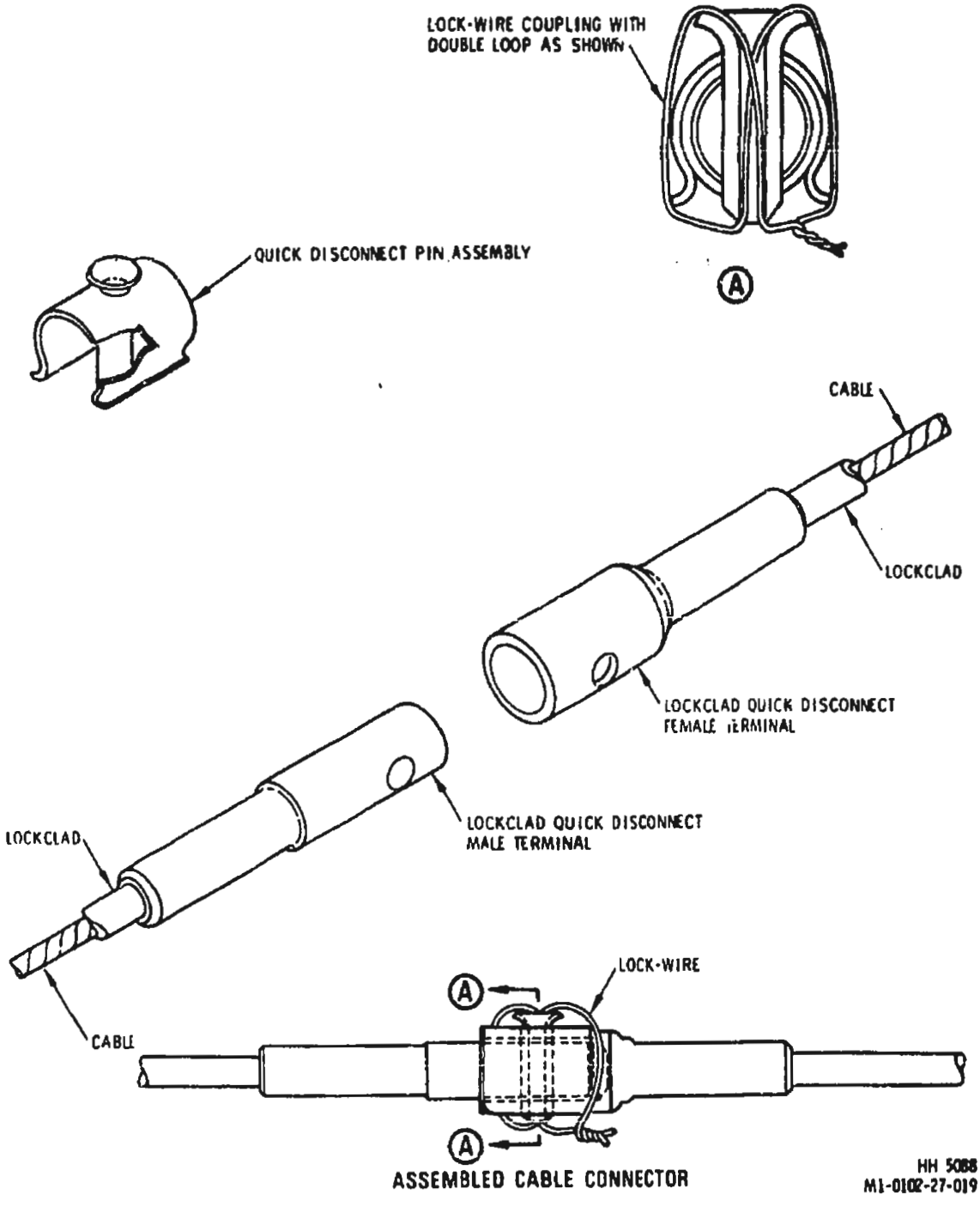
The Lockclad cable assembly is a fairly rigid assembly. However, it can be bent for removal and installation, without producing a permanent bend in the cable, as long as the radius of the bend is not less than 48 inches.

For information on fabricating replacement cable assemblies for the flight control system, refer to Chapter 91.

9. Cable Tension Regulator

A. Description and Operation

The cable tension regulator is used in the stabilizer cable control system to mechanically compensate for the effect of relative length change resulting from temperature variation,



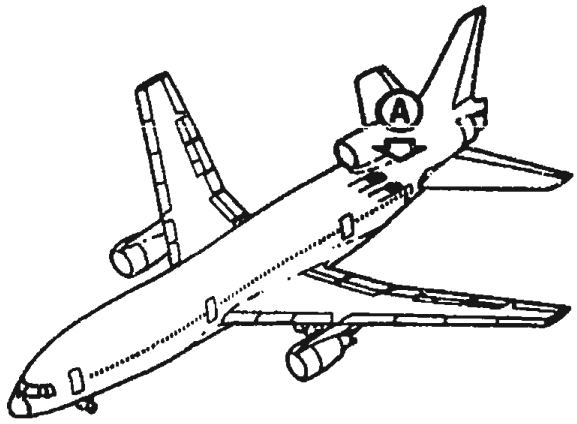
Lockclad Quick Disconnect Coupling
Figure 10

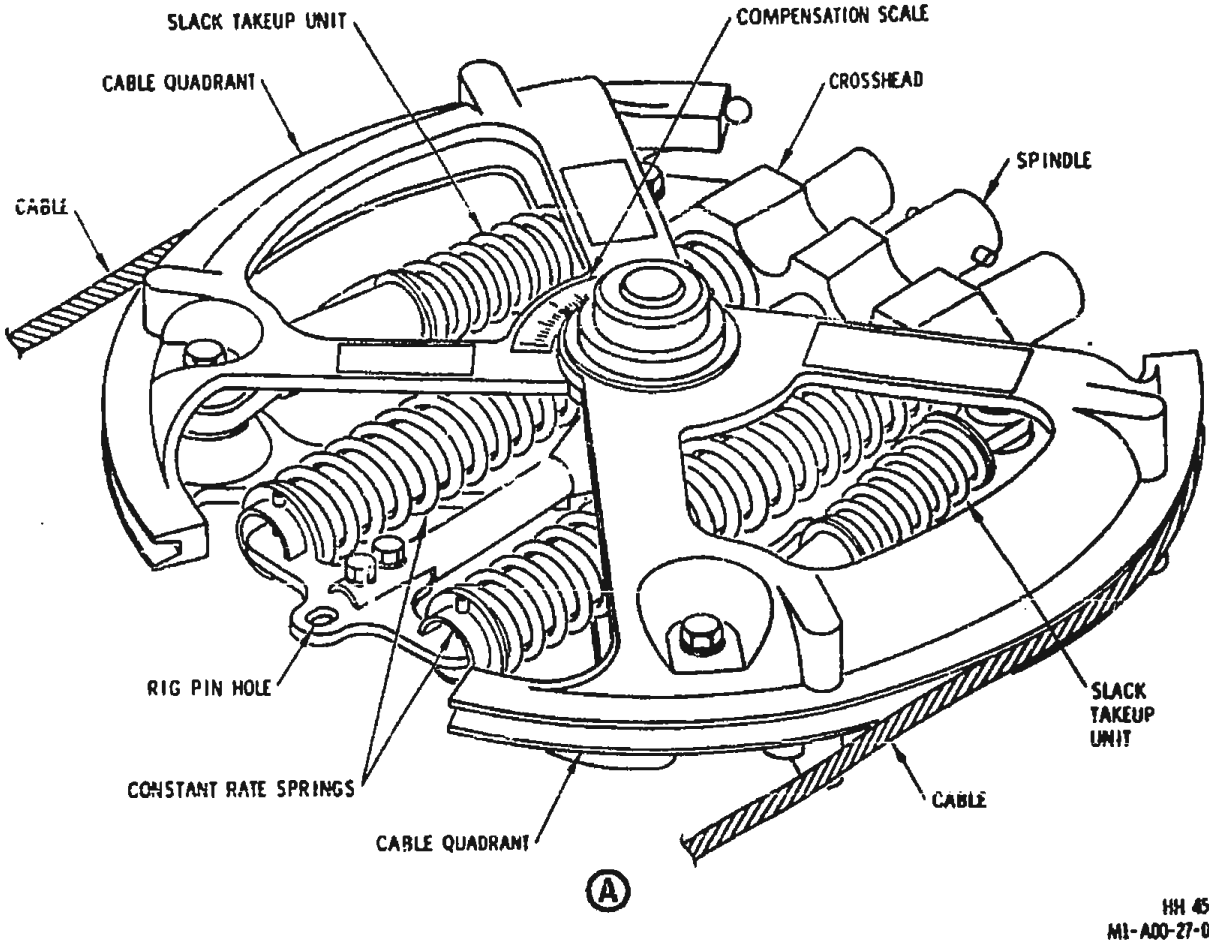
pressurization, and structural deflection. The regulator maintains the cable tension within preselected limits throughout all operating limits. This results in lower and more nearly constant control system friction with subsequent increase in cable fatigue life and decrease in cable wear. The two cable tension regulators are mounted in the ceiling structure of the bulk cargo compartment, just forward of the rear pressure bulkhead (Ref. Fig. 2). The output of the cable tension regulators is applied by a pushrod and bellcrank system to the stabilizer servos mounted in the afterbody. The bellcrank shaft extends through the pressure bulkhead, and a rotary pressure seal around the bellcrank shaft controls cabin pressure leakage.

The tension regulator is composed of two cable quadrants that are bearing mounted to an output torque shaft (Ref. Fig. 11). Splined to the torque shaft is a spindle assembly which provides a bearing surface for a sliding crosshead assembly. The crosshead assembly can slide on the spindle bearing surface. Each end of the crosshead assembly is link connected to one of the cable quadrants. Two constant rate compression springs extend from a spindle pivot link to the crosshead exerting an upward force on the crosshead. This spring force maintains 100 to 120 pounds of tension on both cables as long as no control force is applied and the crosshead is free to slide on the spindle shaft.

Slack takeup units are also incorporated in the tension regulator to prevent excessive slack in the unloaded cable run when high loads are applied to the opposite cable run. The slack takeup units are incorporated in the links between the crosshead and the cable quadrants. Each of the two slack takeup units consist of two telescoping slides, slotted to limit their extended length, and a compression spring. The units are capable of taking up one inch of slack on each cable and of maintaining a minimum of 12 to 25 pounds in the unloaded cable run.

Operation of the tension regulator is controlled by unbalancing the cable loads. Any movement of the controls from the flight station will unbalance the cable loads and cause the crosshead to tilt and lock on the spindle. This action effectively locks the cable quadrants to the spindle so that cable movement results in rotation of the output torque shaft. When the unbalanced cable loads are removed the crosshead will unlock itself from the spindle and allow the constant rate compression springs to maintain the 100 to 120 pounds of tension.





Cable Tension Regulator
Figure 11

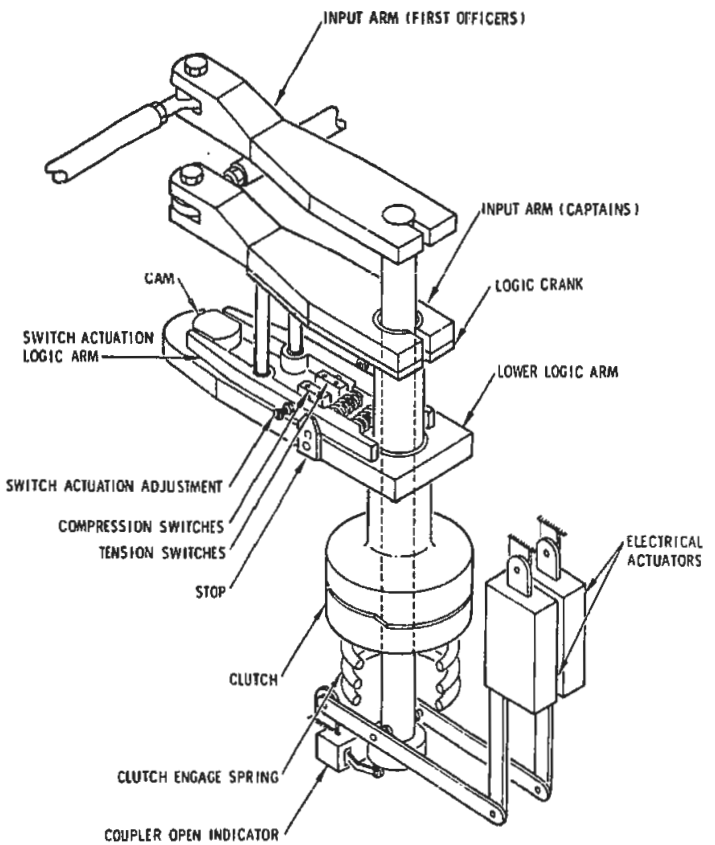
10. Aft Pitch Coupler

A. Description and Operation

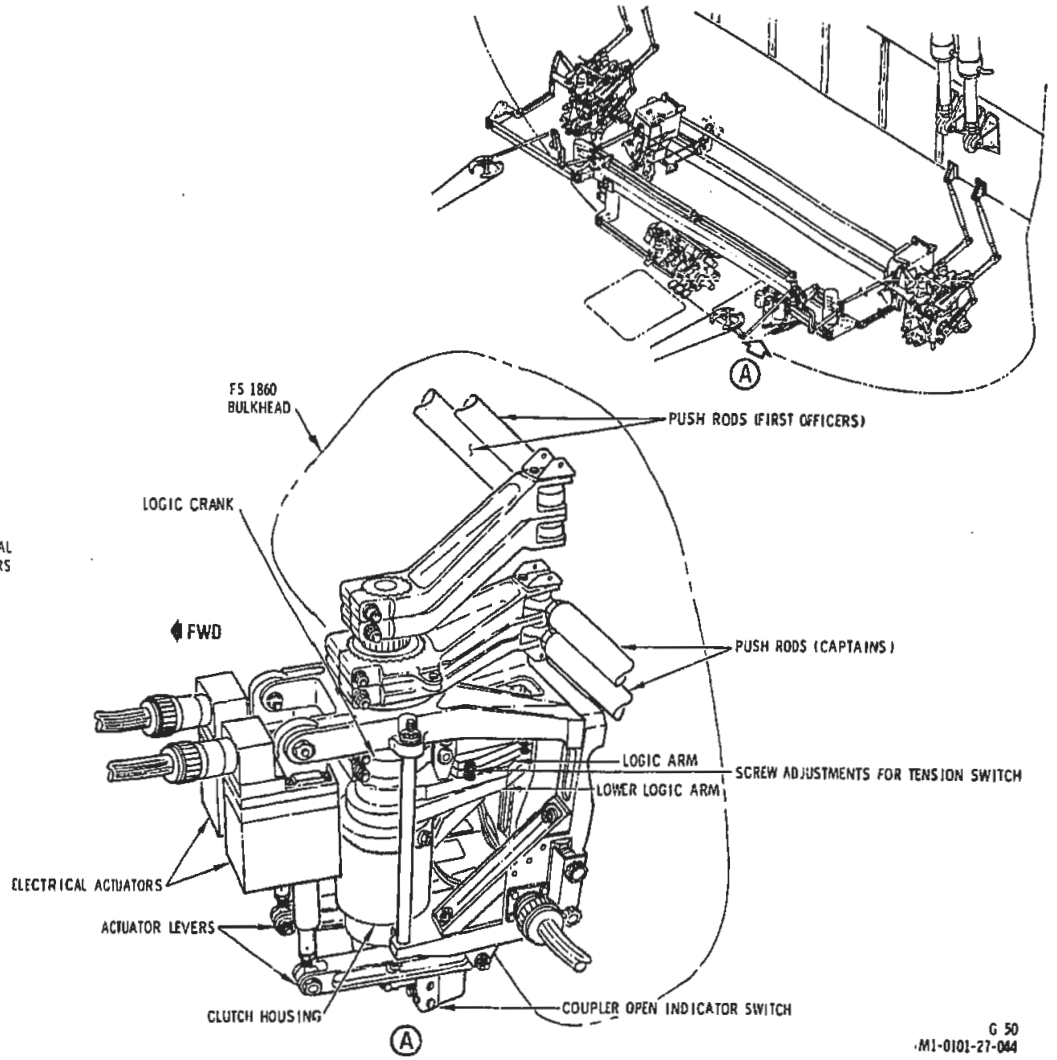
The aft pitch coupler is installed in series with the pushrod linkage that connects the Captains and First Officers stabilizer servo control paths in the afterbody (Ref. Fig. 12). The coupler is a clutch operated mechanism which provides decoupling of the two stabilizer servo control paths in the event of a control path jam to allow continuous pilots control of the stabilizer. Decoupling/recoupling of the coupler is achieved electrically by the PFCS control panel in the flight station.

The aft pitch coupler is schematically shown in Figure 12. The Captains and First Officers input arms are connected by dual pushrods to the respective stabilizer sevo control systems. The First Officers input arms are coupled to a shaft on which the lower clutch half and the collar assembly (at bottom end) are attached. The Captains input arms are attached to the logic crank by a splined shaft. The logic crank in turn is coupled to the switch actuation logic arms which are riding on the lower logic arm. The lower logic arm is attached to the upper clutch half. The electrical actuator levers and the coupler open indicator switch actuators are riding on the collar assembly of the First Officers input shaft.

In the jam-free stabilizer control path operation, the coupler clutch halves are held engaged by the dual-coil clutch engage spring. Consequently, the lower logic arm, which is coupled to the First Officers input arm through the clutch, and the logic crank, which is coupled to the Captains input arm, are rotating as one. When a jam occurs in one of the stabilizer control paths, jamming the associated coupler input arm, a differential movement is developed between the two input arms. The differential movement is translated as an opposite rotation of the lower logic arm and the logic crank. This action causes the switch actuation logic arms (coupled to logic crank) to pivot against the cam and actuate one of the two switches, tension switch or compression switch depending on direction of one input arm motion with respect to the other. The actuated switch signals the FCES computer (Ref. 22-17-00). The FCES computer logic uses the signal in conjunction with the forward bungee sensor signals to provide stabilizer servo shutdown command indications on the appropriate STABILIZER switchlights of the PFCS control panel (Ref. Fig. 4). The affected stabilizer servo is then shut down by releasing these switchlights.



COUPLER SCHEMATIC



Aft Pitch Coupler
Figure 12

Releasing the STABILIZER switchlights also sends an uncoupled command signal to the coupler electrical actuators. The electrical actuator jackscrews extend, causing actuator levers to give the First Officers input shaft collar a downward push. This action disengages the coupler clutch, which results in freeing the jam-free input arm from the jammed input arm. The downward movement of the First Officers input shaft collar actuates the coupler-open indicator switch. The actuated switch sends a coupler-open signal to the FCES computer logic which turns on the AFT CPLR OPEN indicator on the PFCS monitor/control panel. Stroke of each coupler actuator jackscrew is limited by a limit switch in the actuator. After the rod is extended to a limit, the limit switch is actuated to open the uncouple command signal circuit to stop the actuator motor.

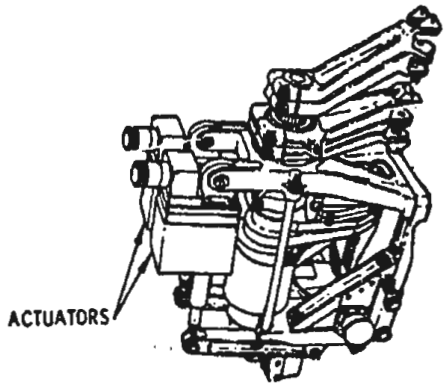
After a jam condition is corrected, recoupling of the coupler is accomplished by depressing all STABILIZER switchlights into the normal operating status. This provides coupling command signals to the coupler actuators. The signals cause the actuator jackscrews to retract, permitting upward movement of the First Officers input shaft and engaging the coupler clutch. Upon engagement of the coupler, the coupler-open indicator switch deactivates and causes the FCES computer to turn off the AFT CPLR OPEN indicator. When jackscrew retraction is completed, a second limit switch in the actuator is actuated to open the coupling command signal circuit to stop the actuator motor.

11. Aft Pitch Coupler Actuator

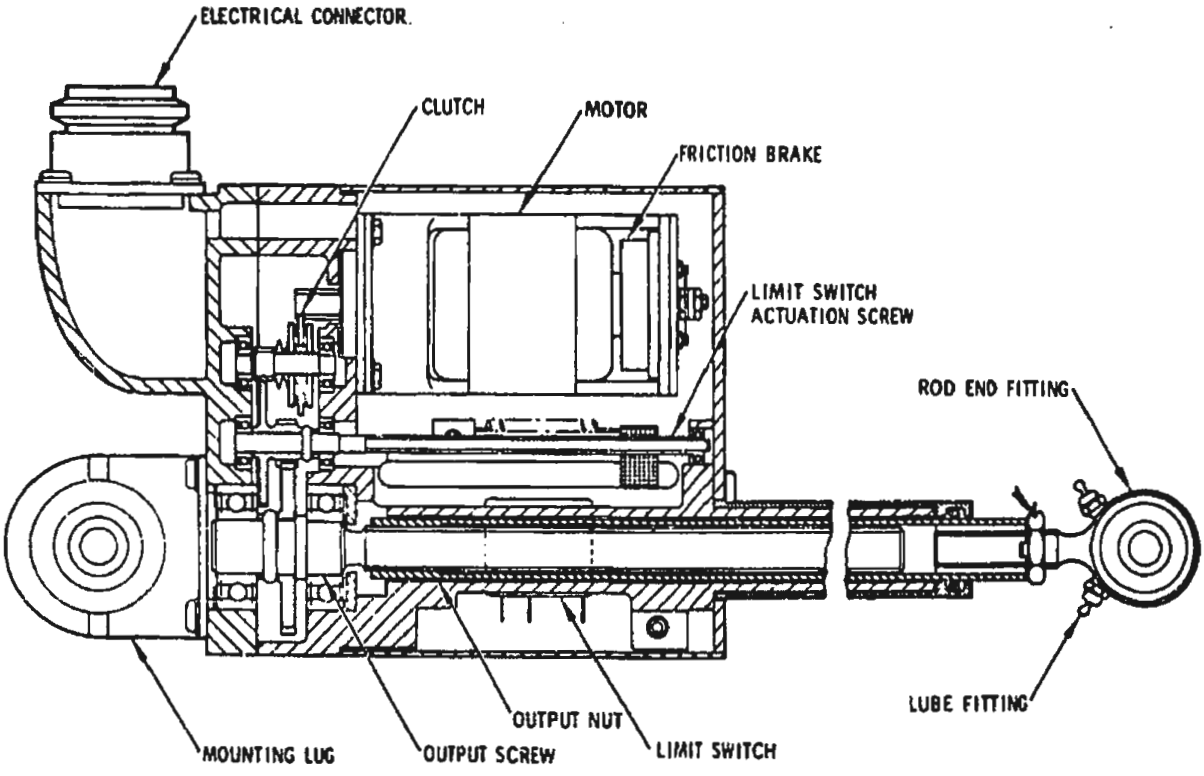
A. Description and Operation

Two identical electrical jackscrew actuators are used in parallel to actuate the aft pitch coupler and separate the Captains and First Officers stabilizer servo control linkage (Ref. Fig. 13). Either actuator will accomplish the uncouple/recouple action. However, if both actuators are extended to the uncouple condition, then both actuators must retract to recouple the control linkage.

The actuator is powered by a 28V dc split field series motor with a magnetic disc brake. The brake is mechanically applied when the motor is deenergized. The motor drives the actuating screw through a spur gear reduction gear train with a ratio of 76 to 1. A simple friction clutch is included in the gear train to prevent damage to the gear train if a limit switch fails and the actuator drives against the mechanical stops.



AFT DISCONNECT COUPLER



M1-0101-27-077

Aft Pitch Coupler Actuator
Figure 13

The output shaft of the last gear contains an acme thread to form the actuating screw. The output nut travels along this screw. The nut contains an extension sleeve that extends through a seal in the gearcase and is threaded to accept a rod end. The rod end contains a spherical bearing that includes a grease fitting for lubrication. The rod end can be adjusted to vary the actuator length. The actuator mounting lug also includes a spherical bearing with a grease fitting.

Two double-pole double-throw microswitches are fitted to the actuator. The microswitches are actuated by a nut that runs along a threaded shaft driven by one of the gear train gears. The switches are used to limit the actuator rod extension and retraction strokes. When the rod is driven for extension or retraction, the associated limit switch is actuated as the rod stroke reaches a predetermined limit. The actuated limit switch opens the motor energizing circuit to stop the motor from driving the rod any further.

12. Stabilizer Actuator

A. Description and Operation

Four hydraulic actuators are used to position the stabilizer. Each actuator (Ref. Fig. 14) is controlled from a separate control valve; and each control valve is supplied by a different hydraulic supply system. Each actuator cylinder assembly is attached to a separate forged machined fitting bolted to the fuselage station 1860 bulkhead. Each actuator piston rod is connected to a separate forged machined fitting bolted to the face of the stabilizer forward spar beam. The actuator includes a load pressure modulator, mounted to the center of the actuator. The modulator damps out cylinder pressure fluctuations that may occur during operation.

The actuator is an equal area piston type. The equal area piston is provided by using a piston rod extension shaft that strokes within the cylinder extension housing. Gland inserts are used in the piston rod end of the cylinder and in the center of the cylinder. The glands contain the static seals, dynamic seals, and scraper rings. Hydraulic leakage is controlled by using two sets of static and dynamic seals. The cavity between the seals is ported to system return; thus, the outer seals are subject to return pressures only.

The stabilizer system primary stops consist of bottoming the actuator piston in the cylinder. Consequently, snubbers are provided to dampen piston bottoming. Snubbing action

consists of trapping oil near the end of the piston stroke and using snubber rings to restrict oil exiting the cylinder.

The cylinder attaching lug and the piston rod end contain self-aligning bearings which are lubricated through a grease fitting in the bearing lugs. The piston rod end is threaded to provide for shop adjustment before installing in aircraft. The rod end is locked by a slot key and safetied locknut arrangement. The actuator weighs 102 pounds wet. Fully retracted the actuator is approximately 72 inches long; fully extended the actuator is approximately 100 inches long.

13. Pitch Electrical Feel/Trim Assembly

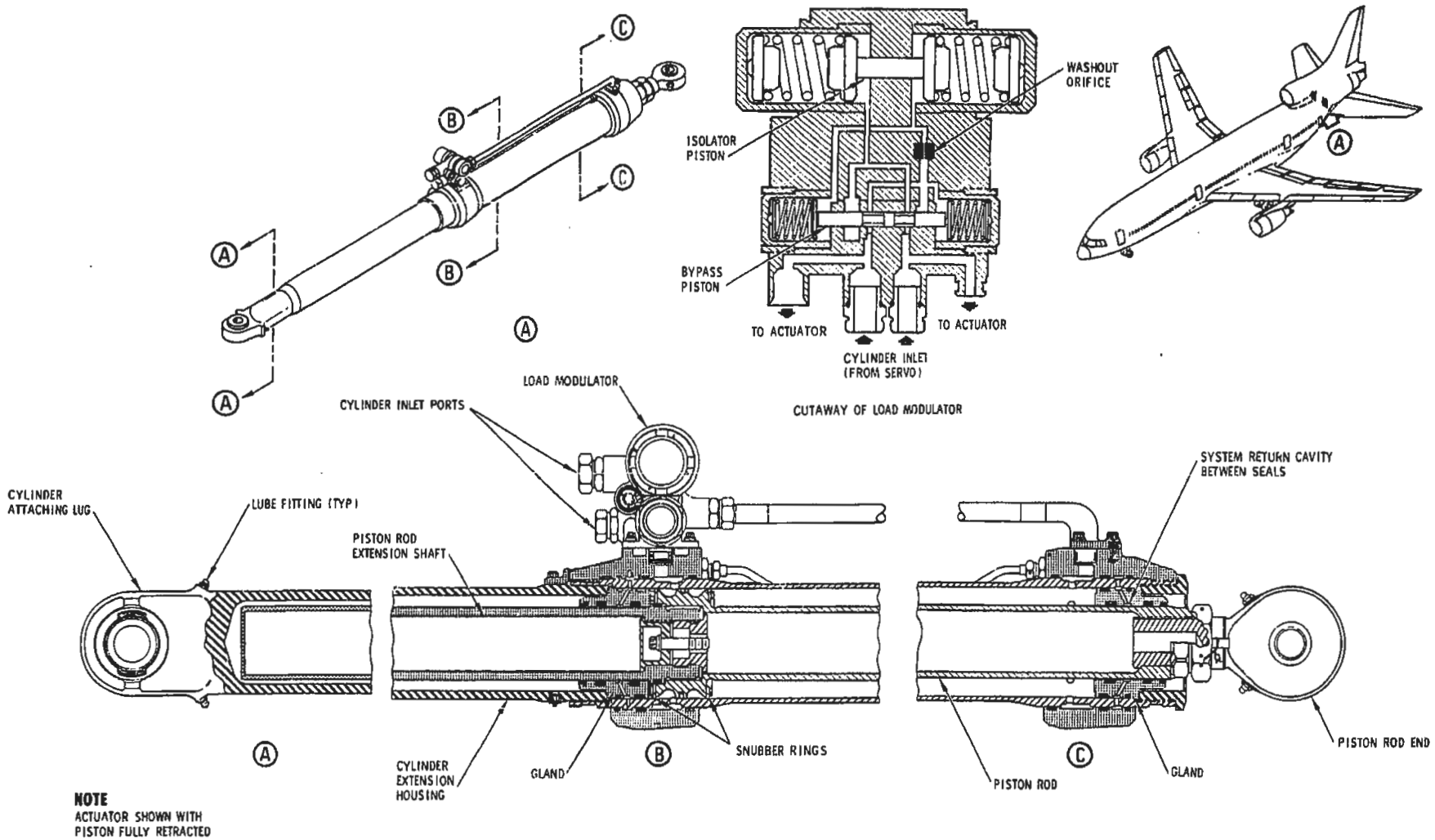
A. Description and Operation

The electrical feel/trim assembly receives and processes all the electrical trim inputs including electric trim (pilots thumbwheels), autopilot trim, Mach trim, and mach schedule. The outputs are mechanically summed and applied to the integral feel unit. The output of the feel unit is then applied to the Captains stabilizer servo control linkage, which results in stabilizer displacement. The electrical feel/trim assembly is located in the lower afterbody section, and is mounted just inboard of the left stabilizer servo module (Ref. Fig. 3).

Electric trim and autopilot trim inputs are applied through two AP/pilot trim motors (No. 1 and No. 2). Electric trim is controlled by rotation of the pitch trim thumbwheel on the control wheels. Thumbwheel inputs are processed by the trim augmentation computer (Ref. 22-18-00) and applied to both AP/pilot trim motors, which operate in parallel. The output of the two motors is mechanically summed through a differential gear mechanism and applied to the feel unit (Ref. Fig. 15). When the autopilot is engaged, the thumbwheel control circuits are disabled and the two AP/pilot trim motors receive autotrim signals from the trim augmentation computer.

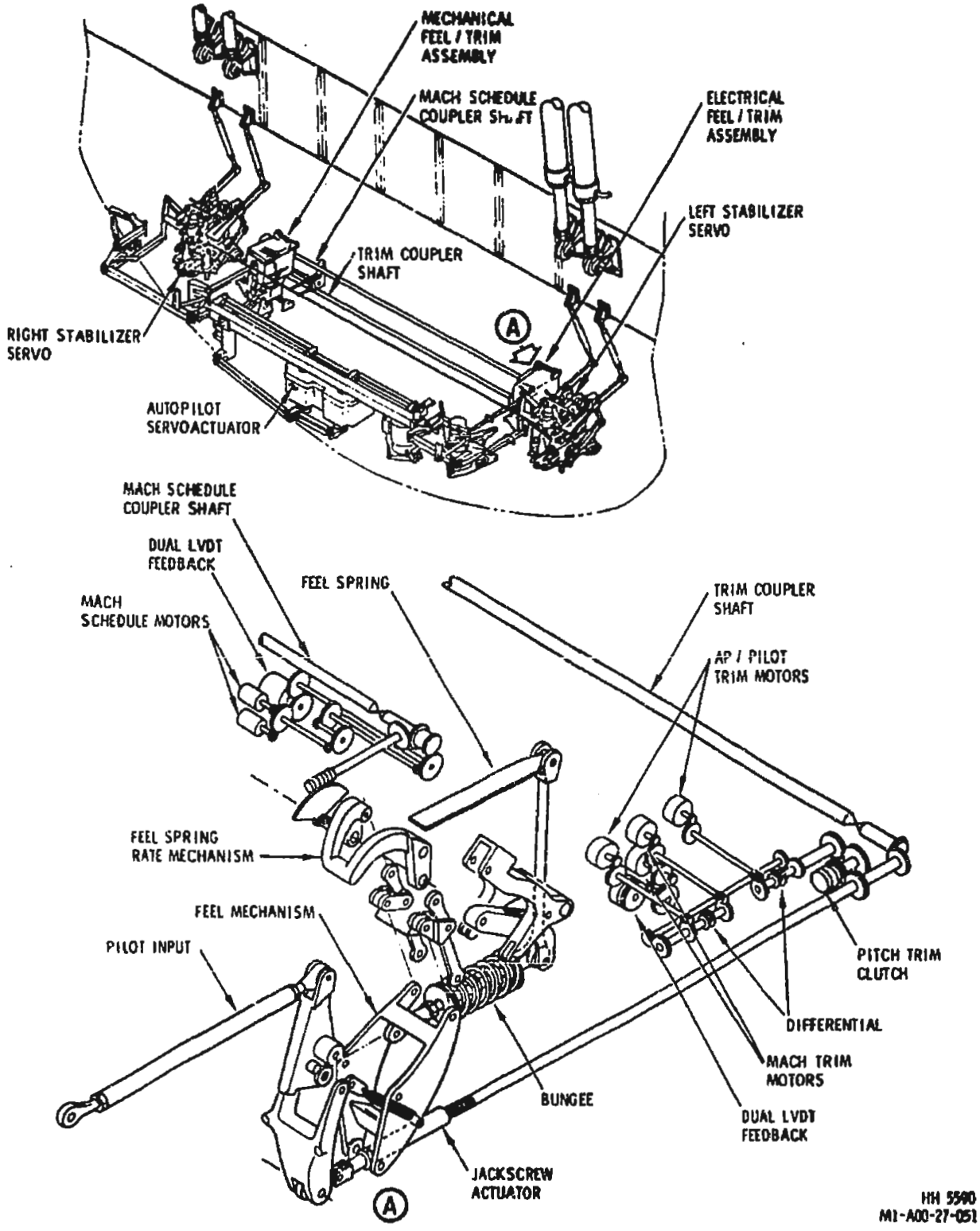
The AP/pilot trim motors are monitored for proper operation by the trim augmentation computer. If a trim motor is not properly responding to command inputs the appropriate PITCH TRIM switchlight on the FCES control panel will illuminate (Ref. Fig. 4). Depressing the illuminated switchlight will deactivate the affected trim motor.

Mach trim compensation is provided to improve longitudinal stability in the .55 to .925 Mach range. In effect, as the



G 472
M1-A00-27-045

Stabilizer Actuator
Figure 14



Electrical Feel/Trim Assembly Schematic
Figure 15

aircraft accelerates into and within the .55 to .925 Mach speed range the center of lift moves rearward causing a nose down pitching moment. The trim augmentation computer receives Mach number inputs from the central air data computers and supplies nose up trim inputs to the Mach trim motors. Mach trim inputs are applied through two motors designated Mach No. 1 and Mach No. 2. The two Mach trim motors operate in parallel with No. 1 motor active and No. 2 motor on standby. The Mach trim motors receive position commands from the trim augmentation computer. The outputs of the two Mach trim motors are mechanically summed with the output of No. 2 AP/pilot trim motor, through a second differential gear mechanism, and applied through the feel mechanism to trim the stabilizer (Ref. Fig. 15). A dual rotary position feedback transducer is connected by a gear train to the Mach trim output gear and completes the servo position loop.

The Mach trim motors are also monitored by the trim augmentation computer. If a Mach trim motor does not properly respond to position commands, then the appropriate MACH TRIM switchlight on the FCES control panel will illuminate (Ref. Fig. 4). Depressing the illuminated switchlight will deactivate the affected Mach trim motor.

Mach schedule inputs are provided to change the feel spring rate and produce optimum control column forces over the entire aircraft speed spectrum. Essentially, as the aircraft speed increases, the feel spring becomes stiffer.

Two Mach schedule motors, operating in parallel, are mounted to the electrical feel trim assembly. Either motor can supply full Mach trim compensation. These two motors receive identical command signals from the trim augmentation computer and position the feel mechanism to change the geometry of the feel spring linkages, and thus change the spring rate. A dual rotary position feedback transducer is coupled to the gear train and provides position information to the computer, thus completing the servo loop.

The output of the Mach schedule motors is also applied to the feel unit in the mechanical feel/trim assembly through a Mach schedule coupler shaft (Ref. Fig. 3). Consequently, both feel assemblies receive identical Mach schedule inputs to vary the feel spring rate.

Monitoring of the mach schedule system is accomplished on the flight control panel on the pilot overhead panel (Ref. Fig.4). Operation of the Mach schedule motors is controlled by the trim augmentation computer. If a Mach schedule motor fails to respond properly to a command input, the associated MACH FEEL switchlight on the panel will illuminate.

Depressing the illuminated switchlight will deactivate the motor. A GRADIENT indicator gage shows the relative position of the Mach schedule mechanism.

14. Pitch Mechanical Feel/Trim Assembly

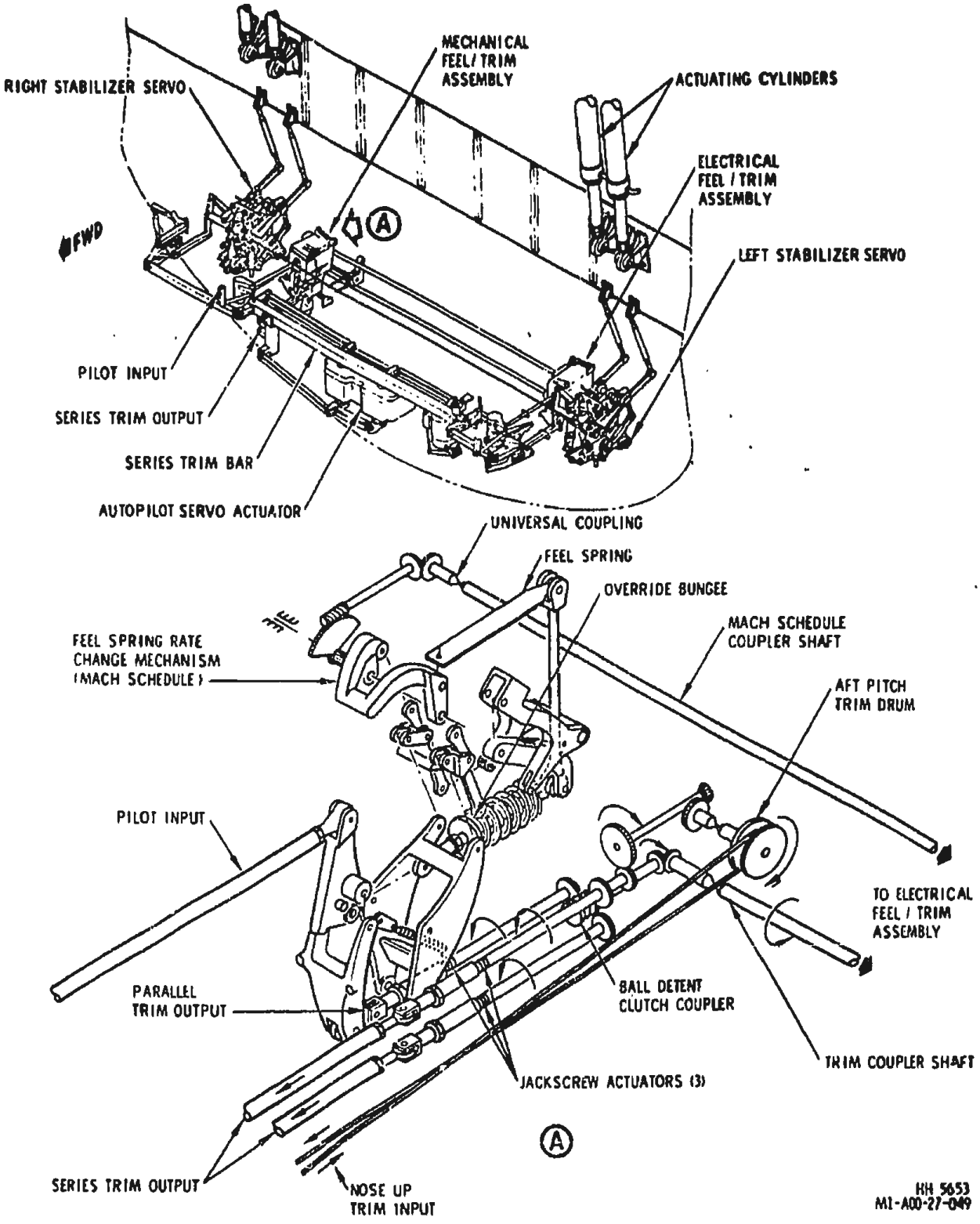
A. Description and Operation

The mechanical feel/trim assembly operates in conjunction with the electrical feel/trim assembly to trim the stabilizer. The mechanical feel/trim assembly receives manual trim inputs from the pitch trim wheels on the center console (Ref. Fig. 2). The electrical feel/trim assembly receives electrical trim, autopilot trim, mach trim, and Mach schedule inputs. The two feel/trim assemblies are coupled by a trim coupler shaft and a Mach schedule coupler shaft. Thus, the two feel/trim assemblies provide identical trim output forces into their respective stabilizer servo control linkage paths.

The mechanical feel/trim assembly combines three parallel acting mechanical jackscrew actuators and a feel spring mechanism. The assembly is located in the lower afterbody section, and is mounted just inboard of the right stabilizer servo (Ref. Fig. 3). The output of the mechanical feel/trim assembly consists of a series trim and parallel trim. These two trim outputs combine to trim the stabilizer and to reduce control column displacement due to trim.

Manual trim inputs from the trim actuator or electrical trim inputs through the trim coupler shaft operate an internal gear train to drive three identical jackscrew actuators in parallel (Ref. Fig. 16). One actuator drives into the feel mechanism which consists of a leaf feel spring, an override bungee and linkages. The output of the feel mechanism provides parallel trim which is coupled directly into the First Officers stabilizer servo control linkage. Parallel trim forces are produced by unbalancing the neutral force position of the feel spring, which results in an input being applied to the stabilizer servo. The override bungee allows the pilot to override any jam encountered in the feel components and maintain control of the stabilizer servo.

Pilot manual trim inputs are also transmitted through a trim coupler shaft to the electrical feel/trim assembly. The coupler shaft insures that mechanical trim inputs are applied equally to the electrical feel/trim assembly, which couples directly into the Captains stabilizer servo control linkage. Conversely, electrical trim inputs from the electrical feel/trim assembly are transmitted to the



Pitch Mechanical Feel/Trim Assembly Schematic
Figure 16

mechanical feel/trim assembly. This assures synchronization of the two trim assemblies.

Two of the three parallel acting jackscrew actuators in the feel/trim assembly are connected by separate pushrods to a common bellcrank that is coupled to the series trim bar (Ref. Fig. 3). This dual output provides series trim. Series trim works in conjunction with parallel trim to trim the stabilizer but also positions the control linkage to reduce the control column travel range due to trim. Full stabilizer trim of minus 10 degrees would cause the control
R column to travel approximately eight inches. Series trim reduces the control column travel to less then four inches.

15. Stabilizer Servo Module

A. Description

The two stabilizer servos are located in the afterbody section behind the pressure bulkhead (Ref. Fig. 3). The servo module is a full power, dual hydraulic, manual control valve assembly which includes its own input linkage and feedback mechanism (Ref. Fig. 17 and 18). Each servo functions to provide hydraulic pressure and flow to position two stabilizer actuator assemblies in response to mechanical input signals. Stabilizer surface position feedback signals are received through two independent feedback arms.

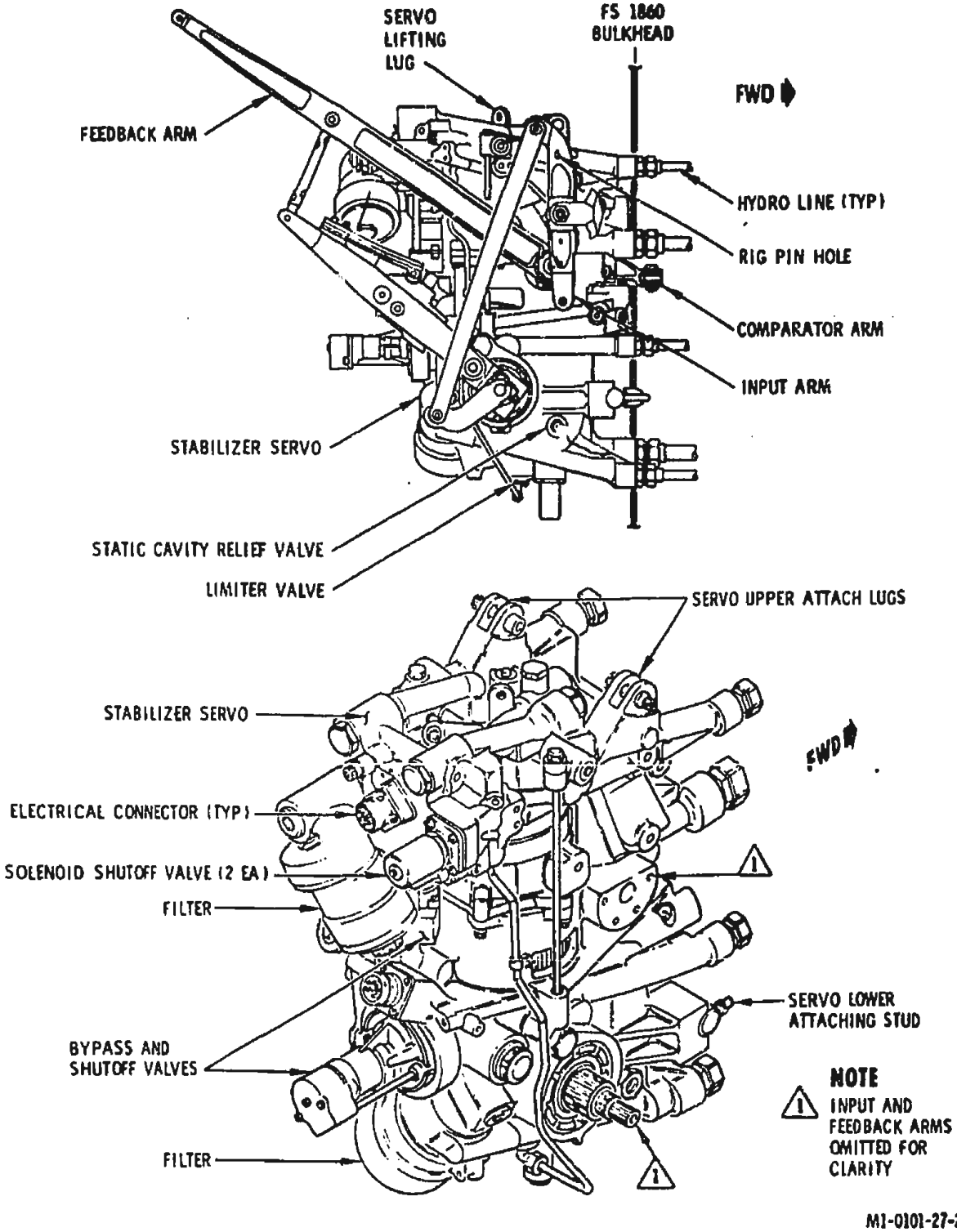
The servo module consists of two separate manifolds, each pressurized by one of the four hydraulic systems; a dual tandem control valve contained between the manifolds; certain modular components mounted on the manifold; and the input linkage and feedback mechanism. The assembly weighs approximately 125 lbs. wet.

A description of the subassemblies and components that comprise the stabilizer servo module is as follows:

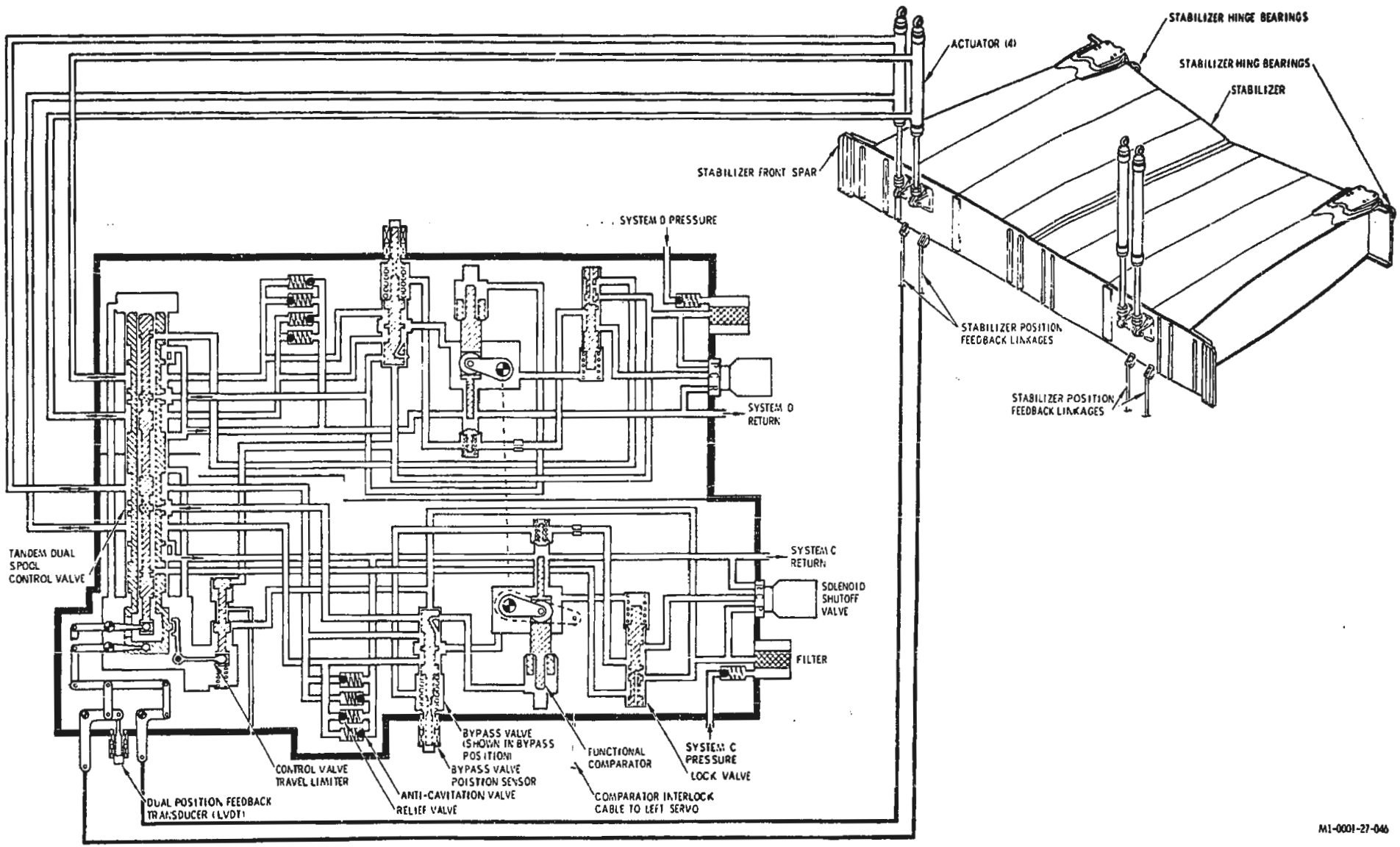
(1) Input/Feedback Linkage Mechanism

The input/feedback linkage mechanism functions to compare mechanical input signals from the pilots servo control linkage with surface position feedback signals and apply a position command to the power control valve proportional to the difference between the input and feedback signals.

The input linkage includes a non-linearizer linkeage, a dual load path input arm and crank assembly, and two internal summing levers. The primary summing lever positions the main spool of the servo valve while the



R Stabilizer Servo Module
R Figure 17



Stabilizer Servo Module Schematic
Figure 18

R
R

EFFECTIVITY: ALL

0013

secondary summing lever positions the monitor spool. Both internal summing levers incorporate design features that permit extensive compliance (flexibility) of the arms themselves to prevent servo module malfunctioning due to jamming of either servo spool (Ref. Fig. 18).

The primary summing lever incorporates a spring loaded ball detent design that permits the lever to disengage if the main spool should become jammed. The detent ball will reseat itself and the lever will assume its normal configuration if the input load is removed or the main spool is freed. A secondary purpose of the ball detent design is to permit check-out of the servo shutdown mechanism.

A pin at the servo spool end of the lever is engaged by the valve travel limiter during check-out to limit valve stroke. With spool stroke limited, the primary lever will disengage, allowing the input linkage to continue to move the monitor spool. This continued movement of the monitor spool with the main spool restrained will initiate hydraulic pressure shutdown in the manifold.

Compliance in the secondary internal summing lever is accomplished by the use of a flexible arm instead of ball detent design. The flexible arm design accomplishes the same general function as the primary detent link design in that it prevents jamming of the servo module if the monitor spool jams.

The non-linearizer linkage is mounted externally on the servo manifold and is attached to the external arm of the input linkage mechanism (Ref. Fig. 3). It functions to provide a varying degree of response to the servo module input signals as displacement from neutral increases. As the stabilizer actuator retracts (pitch down), the response decreases; as the stabilizer actuator extends (pitch up), the response increases. The non-linearizer linkage consists of two bellcranks and an interconnecting link. The geometric configuration of the bellcranks accomplishes the function of making the input to the servo module assembly non-linear.

Feedback is accomplished through two independent feedback arm and crank assemblies. The primary feedback positions the main spool of the servo while the secondary feedback positions the monitor spool. Each external arm of the feedback mechanism incorporates a spring loaded ball detent breakout

design that permits the arms to disengage and prevent high stabilizer feedback forces from being fed back into the servo module assembly if a component upstream of either arm should jam.

(2) Control Valve

The dual tandem control valve controls fluid flow from the two hydraulic systems in the servo module to a pair of the piston actuators attached to the stabilizer surface. The control valve consists of two concentric spools. The outer or main spool serves to meter fluid flow in response to mechanical input signals. The inner or monitor spool normally moves in unison with the main spool, but, by means of a secondary feedback system, it functions to detect a jammed main spool or open feedback path. Any such malfunction creates a difference in axial position between the main and monitor spools which causes system pressure to be ported to the bypass valve via the lock valve to initiate hydraulic system shutdown of the servo.

(3) Filter Element

There is one filter element per hydraulic system (two per servo module) which protects the module components from fluid contaminants. The element is of the recleanable, metal mesh type. The filter is rated as 25 microns absolute.

(4) Inlet Check Valve

There is one inlet check valve per hydraulic system (two per servo module) located immediately downstream of the inlet filter element. The check valve prevents reverse flow through the manifold assembly if system pressure is lost or shut down.

(5) Bypass and Shutoff Valve

There is one bypass and shutoff valve per hydraulic system (two per servo module). During normal operation it is open and provides an uninterrupted fluid flow path from system pressure inlet to the pressure port of the control valve. When actuated, the bypass and shutoff valve functions to shut off system pressure to the control valve and interconnects the cylinder ports to each other and return, thus shutting down the servo. The conditions which cause the valve to actuate are as follows:

(a) The solenoid shutoff valve is actuated by depressing the associated switchlight on the pilots PFCS control panel. This ports system pressure through the lock valve to actuate the bypass valve.

(b) The axial positions of the main and monitor spools of the control valve are sufficiently far apart for system pressure to be ported through the spools to the bypass valve via the lock valve.

(6) Lock Valve

There is one lock valve per hydraulic system (two per servo module). When actuated by pressure signals from the monitor spool displacement within the main spool, due to a main spool jam, the lock valve ports system pressure to actuate the bypass valve and shut off system hydraulic flow to the control valve. The lock valve then hydraulically locks itself in the actuated position, by porting system pressure to its actuation port, to keep the system depressurized. If aircraft hydraulic system pressure in the affected hydraulic system is reduced to 250 psi or below, the spring loaded lock valve will automatically recycle to the unlock position. This allows the bypass valve to reposition to the on position and supply fluid to the control valve.

The purpose of the lock valve is to prevent cycling of the bypass valve with subsequent hydraulic surges. Once the lock valve receives a hydraulic signal from the monitor spool, it locks the bypass valve in the shutoff position.

(7) Anti-Cavitation Check Valve

There are two anti-cavitation check valves per hydraulic system (four per servo module). They function to prevent cavitation (negative pressure) in the cylinder lines when an actuator is stroked after its hydraulic system has been shut down. If a cylinder cavitates, the check valve opens that cylinder line to system return, allowing return oil to flow into the cavitating cylinder. The valve opens when a 2 to 8 psi differential is produced across the valve.

(8) Pressure Relief Valve

There are two relief valves for each hydraulic system (four per servo module). The pressure relief valves relieve cylinder pressure into system return in case of

overpressure caused by simultaneous jamming of the control valve and failure of the bypass valve. The valve relieves at 3200 psi minimum.

(9) Valve Travel Limiter

There is one valve travel limiter per servo module. It consists of a travel limiting arm which is actuated by two pistons in tandem, each of which is pressurized by a separate hydraulic system. Either piston alone is capable of actuating the travel limiter, but normally both function in unison. When hydraulic pressure is applied to the travel limiter during normal system operation, it is stroked to disengage the limit arm from the internal summing link of the control valve spool. When the aircraft hydraulic system is depressurized, a spring causes the limit arm to engage the main spool internal summing link and limit the stroke of the main spool to normal full travel; no overtravel is permitted. The purpose of this feature is to ground-check the hydraulic system shutdown function of the monitor spool. This is accomplished by limiting the main spool to normal full travel and driving the monitor spool to the overtravel condition which mismatches the spools and results in servo shutdown.

The servo shutdown function is checked as follows:

The hydraulic power to the servo being checked is turned off and both the forward disconnect and aft couplers are opened. Hydraulic power is then supplied to the opposite servo and the surface is trimmed to 4 degrees. The control column on the same side as the servo to be checked is then pushed full forward.

With the above conditions, the axial position of the monitor spool will be displaced far enough from the axial position of the main spool to port system pressure to actuate the lock valve which ports system pressure to the bypass valve and prevents the servo module from becoming activated.

(10) Solenoid Shutoff Valve

Two solenoid operated shutoff valves are plate mounted to each servo module. There is one solenoid shutoff valve for each hydraulic system. The solenoid shutoff valve (and the lock valve) control the operation of the bypass and shutoff valve. Energizing the solenoid shutoff valve hydraulically positions the bypass and

shutoff valve, which shuts off hydraulic flow to the control valve and connects the actuating cylinder lines to each other and return. The solenoid shutoff valve is controlled by switchlights on the PFCS MONITOR panel located on the pilots overhead panel (Ref. Fig. 4). There is one switchlight for each of the four solenoid shutoff valves in the servo system.

(11) Functional Comparator

There is one functional comparator per hydraulic system (two per servo module). The comparator prevents shutdown of the second servo module whenever both hydraulic systems in the opposite servo module assembly are shut off either by energizing the solenoid shutoff valves or by a jammed control valve. The four comparators in the stabilizer servo system operate in unison to accomplish this function (Ref. Fig. 19).

When actuated, each comparator opens a check valve. This action opens a fluid flow passage from the bypass valve actuation line to return, consequently, fluid pressure cannot build up in the actuation line to the bypass valve and the bypass valve cannot actuate. System pressure cannot then be shutdown in the servo in which the comparators have actuated.

The two comparators in each servo module assembly are connected through a common shaft such that they actuate in unison. Each pair of comparators is tied to the pair in the opposite servo module through a crosstie interlock cable. During normal operation, each pair of comparators is hydraulically loaded against the other pair, which prevents either pair from opening their respective check valves. If both hydraulic systems in one servo module are shut down, hydraulic pressure in the active servo module comparator actuates its comparator check valves to prevent shutdown of the active servo.

(12) Crosstie Interlock

The crosstie interlock consists of a spring cartridge and a cable system (Ref. Fig. 19). One end of the cartridge is attached to aircraft structure, and the other end is attached to the common comparator shaft on the left servo. A cable connects the left comparator shaft with the right comparator shaft. When both hydraulic systems of a servo are shutoff, the interlock cable opens two check valves in the second servo to prevent shutdown of the second servo.

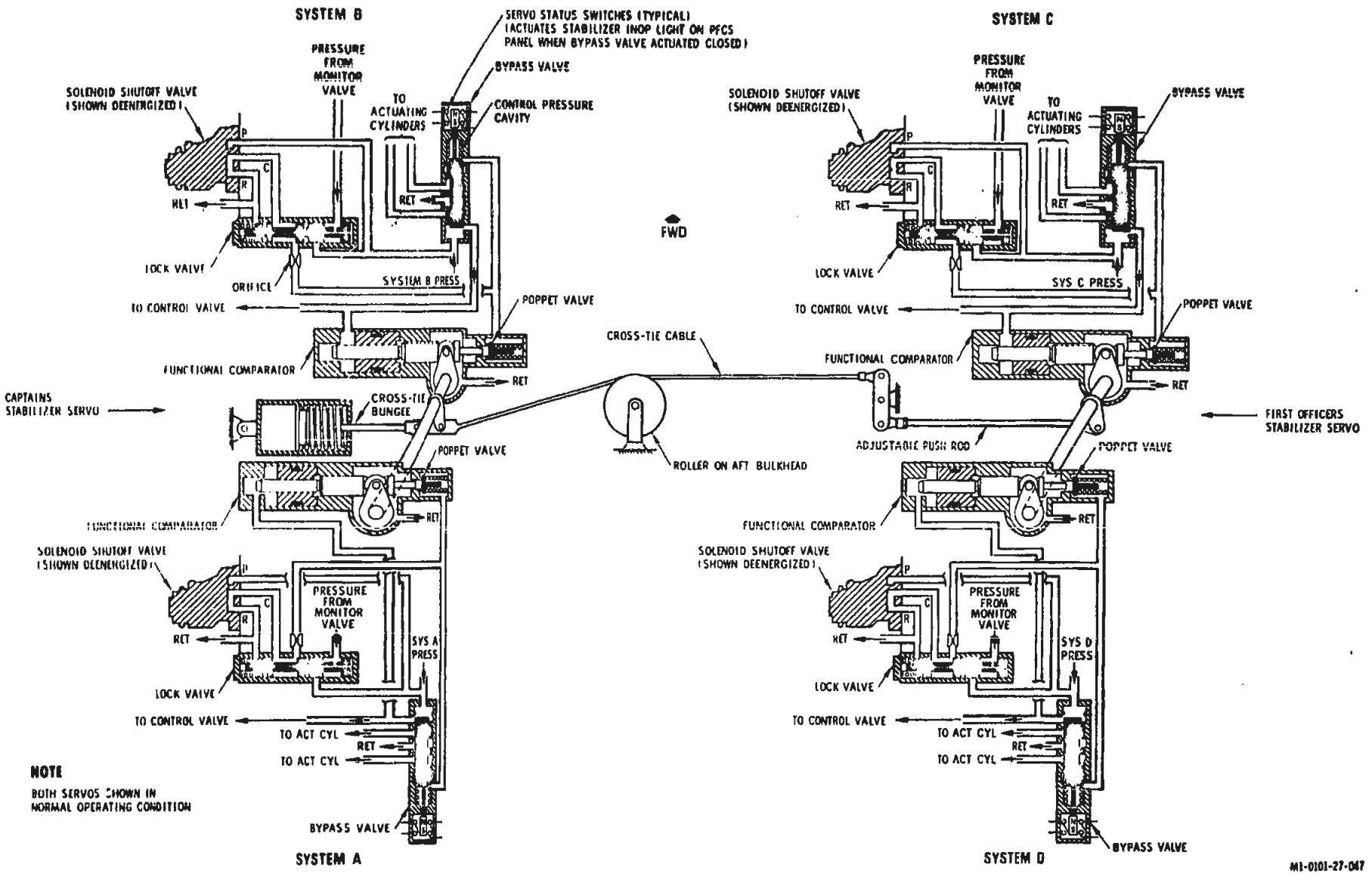
The left stabilizer servo is supplied by systems A and B. System B is the only system that can receive emergency hydraulic pressure (ram air turbine). The spring cartridge provides positive actuation of the left power servo assembly comparators to prevent B-system shutdown in the unlikely event that all four hydraulic systems should fail. The emergency hydraulic system will supply pressure to the B-system during such an emergency, but there is a possibility that the left power servo assembly could be shut down during the decay transient of system B-pressure. The positive displacement of the left functional comparators by the spring cartridge insures that the left servo will not shut down.

B. Operation

Normally, both stabilizer servo modules are active with four hydraulic systems supplying flow to the two modules. The left module is supplied by system A and B; the right module is supplied by system C and D. Both modules are functionally identical and receive the same mechanical inputs.

Movement of either control column in an aft direction (pitch up) provides a mechanical input to both modules. The dual tandem control valve spools are displaced from neutral, opening the actuator extend ports to system pressure and the actuator retract ports to system return. Hydraulic flow to the actuators is proportional to control valve displacement. The four actuators respond to the load induced differential hydraulic pressures and cause the pistons to extend, positioning the stabilizer in a leading edge down direction against the aerodynamic load. Stabilizer movement is mechanically fed back to each servo modules through dual feedback links and compared with the input command signal through the internal summing linkage. The feedback links return the dual tandem spools to their neutral position when the stabilizer reaches the command position. This action equalizes the hydraulic pressure on both sides of the actuator pistons stopping further motion. The stabilizer is now hydraulically locked in the command position.

To maintain the stabilizer in the leading edge down position, the pilot must maintain a pull force on the control column. This force is necessary to overcome the feel spring in each feel/trim assembly. If the pilot releases the control column, the feel springs will move the control column to the trim position and displace the dual tandem spools to open the actuator retract ports to pressure and the actuator extend ports to return. The actuators will respond and move the stabilizer towards the trim position.



Functional Comparator Schematic
Figure 19

When the stabilizer reaches the trim position the dual tandem spool valves will be positioned to neutral by the feedback links. Hydraulic pressure on both sides of the actuators would again be balanced and the stabilizer would be hydraulically locked in the trim position.

A pitch down input (stabilizer leading edge up) is similar except all motions and hydraulic flows are reversed.

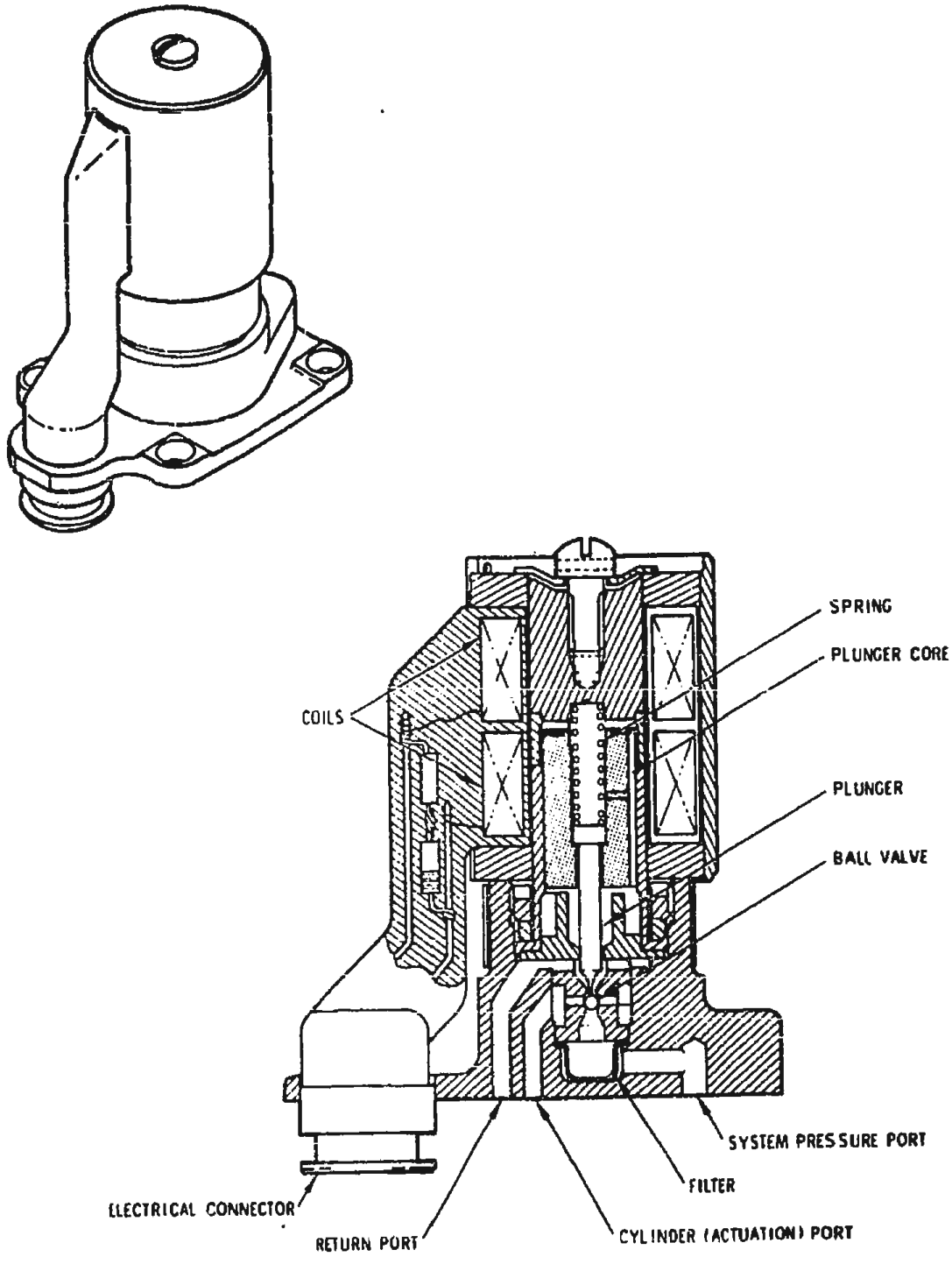
16. Solenoid Shutoff Valve

A. Description and Operation

The solenoid shutoff valve is a plate mounted, electrically controlled, two-position, three-way hydraulic valve (Ref. Fig. 20) which contains a pressure supply port, a cylinder port, and a system return port. The valve functions to open the cylinder port to either pressure or to return. The valve is mounted to the stabilizer and autopilot servos with four screws, and is sealed by a gasket plate face seal. The valve consists of a double coil assembly, filter, sleeve assembly, and a ball check valve assembly. The filter, installed in the pressure supply manifold of the valve insures the supply of contaminant free oil. Eight shutoff valves are used on the stabilizer and autopilot servos. Two shutoff valves are used on each stabilizer servo. These shutoff valves act as pilot valves to control their associated bypass valve which control the hydraulic supply to the servo control valves. Two shutoff valves are used on each channel of the dual autopilot servo and are used to control hydraulic flow to the autopilot channels.

With the solenoid deenergized, a spring loaded plunger holds the ball on the pressure inlet seat, against system pressure. This opens the cylinder port to system return so that no hydraulic pressure can build up in the shutoff valve cylinder port.

When the solenoid is energized by 28V dc, the double coil magnetic force on the plunger core and the system pressure on the ball overcome the plunger spring force to raise the plunger. System pressure then holds the ball against the return seat and opens the pressure port to the shutoff valve cylinder port. Loss of solenoid electrical power will allow the spring loaded plunger to force the ball on the pressure inlet seat, thus shutting off hydraulic flow to the shutoff valve cylinder port.



HH 6468
MJ-A00-27-062

Solenoid Shutoff Valve
Figure 20

R

EFFECTIVITY: ALL

001B

17. Horizontal Stabilizer

A. Description

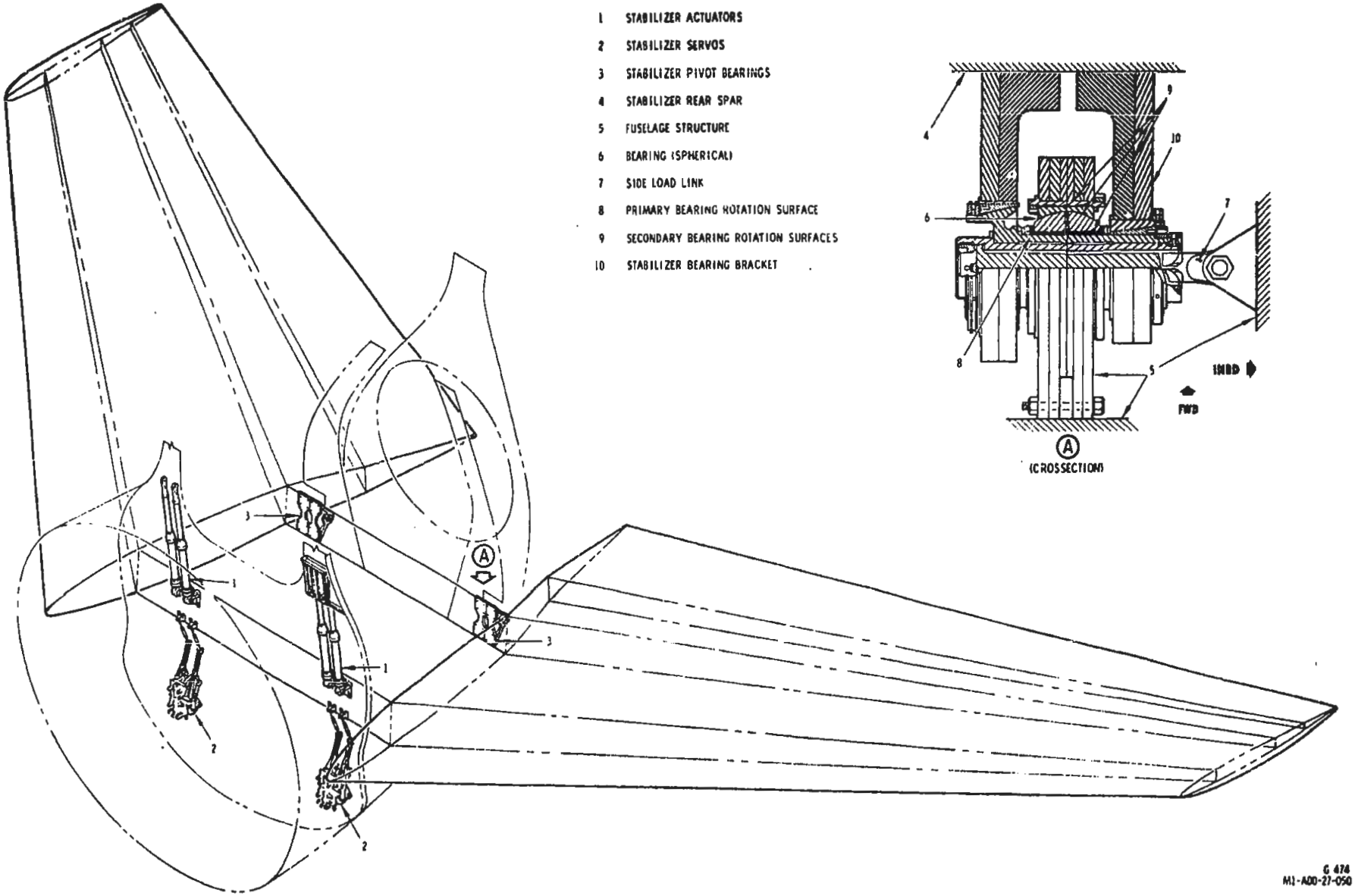
The L-1011 utilizes a flying stabilizer to control the pitch attitude of the aircraft. The entire stabilizer assembly is pivoted on two six-inch spherical bearings incorporating fail-safe design. The bearing hinge fittings are mounted on the rear spar of the stabilizer center section box. Four hydraulic actuators position the stabilizer through four fittings attached to the forward spar of the center section box. The hydraulic actuators are positioned above the stabilizer and are pivoted from four fittings attached to the fuselage station 1860 bulkhead (Ref. Fig. 21).

Stabilizer leading edge travel is one degree up and 14 degrees down from neutral. The travel is controlled by bottoming the pistons in the actuating cylinders. The cylinders contain hydraulic snubbers to reduce bottoming loads.

The horizontal stabilizer assembly consists of left and right outboard sections, permanently attached to a center box section by close tolerance fasteners. An elevator is hinge pivoted from each stabilizer outboard section. The elevator positioning mechanism is mounted to the stabilizer structure. The elevator positioning mechanism and the elevator surface are described in 27-31-00. Openings in the afterbody side structure, to allow movement of the stabilizer, are sealed by two air gate structure assemblies that are attached to the stabilizer structure.

Stabilizer primary structure consists of machined integrally stiffened skins, front and rear spar, and built-up ribs. The leading edge consists of formed ribs and formed chemically milled skins. The trailing edge consists of bonded skin panels, built-up truss ribs, and nine machined elevator hinge ribs. The hinge ribs contain machined forked attachments with bushings pressed into the pivot bolt holes to mate with the elevator hinge fittings. The two most inboard ribs provide the truss supports for mounting the elevator positioning mechanism.

1 STABILIZER ACTUATORS
2 STABILIZER SERVOS
3 STABILIZER PIVOT BEARINGS
4 STABILIZER REAR SPAR
5 FUSELAGE STRUCTURE
6 BEARING (SPHERICAL)
7 SIDE LOAD LINK
8 PRIMARY BEARING ROTATION SURFACE
9 SECONDARY BEARING ROTATION SURFACES
10 STABILIZER BEARING BRACKET



Horizontal Stabilizer Installation
Figure 21

R EFFECTIVITY: ALL
R
001B

HORIZONTAL STABILIZER CONTROL SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

R 2. Supplemental Data - Excessive On The Ground Airframe R Oscillations or Thumping

R A. Impingement of Exhaust Turbulence on the Stabilizer:

R Fuselage oscillations will result from static engine run up R above approximately 70% N1 of either or both wing engines R and may be aggravated by crosswinds. Crosswinds may also R cause audible inlet disturbances (Ref. 71-00-00, Engine R Handling).

R B. Pressure Phasing Out of Tolerance:

R If pressure phasing is out of tolerance, an oscillation will R be felt when reversing control column movement. R Oscillations will be amplified by air in hydraulic systems.

R C. Moving Stabilizer Abruptly on the Ground:

R Rapid movement and or reversal of the control column results R in sudden rotational acceleration and or deceleration of the R horizontal stabilizer which may initiate a vertical R oscillation of the fuselage. Stroke the column smoothly at R a low rate, four seconds or more for approximately full R stroke (avoid hitting stops). Reverse directions slowly and

smoothly. The aircraft is satisfactory if no significant oscillations are felt.

D. Miscellaneous Pitch Control System and Aircraft Faults:

CR (1) If significant oscillations are felt, when stroking the column per Paragraph C, release the column at approximate trim position and at the instant of column release, determine if there is relative motion between the forward end of the stabilizer airgate and the fuselage (stabilizer rotational motion). If there is no motion, the aircraft is satisfactory and no further action is required. If there is motion go to Paragraph E.

CR (2) Freeplay of 3/8 inch between the Pilots and First
CR Officers is common and should not be cause for concern.
CR Specific component fits and clearances are given in
CR Overhaul Manual 27-41-04. However, this looseness
CR together with high friction in the disconnect mechanism
CR will be felt in the columns as a bump when the input
CR load exceeds friction causing the mechanism to shift
CR taking up backlash.

E. Check and Correct the Following Items in the Order Listed, Rechecking Per Paragraph C Whenever Significant Corrections Have Been Made or All Items Have Been Checked:

(1) Air in hydraulic systems (Ref. MM 29-11-00).

NOTE: DEFECTIVE HYDRAULIC GROUND POWER UNITS MAY INTRODUCE AIR TO THE AIRCRAFT.

(2) Stabilizer servos pressure phasing (Ref. MM 27-41-00, Adjustment and Test, Para. 5F).

(3) Pitch control servo input system hysterisis (free play or binding in mechanical linkages and bearings) (Ref. MM 27-41-00, Adjustment and Test, Para. 5G).

(4) Functioning of column pitch damper (replace or bench check per Sesco Overhaul Manual 27-11-31).

(5) Looseness in stabilizer actuator bearings and attach points (Ref. MM 27-41-28, Fig. 401).

(6) Pitch system rigging (Ref. MM 27-41-00, Adjustment and Test, Para. 5B,C,D,E).

(7) Excessive servo leakage (Ref. MM 29-11-00).

(8) Center of gravity within aft limit (Ref. Operations Engineering Dept.).

(9) Main and nose landing gear shock struts for proper servicing (Ref. MM 12-14-12 and 12-14-13).

(10) Tires for proper inflation (Ref. MM 12-14-01).

(11) Stabilizer pivot bearing looseness (Ref. MM 55-55-51).

3. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

Table 101

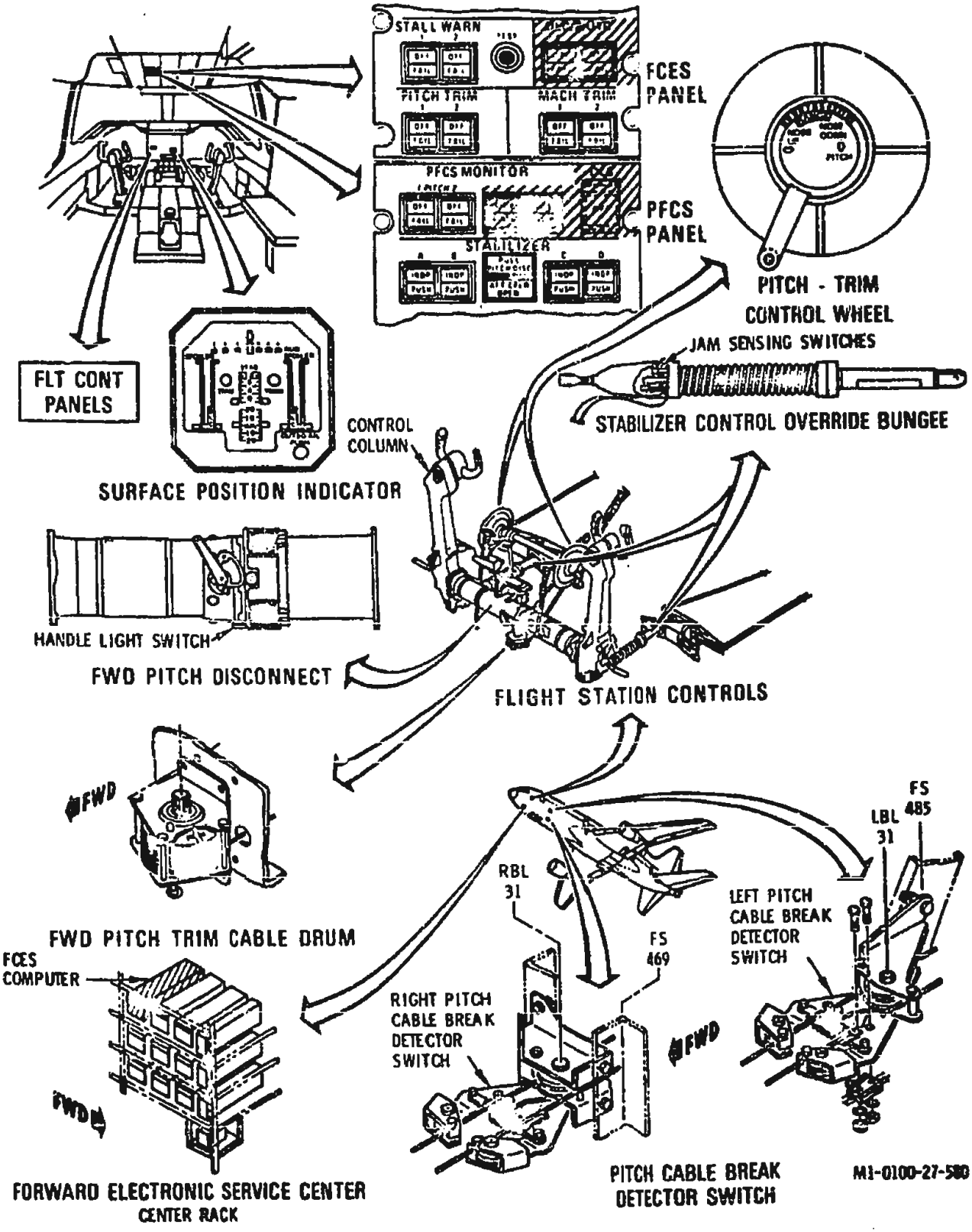
FIGURE	TITLE
101	Component Locator Index
102	Component Locator Diagrams
103	STABILIZER Switchlight (A, B, C, D) on PFCS Panel Indicates INOP
104	Pitch Monitor switchlight on PFCS Panel Indicates FAIL
105	Pitch Manual Trim Wheel Operation Stiff or Notchy
106	Stabilizer Does Not Respond to Manual Pitch Trim Inputs
107	STABILIZER Switchlight on PFCS Panel Indicates PUSH
108	Control Column Operation Stiff or Notchy
109	STABILIZER Switchlight INOP Light (A, B, C, D) On PFCS Panel Is Out With Associated Hydraulic System Off
110	PULL PITCH DISC or AFT CPLR OPEN Legend Fault
SCHEM 1	Stabilizer Shutdown Control and Annunciation Electrical Schematic
SCHEM 2	Stabilizer PFCS Monitor Control Electrical Schematic
SCHEM 3	Stabilizer Aft Coupler Control Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
AUTOPILOT SERVO - STAB	1	AFTERBODY/316DB	22-11-08
BUMPER - STAB CONT OVERRIDE	2	FESC/112AB, 211CB	27-41-06
BYPRES AND SHUTOFF VALVE - STAB SERVO	2	AFTERBODY/317AB, 317CB	27-41-39
CABLE BREAK DETECTOR - PITCH	2	FWD CARGO CEILING/125NR, 125NL	27-41-41
CABLE DRUM - FWD - PITCH TRIM	1	FESC/112AB, 211CB	27-42-05
COUPLE - AFT PITCH	1	AFTERBODY/316BB	27-41-17
DISCONNECT - FWD - PITCH	1	FESC/112AB, 211CB	27-41-0[illegible]
FCES COMPUTER	1	FESC/112AB, 211CB	27-17-01
FEEL/TRIM ASSY - PITCH - MECH	1	AFTERBODY/317CB	27-41-17
FEEL/TRIM ASSY - PITCH - ELEC	1	AFTERBODY/317AB	27-41-16
INDICATOR - SURFACE POSITION	1	PILOTS MAIN PANEL	27-00-00
SERVO MODULE - STAB	2	AFTERBODY/317AB, 317CB	27-41-20
SWITCHLIGHT - CONTROL	1	PILOTS OVHD PANEL	27-00-00
TENSION REGULATOR - PITCH CABLES	2	AFT CARGO, BEHIND REAR BULKHEAD	27-41-09
TRIM CONTROL - PITCH	2	PILOTS CENT CONSOLE	27-42-01

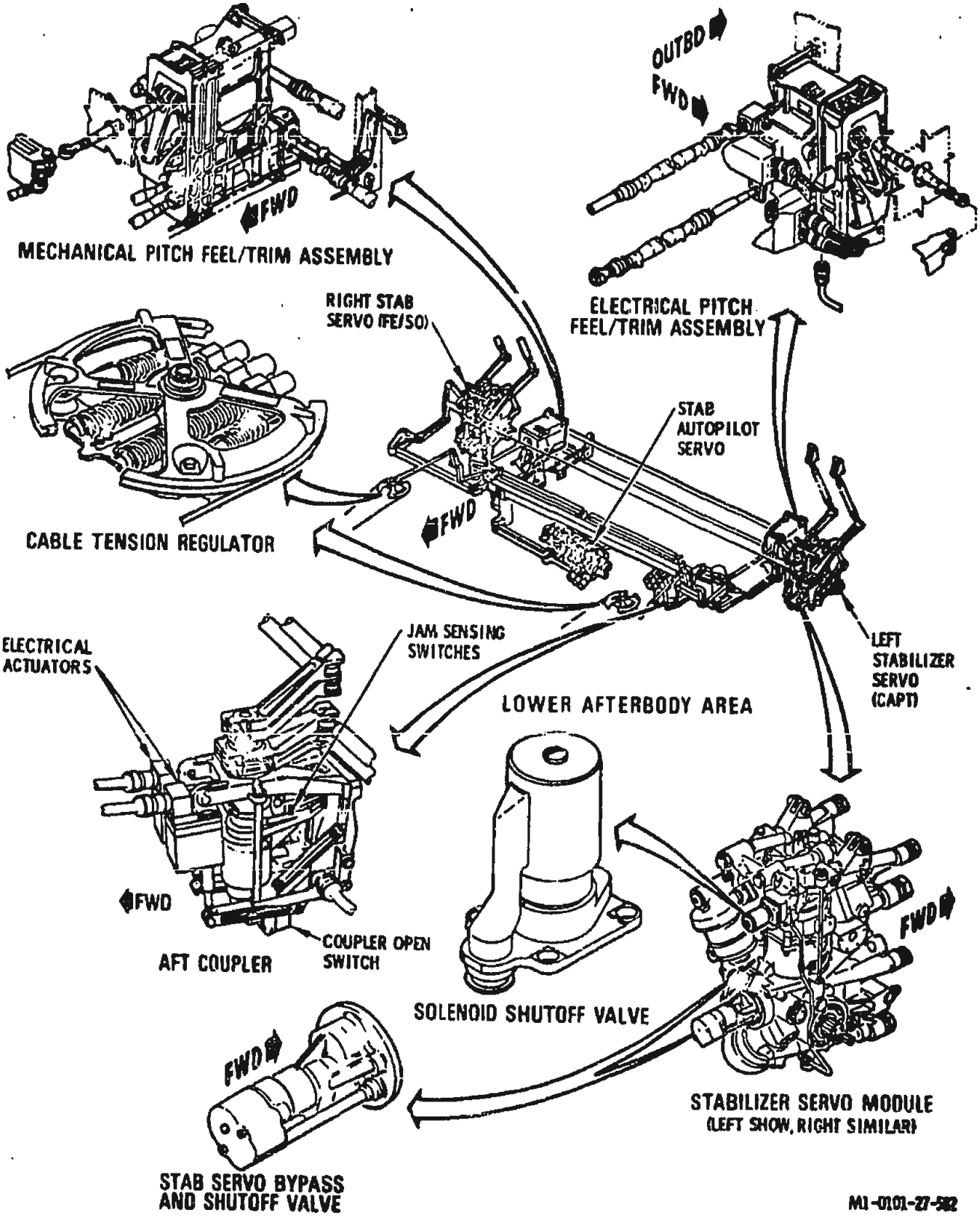
M1 0000 27 026

Component Locator Index
Figure 101

R EFFECTIVITY: ALL
R
001B



Component Locator Diagram
Figure 102 (Sheet 1)



Component Locator Diagram
Figure 102 (Sheet 2)

STABILIZER SWITCHLIGHT (A, B, C, D) ON PFCS PANEL INDICATES INOP (SWITCHLIGHT LATCHED AND HYDRO ON) ⚠1

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00)
CIRCUIT BREAKERS: 185
2H16, 2H17,
2H18, 2H19, 2F1
3G8

1 WARNING
VERIFY THAT ALL FLIGHT CONTROL AREAS ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE.
CHECK IF STAB SERVO IS FAILED IN SHUTDOWN POSITION AS FOLLOWS:
1 TURN ON ONLY HYDRO SYSTEM(S) SUPPLYING INOP CHANNEL(S).
2 POSITION CONTROL COLUMN.
DOES STABILIZER RESPOND TO CONTROL COLUMN?

NO → **3** IS ONE OR A PAIR (A-B OR C-D) OF LEGENDS ON?

PAIR → **6** REPLACE STAB SERVO (MM27-41-20)

ONE → **4** REPLACE ASSOCIATED SOLENOID SHUTOFF VALVE (MM 27-41-22).
DOES STABILIZER RESPOND TO CONTROL COLUMN?

NO → **7** REPLACE AFFECTED SERVO BYPASS AND SHUTOFF VALVE (MM 27-41-39).
IF FAULT PERSISTS, REPLACE STAB SERVO (MM27-41-20).

YES → **8** REJECT SOLENOID SHUTOFF VALVE.

YES → **2** IF SERVO IS OPERATIVE, SHORTED SERVO BYPASS VALVE SWITCH IS INDICATED. CHECK AS FOLLOWS:

CAUTION
WHEN CHECKING BYPASS VALVE SWITCH CONTINUITY, DO NOT USE TEST EQUIPMENT THAT DRAWS MORE THAN 20 MILLIAMPS OR SWITCHES WILL BE DAMAGED.

1 WITH HYDRAULIC PRESSURE ON, DISCONNECT SERVO ELECTRICAL CONNECTOR.
2 CHECK FOR NO CONTINUITY BETWEEN PINS AS FOLLOWS (SCHEM 1)

LEFT SERVO:		
SYS A:	P6	1-5
		10-12
SYS B:	P7	2-9
		11-13
RIGHT SERVO:		
SYS C:	P9	2-9
		11-13
SYS D:	P8	1-5
		10-12

DOES SWITCH SHOW CONTINUITY?

YES (FAULTY SWITCH) → **9** REPLACE AFFECTED SERVO BYPASS AND SHUTOFF VALVE (MM27-41-39).

NO → **5** REMOVE FCES COMPUTER.
DOES INOP LEGEND GO OFF?

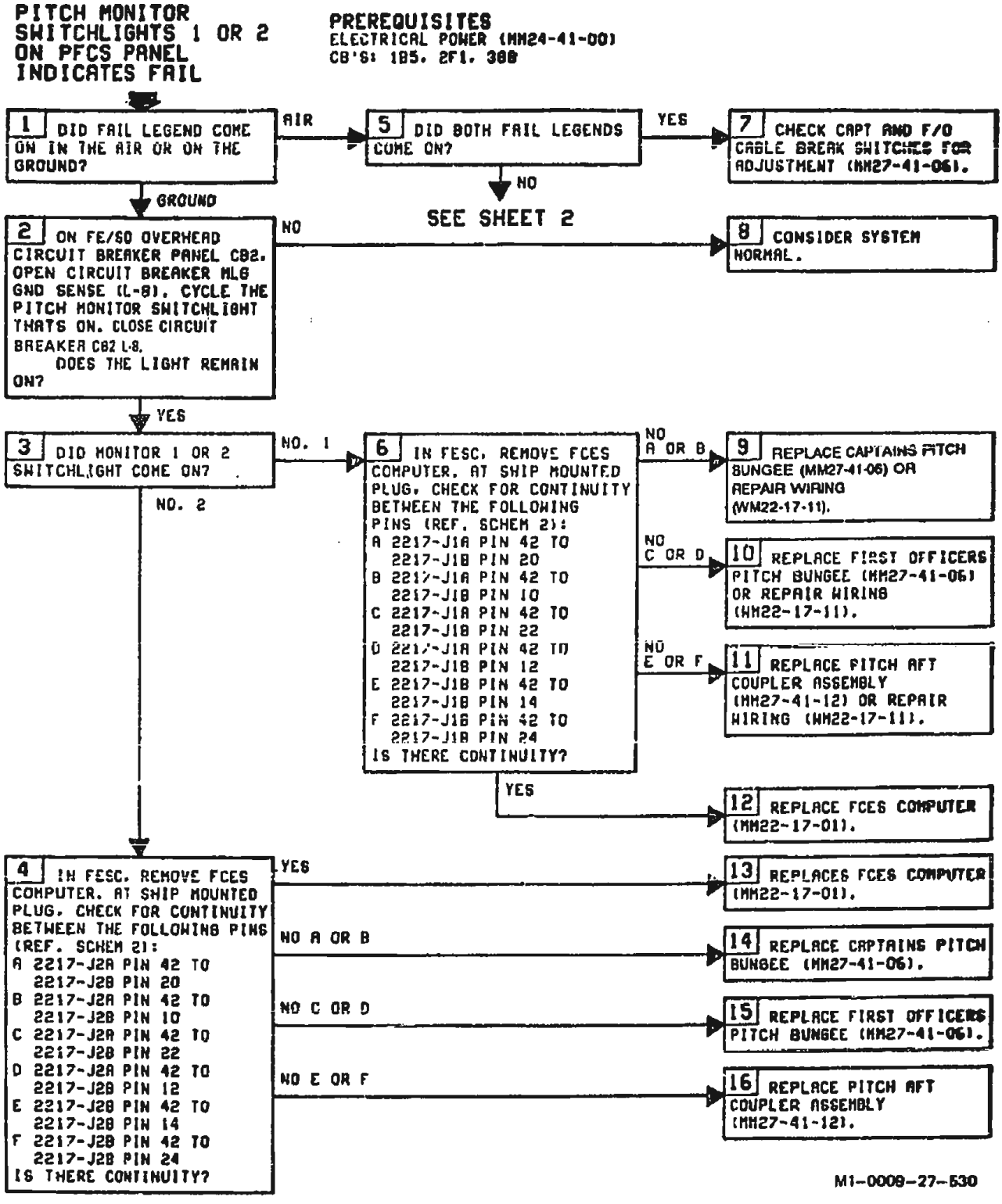
YES → **10** REPLACE FCES COMPUTER (MM22-17-01).

NO → **11** REINSTALL FCES COMPUTER.
CHECK FOR SHORT TO GROUND IN INOP LIGHT CIRCUIT IN PFCS PANEL OR IN WIRING BETWEEN PFCS PANEL AND FCES COMPUTER (SCHEM 1).

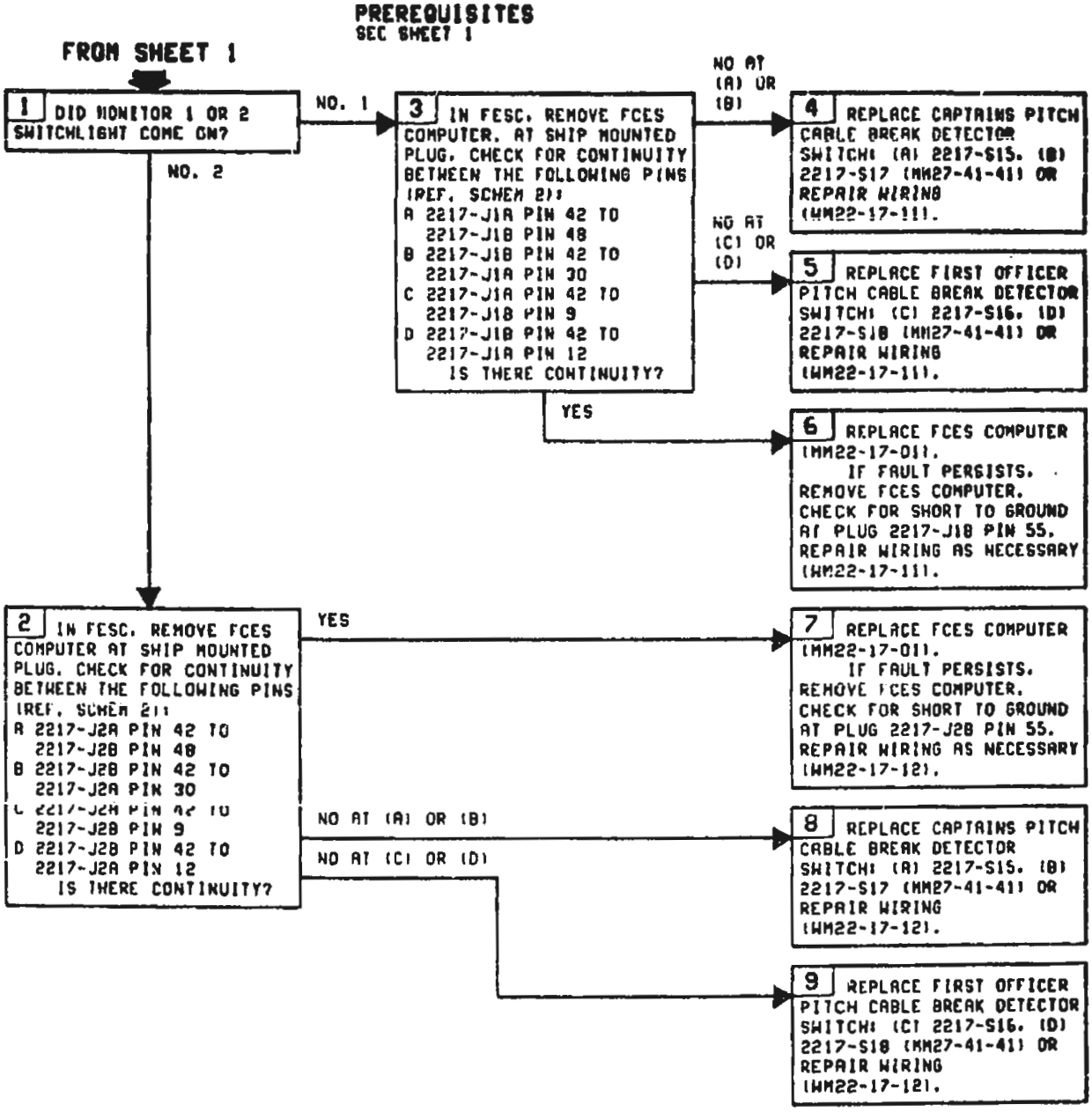
⚠1 **NOTE**
IF STABILIZER TRIM WHEEL IS NOT AT ZERO WHEN HYDRO TURNED ON, ANY ONE OF FOUR STABILIZER SERVO CHANNEL LOCK VALVES IN STABILIZER SERVOS MAY ACTUATE TO POSITION BYPASS VALVE AND SHUT OFF SERVO. TO CHECK, TURN OFF HYDRO SYSTEM ON CHANNEL WITH INOP LEGEND, ALLOW HYDRO PRESSURE TO DECAY TO ZERO, THEN WAIT ONE ADDITIONAL MINUTE. TURN ON SAME HYDRO SYSTEM; INOP LEGEND SHOULD GO OFF. IF NOT, CONSIDER INOP LEGEND A FAULT.

M1-0009-27-528

Stabilizer Switchlight (A, B, C, D) On
PFCS Panel Indicates INOP
Figure 103


PITCH MONITOR SWITCHLIGHTS 1 OR 2 ON PFCS PANEL INDICATES FAIL
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: 1B5, 2F1, 38B
1 DID FAIL LEGEND COME ON IN THE AIR OR ON THE GROUND?
AIR
5 DID BOTH FAIL LEGENDS COME ON?
YES
7 CHECK CAPT AND F/O CABLE BREAK SWITCHES FOR ADJUSTMENT (MM27-41-06).
NO
SEE SHEET 2
GROUND
2 ON FE/SO OVERHEAD CIRCUIT BREAKER PANEL CB2, OPEN CIRCUIT BREAKER MLG GND SENSE (L-8). CYCLE THE PITCH MONITOR SWITCHLIGHT THATS ON. CLOSE CIRCUIT BREAKER CB2 L-8.
DOES THE LIGHT REMAIN ON?
NO
8 CONSIDER SYSTEM NORMAL.
YES
3 DID MONITOR 1 OR 2 SWITCHLIGHT COME ON?
NO. 1
6 IN FESC, REMOVE FCES COMPUTER, AT SHIP MOUNTED PLUG, CHECK FOR CONTINUITY BETWEEN THE FOLLOWING PINS (REF. SCHEM 2):
A 2217-J1A PIN 42 TO 2217-J1B PIN 20
B 2217-J1A PIN 42 TO 2217-J1B PIN 10
C 2217-J1A PIN 42 TO 2217-J1B PIN 22
D 2217-J1A PIN 42 TO 2217-J1B PIN 12
E 2217-J1B PIN 42 TO 2217-J1B PIN 14
F 2217-J1B PIN 42 TO 2217-J1B PIN 24
IS THERE CONTINUITY?
NO A OR B
9 REPLACE CAPTAINS PITCH BUNGEE (MM27-41-06) OR REPAIR WIRING (WM22-17-11).
NO C OR D
10 REPLACE FIRST OFFICERS PITCH BUNGEE (MM27-41-06) OR REPAIR WIRING (WM22-17-11).
NO E OR F
11 REPLACE PITCH AFT COUPLER ASSEMBLY (MM27-41-12) OR REPAIR WIRING (WM22-17-11).
YES
12 REPLACE FCES COMPUTER (MM22-17-01).
NO. 2
4 IN FESC, REMOVE FCES COMPUTER, AT SHIP MOUNTED PLUG, CHECK FOR CONTINUITY BETWEEN THE FOLLOWING PINS (REF. SCHEM 2):
A 2217-J2A PIN 42 TO 2217-J2B PIN 20
B 2217-J2A PIN 42 TO 2217-J2B PIN 10
C 2217-J2A PIN 42 TO 2217-J2B PIN 22
D 2217-J2A PIN 42 TO 2217-J2B PIN 12
E 2217-J2B PIN 42 TO 2217-J2B PIN 14
F 2217-J2B PIN 42 TO 2217-J2B PIN 24
IS THERE CONTINUITY?
YES
13 REPLACES FCES COMPUTER (MM22-17-01).
NO A OR B
14 REPLACE CAPTAINS PITCH BUNGEE (MM27-41-06).
NO C OR D
15 REPLACE FIRST OFFICERS PITCH BUNGEE (MM27-41-06).
NO E OR F
16 REPLACE PITCH AFT COUPLER ASSEMBLY (MM27-41-12).
M1-0009-27-530

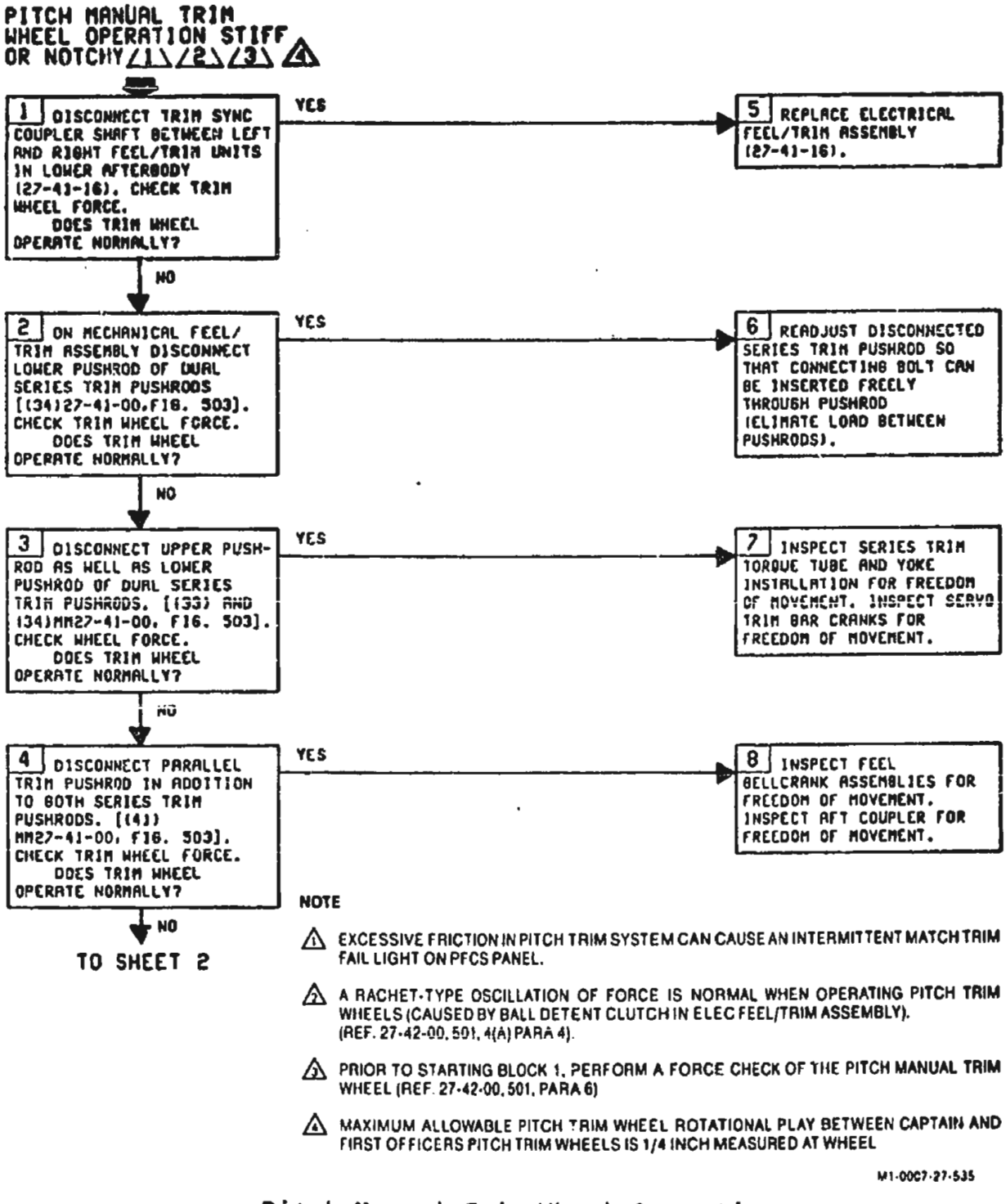
R Pitch Monitor Switchlight on
R PFCS Panel Indicates FAIL
R Figure 104 (Sheet 1)


PREREQUISITES
SEE SHEET 1
FROM SHEET 1
1 DID MONITOR 1 OR 2 SWITCHLIGHT COME ON?
NO. 1
NO. 2
3 IN FESC, REMOVE FCES COMPUTER, AT SHIP MOUNTED PLUG, CHECK FOR CONTINUITY BETWEEN THE FOLLOWING PINS (REF. SCHEM 2):
A 2217-J1A PIN 42 TO 2217-J1B PIN 48
B 2217-J1B PIN 42 TO 2217-J1A PIN 30
C 2217-J1A PIN 42 TO 2217-J1B PIN 9
D 2217-J1B PIN 42 TO 2217-J1A PIN 12
IS THERE CONTINUITY?
NO AT (A) OR (B)
NO AT (C) OR (D)
YES
4 REPLACE CAPTAINS PITCH CABLE BREAK DETECTOR SWITCH: (A) 2217-S15, (B) 2217-S17 (MM27-41-41) OR REPAIR WIRING (MM22-17-11).
5 REPLACE FIRST OFFICER PITCH CABLE BREAK DETECTOR SWITCH: (C) 2217-S16, (D) 2217-S18 (MM27-41-41) OR REPAIR WIRING (MM22-17-11).
6 REPLACE FCES COMPUTER (MM22-17-01).
IF FAULT PERSISTS, REMOVE FCES COMPUTER. CHECK FOR SHORT TO GROUND AT PLUG 2217-J1B PIN 55. REPAIR WIRING AS NECESSARY (MM22-17-11).
2 IN FESC, REMOVE FCES COMPUTER AT SHIP MOUNTED PLUG, CHECK FOR CONTINUITY BETWEEN THE FOLLOWING PINS (REF. SCHEM 2):
A 2217-J2A PIN 42 TO 2217-J2B PIN 48
B 2217-J2B PIN 42 TO 2217-J2A PIN 30
C 2217-J2A PIN 42 TO 2217-J2B PIN 9
D 2217-J2B PIN 42 TO 2217-J2A PIN 12
IS THERE CONTINUITY?
YES
NO AT (A) OR (B)
NO AT (C) OR (D)
7 REPLACE FCES COMPUTER (MM22-17-01).
IF FAULT PERSISTS, REMOVE FCES COMPUTER. CHECK FOR SHORT TO GROUND AT PLUG 2217-J2B PIN 55. REPAIR WIRING AS NECESSARY (MM22-17-12).
8 REPLACE CAPTAINS PITCH CABLE BREAK DETECTOR SWITCH: (A) 2217-S15, (B) 2217-S17 (MM27-41-41) OR REPAIR WIRING (MM22-17-12).
9 REPLACE FIRST OFFICER PITCH CABLE BREAK DETECTOR SWITCH: (C) 2217-S16, (D) 2217-S18 (MM27-41-41) OR REPAIR WIRING (MM22-17-12).

MI-0001-27-041

Pitch Monitor Switchlight on
PFCS Panel Indicates FAIL
Figure 104 (Sheet 2)

PREREQUISITES
ELECTRICAL POWER (24-41-00).


PITCH MANUAL TRIM WHEEL OPERATION STIFF OR NOTCHY /1\ /2\ /3\ 4
1 DISCONNECT TRIM SYNC COUPLER SHAFT BETWEEN LEFT AND RIGHT FEEL/TRIM UNITS IN LOWER AFTERBODY (27-41-16). CHECK TRIM WHEEL FORCE. DOES TRIM WHEEL OPERATE NORMALLY?
YES
5 REPLACE ELECTRICAL FEEL/TRIM ASSEMBLY (27-41-16).
NO
2 ON MECHANICAL FEEL/ TRIM ASSEMBLY DISCONNECT LOWER PUSHROD OF DUAL SERIES TRIM PUSHRODS [(34)27-41-00,FIG. 503]. CHECK TRIM WHEEL FORCE. DOES TRIM WHEEL OPERATE NORMALLY?
YES
6 READJUST DISCONNECTED SERIES TRIM PUSHROD SO THAT CONNECTING BOLT CAN BE INSERTED FREELY THROUGH PUSHROD (ELIMATE LOAD BETWEEN PUSHRODS).
NO
3 DISCONNECT UPPER PUSH-ROD AS WELL AS LOWER PUSHROD OF DUAL SERIES TRIM PUSHRODS. [(33) AND (34)MM27-41-00, FIG. 503]. CHECK WHEEL FORCE. DOES TRIM WHEEL OPERATE NORMALLY?
YES
7 INSPECT SERIES TRIM TORQUE TUBE AND YOKE INSTALLATION FOR FREEDOM OF MOVEMENT. INSPECT SERVO TRIM BAR CRANKS FOR FREEDOM OF MOVEMENT.
NO
4 DISCONNECT PARALLEL TRIM PUSHROD IN ADDITION TO BOTH SERIES TRIM PUSHRODS. [(41) MM27-41-00, FIG. 503]. CHECK TRIM WHEEL FORCE. DOES TRIM WHEEL OPERATE NORMALLY?
YES
8 INSPECT FEEL BELLCRANK ASSEMBLIES FOR FREEDOM OF MOVEMENT. INSPECT AFT COUPLER FOR FREEDOM OF MOVEMENT.
NO
TO SHEET 2

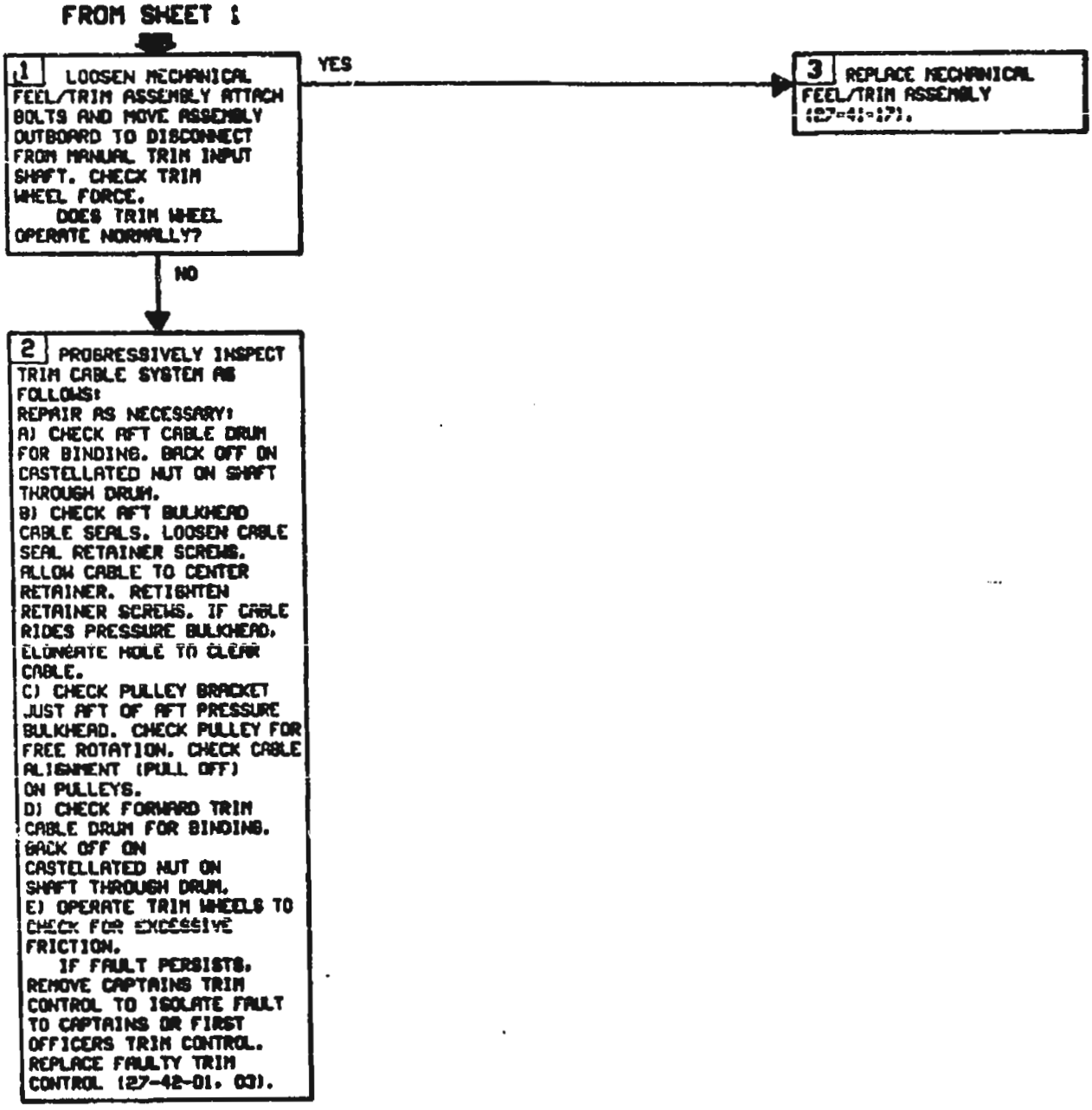
NOTE

1. EXCESSIVE FRICTION IN PITCH TRIM SYSTEM CAN CAUSE AN INTERMITTENT MATCH TRIM FAIL LIGHT ON PFCS PANEL.
2. A RACHET-TYPE OSCILLATION OF FORCE IS NORMAL WHEN OPERATING PITCH TRIM WHEELS (CAUSED BY BALL DETENT CLUTCH IN ELEC FEEL/TRIM ASSEMBLY). (REF. 27-42-00, 501, 4(A) PARA 4).
3. PRIOR TO STARTING BLOCK 1, PERFORM A FORCE CHECK OF THE PITCH MANUAL TRIM WHEEL (REF. 27-42-00, 501, PARA 6)
4. MAXIMUM ALLOWABLE PITCH TRIM WHEEL ROTATIONAL PLAY BETWEEN CAPTAIN AND FIRST OFFICERS PITCH TRIM WHEELS IS 1/4 INCH MEASURED AT WHEEL

M1-0007-27-535

R Pitch Manual Trim Wheel Operation
R Stiff or Notchy
R Figure 105 (Sheet 1)

PREREQUISITES
SEE SHEET 1


FROM SHEET 1
1 LOOSEN MECHANICAL FEEL/TRIM ASSEMBLY ATTACH BOLTS AND MOVE ASSEMBLY OUTBOARD TO DISCONNECT FROM MANUAL TRIM INPUT SHAFT. CHECK TRIM WHEEL FORCE.
DOES TRIM WHEEL OPERATE NORMALLY?
YES
3 REPLACE MECHANICAL FEEL/TRIM ASSEMBLY (27-41-17).
NO
2 PROGRESSIVELY INSPECT TRIM CABLE SYSTEM AS FOLLOWS: REPAIR AS NECESSARY:
A) CHECK AFT CABLE DRUM FOR BINDING. BACK OFF ON CASTELLATED NUT ON SHAFT THROUGH DRUM.
B) CHECK AFT BULKHEAD CABLE SEALS. LOOSEN CABLE SEAL RETAINER SCREWS. ALLOW CABLE TO CENTER RETAINER. RETIGHTEN RETAINER SCREWS. IF CABLE RIDES PRESSURE BULKHEAD, ELONGATE HOLE TO CLEAR CABLE.
C) CHECK PULLEY BRACKET JUST AFT OF AFT PRESSURE BULKHEAD. CHECK PULLEY FOR FREE ROTATION. CHECK CABLE ALIGNMENT (PULL OFF) ON PULLEYS.
D) CHECK FORWARD TRIM CABLE DRUM FOR BINDING. BACK OFF ON CASTELLATED NUT ON SHAFT THROUGH DRUM.
E) OPERATE TRIM WHEELS TO CHECK FOR EXCESSIVE FRICTION.
IF FAULT PERSISTS, REMOVE CAPTAINS TRIM CONTROL TO ISOLATE FAULT TO CAPTAINS OR FIRST OFFICERS TRIM CONTROL. REPLACE FAULTY TRIM CONTROL (27-42-01, 03).
NOTE
SEE SHEET 1

MI-0000-27-808

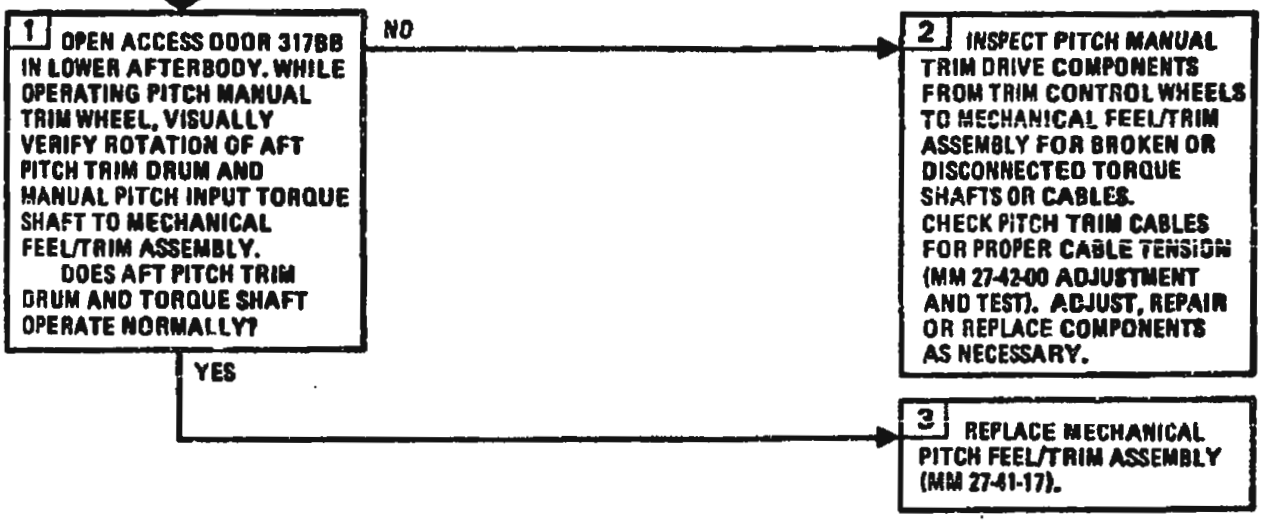
Pitch Manual Trim Wheel Operation
Stiff or Notchy
Figure 105 (Sheet 2)

PREREQUISITES
ELECTRICAL POWER (MM 24-41-00)
HYDRAULIC POWER, SYS B (MM 29-11-00)
CB'S: 1A7, 1A8, 1A25, 1A26
2H16, 2H17, 2H18, 2H19

WARNING

VERIFY THAT ALL FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE.

STABILIZER DOES NOT RESPOND TO MANUAL PITCH TRIM WHEEL INPUTS


1 OPEN ACCESS DOOR 317BB IN LOWER AFTERBODY. WHILE OPERATING PITCH MANUAL TRIM WHEEL, VISUALLY VERIFY ROTATION OF AFT PITCH TRIM DRUM AND MANUAL PITCH INPUT TORQUE SHAFT TO MECHANICAL FEEL/TRIM ASSEMBLY.
DOES AFT PITCH TRIM DRUM AND TORQUE SHAFT OPERATE NORMALLY?
NO
YES
2 INSPECT PITCH MANUAL TRIM DRIVE COMPONENTS FROM TRIM CONTROL WHEELS TO MECHANICAL FEEL/TRIM ASSEMBLY FOR BROKEN OR DISCONNECTED TORQUE SHAFTS OR CABLES. CHECK PITCH TRIM CABLES FOR PROPER CABLE TENSION (MM 27-42-00 ADJUSTMENT AND TEST). ADJUST, REPAIR OR REPLACE COMPONENTS AS NECESSARY.
3 REPLACE MECHANICAL PITCH FEEL/TRIM ASSEMBLY (MM 27-41-17).

M1-0102-27-536

Stabilizer Does Not Respond to Manual Pitch Trim Inputs
Figure 106

PREREQUISITES
ELECTRICAL POWER (MM 24-11-00)
HYDRO POWER, ALL FOUR SYSTEMS (29-11-00)
CB'S: 1B5
2F1, 2H16, 2H17, 2H18, 2H19
3G8

WARNING
VERIFY THAT ALL CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS

STABILIZER SWITCHLIGHT ON PFCS PANEL INDICATES PUSH

1 IS ONE LIGHT (A, B, C, OR D) ON OR ARE LIGHTS ON IN PAIRS (A–B, OR C–D)?
- ONE LIGHT ON → 5 REMOVE FCES COMPUTER FROM RACK. IF LIGHT STAYS ON, CHECK WIRING BETWEEN PFCS MONITOR PANEL AND FCES COMPUTER FOR SHORT TO GROUND (REF. SCHEM 2 AND WM 22-17-11 AND 12). IF LIGHT GOES OUT, REPLACE FCES COMPUTER (MM 22-17-01).
- LIGHTS ON IN PAIRS →

2 CHECK PITCH CONTROLS FOR OPERATION: SEPARATE CAPT AND FO'S CONTROL PATH BY RELEASING (OUT) STABILIZER A–B OR C–D SWITCHLIGHTS AND PULLING UP ON PITCH DISC HANDLE ON CENTER CONSOLE. OPERATE BOTH CONTROL COLUMNS. DOES CONTROL COLUMN OPERATION APPEAR NORMAL? (1)
- CONTROL FORCES VERY LIGHT → 6 CHECK FAULTY CONTROL PATH CABLES FOR BROKEN CABLE OR LOW CABLE TENSION. REPLACE BROKEN CABLE OR RETENSION CABLES (MM 27-41-00, ADJUSTMENT/TEST, PARA. 5C).
- CONTROL FORCES EXCESSIVE → 7 SEE FIG. 108 (CONTROL COLUMN OPERATION STIFF OR NOTCHY).
- YES →

3 DOES PITCH MONITOR SWITCHLIGHT ON PFCS MONITOR PANEL INDICATE FAIL?
- YES → 8 SEE FIG. 104 (PITCH MONITOR SWITCHLIGHT ON PFCS PANEL INDICATES FAIL).
- NO →

4 RESET FCES COMPUTER: RELEASE (OUT) FOR 5 SECONDS AND DEPRESS IN BOTH PITCH SWITCHLIGHTS ON PFCS MONITOR PANEL. STABILIZER PUSH LIGHTS WILL GO OUT (IF NO PERMANENT FAULT PRESENT). OPERATE CONTROL COLUMNS THROUGH FULL PITCH INPUTS. DO STABILIZER PUSH LIGHTS STAY OUT?
- YES → 9 CONSIDER PUSH LIGHT FAULT TRANSIENT. SYSTEM IS OPERATIONAL.
- NO → 10 REPLACE FCES COMPUTER (MM 22-17-01).

(1) NOTE
WITH PITCH TRIM AT 4° AND MACH INDICATOR ON MACH FEEL PANEL AT .4 MACH, THE CONTROL COLUMN AFT TRAVEL FORCE SHOULD BE 53 TO 83 POUNDS; THE FORWARD TRAVEL FORCE SHOULD BE 50 TO 75 POUNDS

M1–0103–27–532

Stabilizer Switchlight on PFCS Panel Indicate PUSH
Figure 107

PREREQUISITES
HYDRAULIC POWER, SYS A AND B LEFT SERVO; SYS C AND D RIGHT SERVO (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB'S 1B9, 1B27, 2H16, 2H17, 2H18, 2H19

WARNING
VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS

CONTROL COLUMN OPERATION STIFF OR NOTCHY (1)

1 ISOLATE CAPTAINS AND FIRST OFFICERS CONTROL PATH AS FOLLOWS:
ON PFCS PANEL UNLATCH STABILIZER C AND D SWITCHLIGHTS.
ON PEDESTAL PULL UP AND LOCK PITCH DISCONNECT HANDLE.
OPERATE CAPTAINS CONTROL COLUMN TO DETERMINE IF IT IS THE FAULTY CONTROL PATH.
ON PFCS PANEL UNLATCH STABILIZER A AND B SWITCHLIGHTS. LATCH STABILIZER C AND D SWITCHLIGHTS.
OPERATE FIRST OFFICERS CONTROL COLUMN TO DETERMINE IF IT IS THE FAULTY CONTROL PATH.
IF CAPTAINS CONTROL PATH IS FAULTY, LATCH STABILIZER A AND B SWITCHLIGHTS ON PFCS PANEL AND UNLATCH C AND D SWITCHLIGHTS.
IF FIRST OFFICERS CONTROL PATH IS FAULTY, LATCH STABILIZER C AND D SWITCHLIGHTS ON PFCS PANEL AND UNLATCH A AND B SWITCHLIGHTS.
IN FAULTY PATH, DISCONNECT SERVO INPUT ROD AT SERVO. MEASURE INTERNAL SERVO FRICTION WITH SPRING TENSION SCALE. FRICTION SHOULD NOT EXCEED 2 LBS.
IS SERVO INTERNAL FRICTION GREATER THAN 2 LBS?

YES → 3 REPLACE FAULTY STABILIZER SERVO (MM27-41-20).

NO ↓

2 IN FAULTY PATH, DISCONNECT PUSHPOD AT CABLE TENSIONER ARM TO ISOLATE CABLE LOOP. OPERATE CONTROL COLUMN TO MEASURE CABLE SYSTEM FRICTION FORCE WITH SPRING TENSION SCALE. FORCE SHOULD NOT BE SIGNIFICANTLY GREATER THAN 2 LBS (2)
IS CABLE SYSTEM FRICTION FORCE EXCESSIVE?

YES → 4 INSPECT PITCH CABLE CONTROL COMPONENTS IN FAULTY CONTROL PATH FOR FREEDOM OF OPERATION. REPAIR OR REPLACE AS REQUIRED CHECK OPERATION OF CABLE TENSION REGULATOR. (MM27-41-09, INSPECTION AND CHECK) IN FESC-CHECK CONTROL COLUMN PIVOT BEARINGS, OVERRIDE BUNGEE, FORWARD CABLE DRIVE ARM, IDLER ARMS, AND CABLE PULLEYS.
IN CEILING OF FORWARD CARGO COMPARTMENT, GALLEY, MESC AND CENTER CARGO COMPARTMENT-CHECK CABLE PULLEYS. IN AFT CARGO COMPARTMENT-CHECK IDLER ARMS AND CABLE PULLEYS. (CABLE OVER WING BOX BEAM ACCESSIBLE THROUGH PASSENGER COMPARTMENT FLOOR.

NO → 5 AFT STABILIZER CONTROL LINKAGES OR BEARINGS IN FAULTY CONTROL PATH ARE SUSPECT. IN LOWER AFTERBODY-CHECK STABILIZER LINKAGES, SERIES TRIM BAR, MECHANICAL AND ELECTRICAL FEEL/TRIM UNITS INPUT LINKAGES, AUTOPILOT SERVO INPUT LINKAGES, AND STABILIZER LINKAGE BEARINGS FOR WEAR OR CORROSION DAMAGE BY DISCONNECTING PUSHRODS TO PERMIT HAND OPERATION OF BELLCRANKS. ALL UNITS SHOULD MOVE WITH FORCES IN THE 1-2 LBS. RANGE. PRIME SUSPECT COMPONENTS AND LINKAGE BEARINGS AND THEIR ASSOCIATED FAULTS ARE LISTED IN TABLE 1, FIG. 108 (SHEET 2).

NOTE

(1) NORMAL CONTROL COLUMN FORCES ARE DETAILED IN STABILIZER CONTROL SYSTEM FRICTION AND SURFACE TRAVEL CHECK (REF. MM27-41-00, INSPECTION AND CHECK).

(2) CHECK CONTROL COLUMN FORCE AT CONTROL WHEEL HUB.

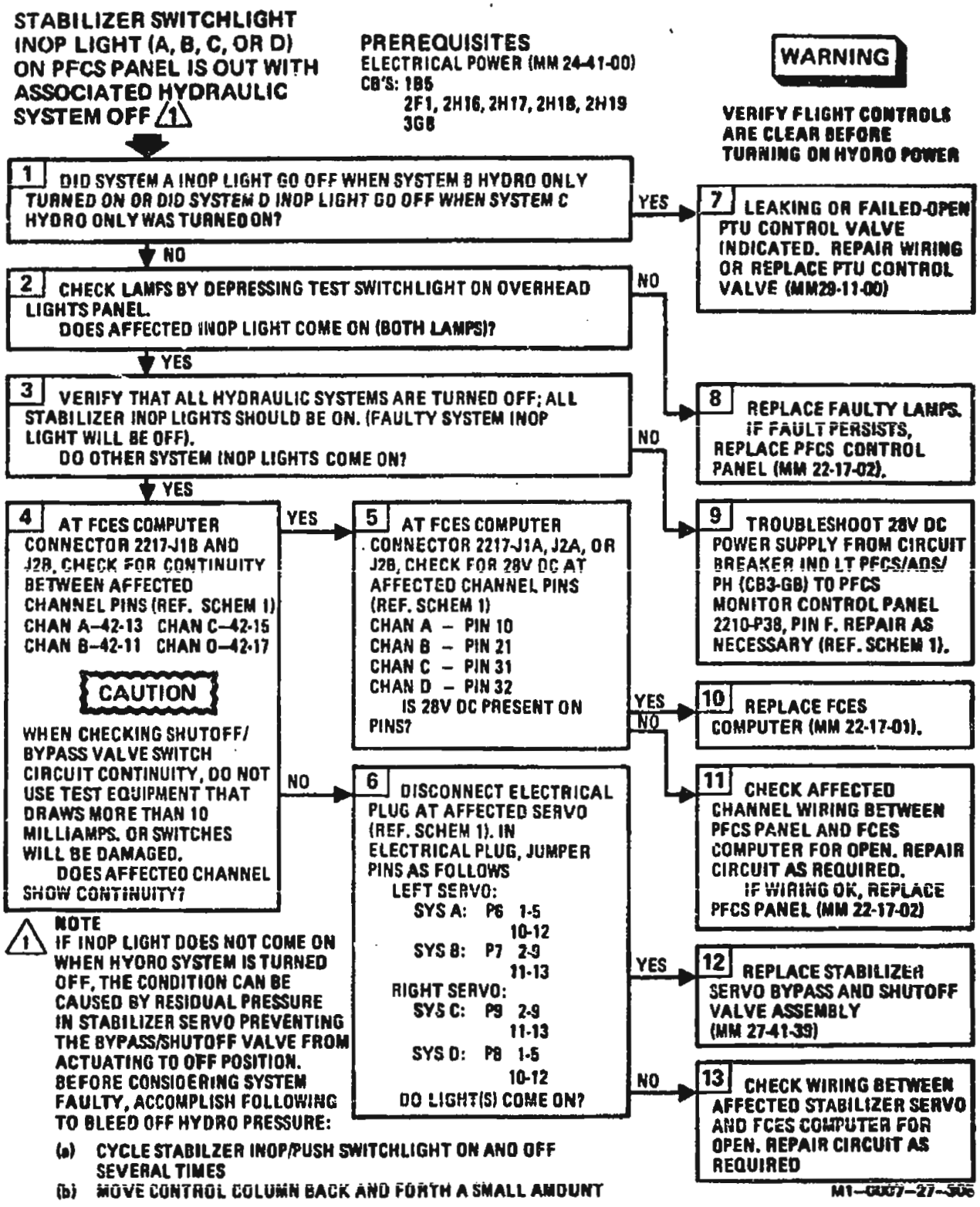
M1-0005-27-533

R Control Column Operation Stiff or Notchy
R Figure 108 (Sheet 1)

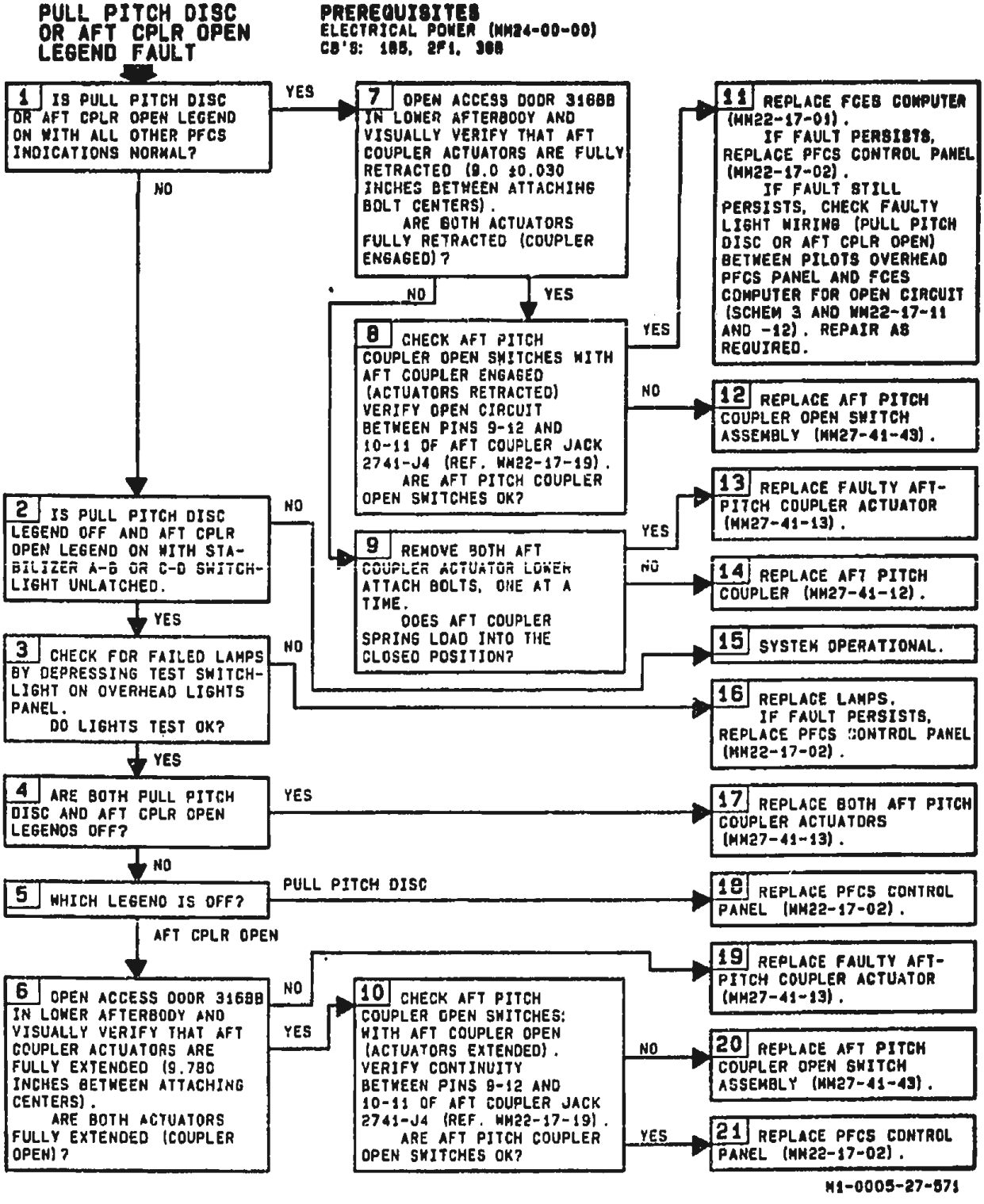
FAULTS	ASSOCIATED FAILURES
• AIRCRAFT VERY HARD TO ROTATE AND CONTROL COLUMN STIFF • STABILIZER TRAVEL LIMITED, NO JAM INDICATED	PITCH CONTROL SYSTEM, RIGHT HAND FEEL BELL CRANK INSTL – BEARING – BINDING
• STABILIZER TRIM BINDING WITH ELECTRIC TRIM, OPERATING MECHANICAL TRIM ALLOWED FURTHER TRAVEL WITH ELECTRIC TRIM • STABILIZER JAMMED IN 1 TO 4 DEGREE TRIM RANGE WITH BOTH MECHANICAL AND ELECTRIC TRIM	SERIES TRIM YOKE ASSY – BEARING RUSTED, BINDING, PARTIALLY JAMMED
• WITH AIRPLANE TRIMMED TO 0° AND FORWARD AND AFT COUPLERS DISCONNECTED, CAPTAINS COLUMN MOVED SURFACE THROUGH NORMAL RANGE, COPILOT'S COLUMN MOVED SURFACE ONLY 1/2°, COPILOTS COLUMN MOVED SURFACE THROUGH NORMAL RANGE WITH AUTO PILOT SERVO DISCONNECTED	PITCH AUTO PILOT – HIGH INTERNAL FRICTION
• NOTCHY OPERATION OF STABILIZER THROUGHOUT OPERATING RANGE	STABILIZER SERVO – HIGH INTERNAL LEAKAGE (IN EXCESS OF 2.5 GPM)
• STABILIZER SERVOS OUT OF PHASE	LH SIDE SUMMING BEAM OUTPUT ROD ASSY – ROD END BEARING BROKEN ON UPPER ROD – SLIP BUSHING MISSING ON LOWER ROD
• VIBRATION AND SHUDDERS FELT IN FLIGHT STATION WITH FORWARD OR AFT CONTROL COLUMN MOVEMENT WITH ALL HYDRAULIC SYSTEMS ON OR WITH EACH HYDRAULIC SYSTEM ISOLATED INDIVIDUALLY	SERVO INPUT ROD ASSY – BAD BEARING
• AIRCRAFT VERY HARD TO ROTATE AND CONTROL COLUMN MOVEMENT STIFF • SLIGHT PULSATION FELT IN CONTROL COLUMN IN A OR B AUTO PILOT, NO MOVEMENT OF AIRCRAFT. NO PULSATION WHEN FLOWN MANUALLY BUT CONTROLS WERE STIFF • PITCH TRIM INPUT RESULTED IN DELAYED CONTROL COLUMN MOVEMENT • STABILIZER TRAVELS WERE LIMITED BUT NO JAM WAS INDICATED • AFT COUPLER OPEN LIGHT ON • IMPROPER PITCH CONTROL JAM INDICATIONS • PITCH CONTROL OVERRIDE BUNGEE FORCES HIGH • UNABLE TO ACCOMPLISH PITCH OVERRIDE BUNGEE ADJUSTMENT AND TEST	AFT PITCH COUPLER – HIGH FRICTION
• AIRCRAFT PORPOISING WITH AUTO PILOT SERVO OFF	AFT PITCH COUPLER – MISRIGGED/ MALADJUSTED IN THE OPEN COUPLER DIRECTION
• MACH TRIM FAIL LIGHT ON	MACH TRIM MOTORS – BINDING
• MACH TRIM AND PITCH TRIM FAULT INDICATIONS IN FLIGHT STATION	SERIES TRIM OUTPUT RODS – BINDING TOGETHER

M1-0000-27-000

Control Column Operation Stiff or Notchy
Figure 108 (Sheet 2)


STABILIZER SWITCHLIGHT INOP LIGHT (A, B, C, OR D) ON PFCS PANEL IS OUT WITH ASSOCIATED HYDRAULIC SYSTEM OFF 1
PREREQUISITES
ELECTRICAL POWER (MM 24-41-00)
CB'S: 1B5
2F1, 2H16, 2H17, 2H18, 2H19
3G8
WARNING
VERIFY FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRO POWER
1 DID SYSTEM A INOP LIGHT GO OFF WHEN SYSTEM B HYDRO ONLY TURNED ON OR DID SYSTEM D INOP LIGHT GO OFF WHEN SYSTEM C HYDRO ONLY WAS TURNED ON?
YES
7 LEAKING OR FAILED-OPEN PTU CONTROL VALVE INDICATED. REPAIR WIRING OR REPLACE PTU CONTROL VALVE (MM29-11-00)
NO
2 CHECK LAMPS BY DEPRESSING TEST SWITCHLIGHT ON OVERHEAD LIGHTS PANEL.
DOES AFFECTED INOP LIGHT COME ON (BOTH LAMPS)?
NO
8 REPLACE FAULTY LAMPS. IF FAULT PERSISTS, REPLACE PFCS CONTROL PANEL (MM 22-17-02).
YES
3 VERIFY THAT ALL HYDRAULIC SYSTEMS ARE TURNED OFF; ALL STABILIZER INOP LIGHTS SHOULD BE ON. (FAULTY SYSTEM INOP LIGHT WILL BE OFF).
DO OTHER SYSTEM INOP LIGHTS COME ON?
NO
9 TROUBLESHOOT 28V DC POWER SUPPLY FROM CIRCUIT BREAKER IND LT PFCS/ADS/PH (CB3-GB) TO PFCS MONITOR CONTROL PANEL 2210-P38, PIN F. REPAIR AS NECESSARY (REF. SCHEM 1).
YES
4 AT FCES COMPUTER CONNECTOR 2217-J1B AND J2B, CHECK FOR CONTINUITY BETWEEN AFFECTED CHANNEL PINS (REF. SCHEM 1)
CHAN A–42-13 CHAN C–42-15
CHAN B–42-11 CHAN D–42-17
CAUTION
WHEN CHECKING SHUTOFF/BYPASS VALVE SWITCH CIRCUIT CONTINUITY, DO NOT USE TEST EQUIPMENT THAT DRAWS MORE THAN 10 MILLIAMPS, OR SWITCHES WILL BE DAMAGED.
DOES AFFECTED CHANNEL SHOW CONTINUITY?
YES
5 AT FCES COMPUTER CONNECTOR 2217-J1A, J2A, OR J2B, CHECK FOR 28V DC AT AFFECTED CHANNEL PINS (REF. SCHEM 1)
CHAN A – PIN 10
CHAN B – PIN 21
CHAN C – PIN 31
CHAN D – PIN 32
IS 28V DC PRESENT ON PINS?
YES
10 REPLACE FCES COMPUTER (MM 22-17-01).
NO
11 CHECK AFFECTED CHANNEL WIRING BETWEEN PFCS PANEL AND FCES COMPUTER FOR OPEN. REPAIR CIRCUIT AS REQUIRED.
IF WIRING OK, REPLACE PFCS PANEL (MM 22-17-02)
NO
6 DISCONNECT ELECTRICAL PLUG AT AFFECTED SERVO (REF. SCHEM 1). IN ELECTRICAL PLUG, JUMPER PINS AS FOLLOWS
LEFT SERVO:
SYS A: P6 1-5
10-12
SYS B: P7 2-9
11-13
RIGHT SERVO:
SYS C: P9 2-9
11-13
SYS D: P8 1-5
10-12
DO LIGHT(S) COME ON?
YES
12 REPLACE STABILIZER SERVO BYPASS AND SHUTOFF VALVE ASSEMBLY (MM 27-41-39)
NO
13 CHECK WIRING BETWEEN AFFECTED STABILIZER SERVO AND FCES COMPUTER FOR OPEN. REPAIR CIRCUIT AS REQUIRED
1 NOTE
IF INOP LIGHT DOES NOT COME ON WHEN HYDRO SYSTEM IS TURNED OFF, THE CONDITION CAN BE CAUSED BY RESIDUAL PRESSURE IN STABILIZER SERVO PREVENTING THE BYPASS/SHUTOFF VALVE FROM ACTUATING TO OFF POSITION. BEFORE CONSIDERING SYSTEM FAULTY, ACCOMPLISH FOLLOWING TO BLEED OFF HYDRO PRESSURE:
(a) CYCLE STABILZER INOP/PUSH SWITCHLIGHT ON AND OFF SEVERAL TIMES
(b) MOVE CONTROL COLUMN BACK AND FORTH A SMALL AMOUNT
M1-GUG7-27-506

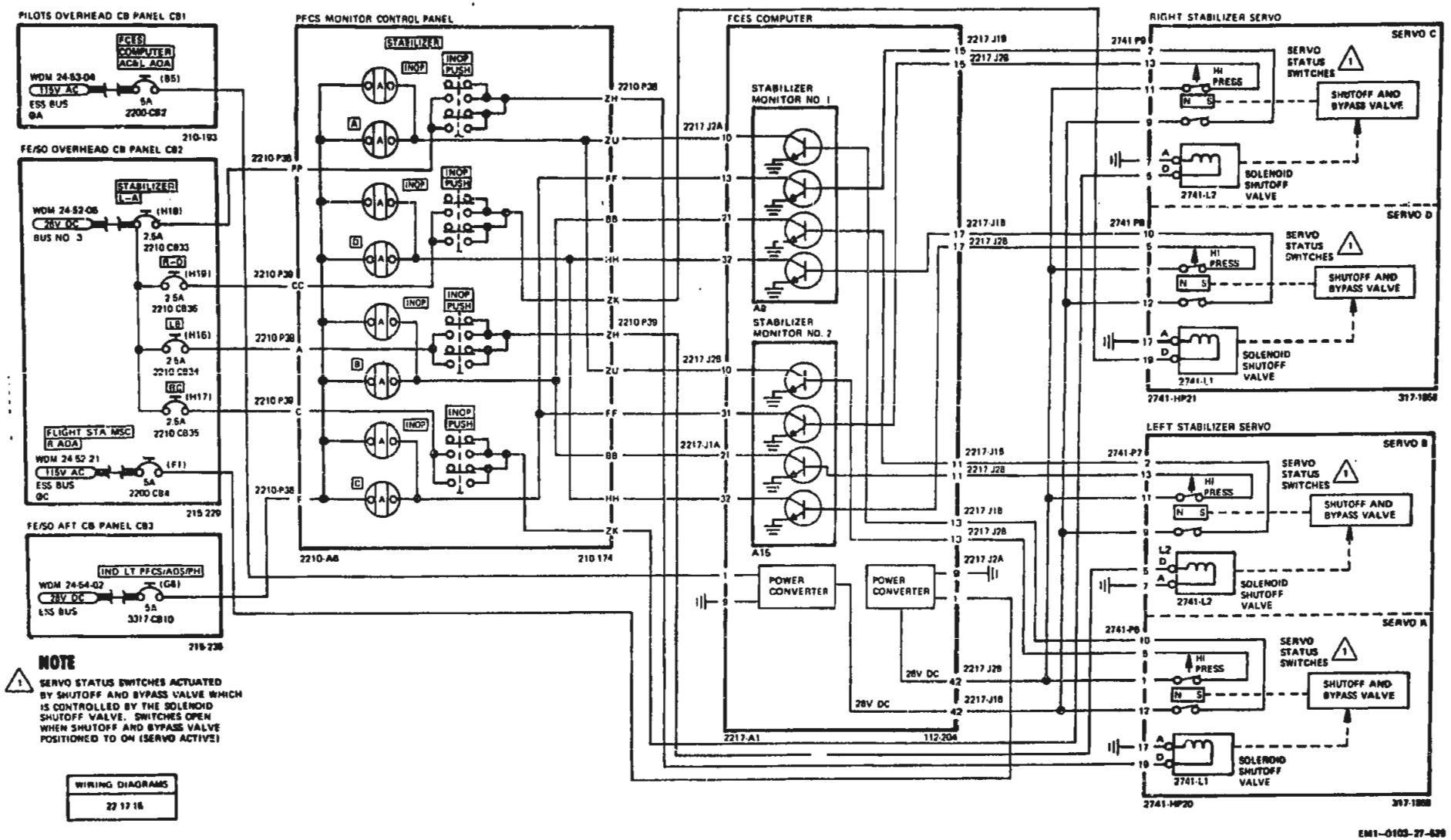
Stabilizer Switchlight INOP Light (A, B, C, D)
On PFCS Panel Is Out With Associated Hydraulic System Off
Figure 109


PULL PITCH DISC OR AFT CPLR OPEN LEGEND FAULT
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 185, 2F1, 308
1 IS PULL PITCH DISC OR AFT CPLR OPEN LEGEND ON WITH ALL OTHER PFCS INDICATIONS NORMAL?
YES
NO
7 OPEN ACCESS DOOR 3168B IN LOWER AFTERBODY AND VISUALLY VERIFY THAT AFT COUPLER ACTUATORS ARE FULLY RETRACTED (9.0 ±0.030 INCHES BETWEEN ATTACHING BOLT CENTERS). ARE BOTH ACTUATORS FULLY RETRACTED (COUPLER ENGAGED)?
NO
YES
8 CHECK AFT PITCH COUPLER OPEN SWITCHES WITH AFT COUPLER ENGAGED (ACTUATORS RETRACTED) VERIFY OPEN CIRCUIT BETWEEN PINS 9-12 AND 10-11 OF AFT COUPLER JACK 2741-J4 (REF. MM22-17-19). ARE AFT PITCH COUPLER OPEN SWITCHES OK?
YES
11 REPLACE FCES COMPUTER (MM22-17-01). IF FAULT PERSISTS, REPLACE PFCS CONTROL PANEL (MM22-17-02). IF FAULT STILL PERSISTS, CHECK FAULTY LIGHT WIRING (PULL PITCH DISC OR AFT CPLR OPEN) BETWEEN PILOTS OVERHEAD PFCS PANEL AND FCES COMPUTER FOR OPEN CIRCUIT (SCHEM 3 AND MM22-17-11 AND -12). REPAIR AS REQUIRED.
NO
12 REPLACE AFT PITCH COUPLER OPEN SWITCH ASSEMBLY (MM27-41-43).
2 IS PULL PITCH DISC LEGEND OFF AND AFT CPLR OPEN LEGEND ON WITH STA-BILIZER A-B OR C-D SWITCH-LIGHT UNLATCHED.
NO
9 REMOVE BOTH AFT COUPLER ACTUATOR LOWER ATTACH BOLTS, ONE AT A TIME. DOES AFT COUPLER SPRING LOAD INTO THE CLOSED POSITION?
YES
13 REPLACE FAULTY AFT-PITCH COUPLER ACTUATOR (MM27-41-13).
NO
14 REPLACE AFT PITCH COUPLER (MM27-41-12).
YES
3 CHECK FOR FAILED LAMPS BY DEPRESSING TEST SWITCH-LIGHT ON OVERHEAD LIGHTS PANEL. DO LIGHTS TEST OK?
NO
15 SYSTEM OPERATIONAL.
YES
16 REPLACE LAMPS. IF FAULT PERSISTS, REPLACE PFCS CONTROL PANEL (MM22-17-02).
4 ARE BOTH PULL PITCH DISC AND AFT CPLR OPEN LEGENDS OFF?
YES
17 REPLACE BOTH AFT PITCH COUPLER ACTUATORS (MM27-41-13).
NO
5 WHICH LEGEND IS OFF?
PULL PITCH DISC
18 REPLACE PFCS CONTROL PANEL (MM22-17-02).
AFT CPLR OPEN
19 REPLACE FAULTY AFT-PITCH COUPLER ACTUATOR (MM27-41-13).
6 OPEN ACCESS DOOR 3168B IN LOWER AFTERBODY AND VISUALLY VERIFY THAT AFT COUPLER ACTUATORS ARE FULLY EXTENDED (9.780 INCHES BETWEEN ATTACHING CENTERS). ARE BOTH ACTUATORS FULLY EXTENDED (COUPLER OPEN)?
NO
YES
10 CHECK AFT PITCH COUPLER OPEN SWITCHES: WITH AFT COUPLER OPEN (ACTUATORS EXTENDED). VERIFY CONTINUITY BETWEEN PINS 9-12 AND 10-11 OF AFT COUPLER JACK 2741-J4 (REF. MM22-17-19). ARE AFT PITCH COUPLER OPEN SWITCHES OK?
NO
20 REPLACE AFT PITCH COUPLER OPEN SWITCH ASSEMBLY (MM27-41-43).
YES
21 REPLACE PFCS CONTROL PANEL (MM22-17-02).
M1-0005-27-571

R PULL PITCH DISC or AFT CPLR OPEN Legend Fault
R Figure 110

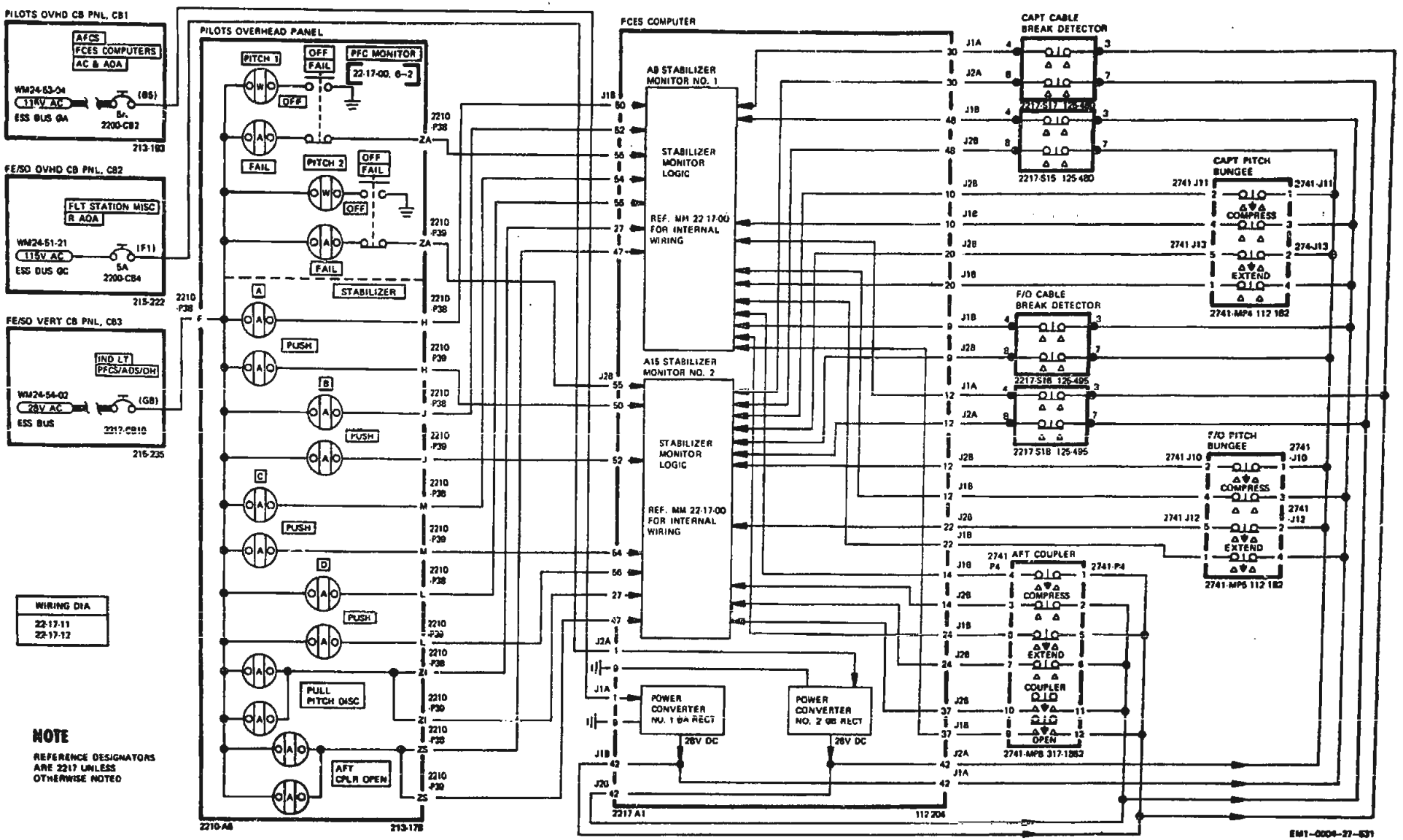
EFFECTIVITY: ALL

001B



Stabilizer Shutdown Control and Annunciation Electrical Schematic
SCHEM 1

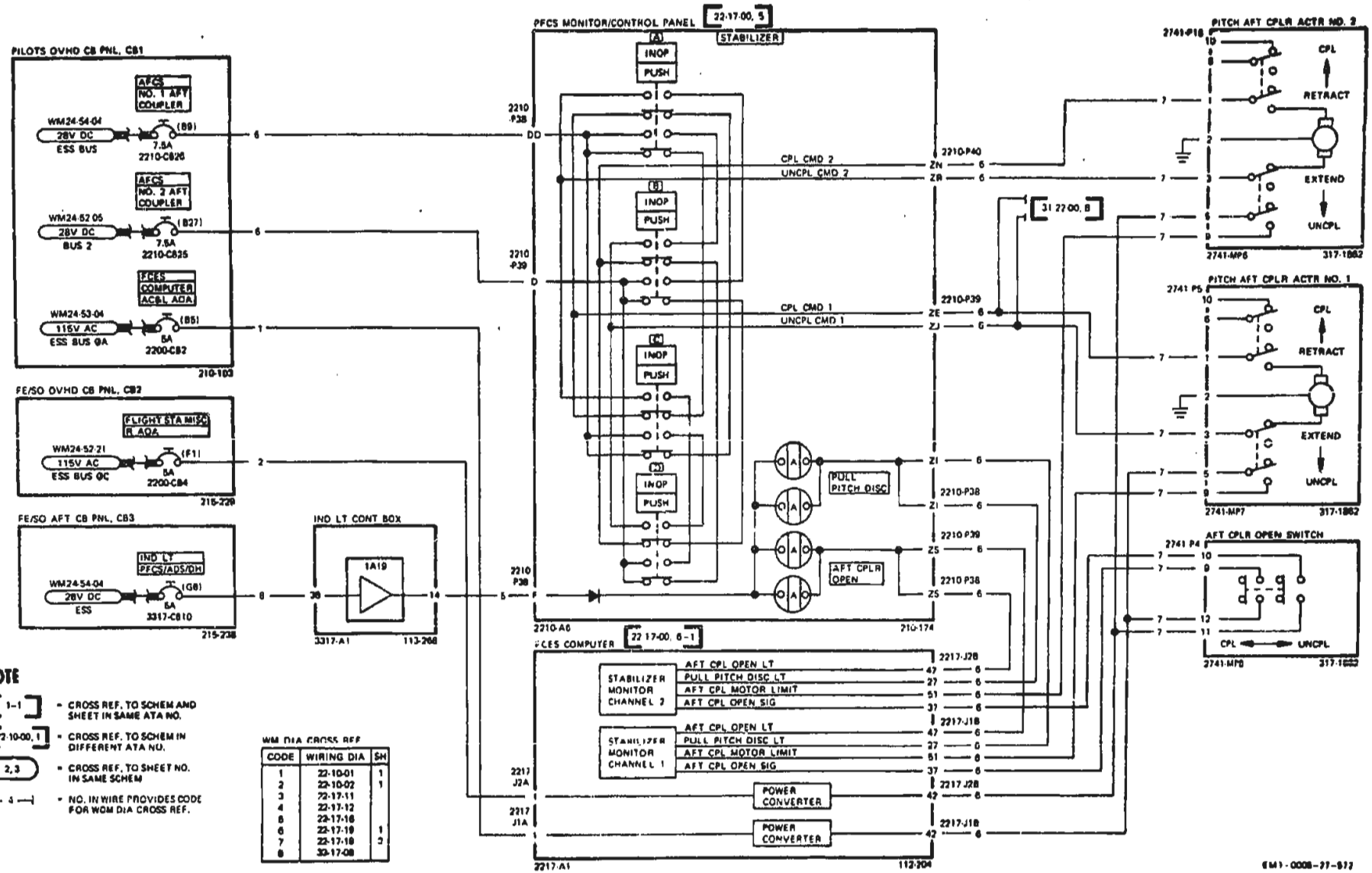
R EFFECTIVITY: ALL
R
001B



Stabilizer PFCS Monitor Control Electrical Schematic
SCHEM 2

R
RR
001B

EFFECTIVITY: ALL



NOTE

1. [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2,3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— - NO. IN WIRE PROVIDES CODE FOR WOM DIA CROSS REF.

WM DIA CROSS REF

CODE	WIRING DIA	SH
1	22-10-01	1
2	22-10-02	1
3	22-17-11	
4	22-17-12	
5	22-17-16	
6	22-17-19	1
7	22-17-19	2
8	32-17-08	

EM1-0008-27-572

R Stabilizer Aft Coupler Control Electrical Schematic
R SCHEM 3

EFFECTIVITY: ALL

001B

HORIZONTAL STABILIZER CONTROL SYSTEM - ADJUSTMENT AND TEST

R 1. General

These procedures must be used to perform operational tests (Ref. Para. 4) and a rigging check and adjustment (Ref. Para. 5) of the horizontal stabilizer control system.

R Various conditions are known to generate a buffeting or thump in
R the aircraft during static ground operations. To
R determine/rectify reported oscillations or thumping see
R MM27-41-00, Fault Isolation.

2. Equipment and Materials

Protractor, 0 to 90 degrees (for adjusting control column stop)

Horizontal Stabilizer Attitude Indicator, PN BF75, or equivalent

Tensiometer, Pacific Scientific PN 1601009-03, or equivalent

Rig Pin, Bertea PN 216135-101, or equivalent. (Four rig pins are required:; two for autopilot servo, and one for each stabilizer servo. Rig pins normally come installed in new stabilizer autopilot. Bertea autopilot and power servo rig pin holes and rig pins are made to a tighter tolerance than rig pins in B734 rig pin kit. Bertea rig pins are 0.3120 to 0.3125 inch; equivalent rig pins in B734 kit are 0.3120 to 0.3130 inch. Consequently B734 rig pins could be a tight fit in autopilot and power servos.)

Rig Pin Kit - Empennage Controls, PN B734, or equivalent

NOTE: Rig pin kit includes the following 5/16-inch-diameter pins (except for R7 which is 9/16-inch diameter and R9 which is 1/2-inch diameter):

RIG PIN	GRIP LENGTH (INCHES)	COLOR
R1	1	Blue
R2	2	Red
R3	3	Green
R4	4	Yellow
R7	7	Black

RIG PIN	GRIP LENGTH (INCHES)	COLOR
R9	7-1/2	White

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-00-00	Electrical Power - Maintenance Practices
27-41-00	Horizontal Stabilizer Control System - Fault Isolation
27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
27-41-03	Pitch Disconnect Mechanism - Adjustment and Test
27-41-06	Pitch Control Override Bungee and Aft Coupler - Adjustment and Test
27-41-13	Aft Pitch Coupler Actuator - Removal and Installation
27-41-17	Mechanical Pitch Feel/Trim Assembly - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Tests

Operational tests are provided for the following:

Horizontal Stabilizer Control System Test (Para. 4A)

Stabilizer Servo Hydraulic Integrity Test (Para. 4B)

Operational Check of Shutdown Function (Para. 4C).

A. Horizontal Stabilizer Control System Test

NOTE: This test is performed to verify normal operation of the horizontal stabilizer control system.

Use surface position indicator on pilots main instrument panel to verify horizontal stabilizer surface position.

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

FCES COMPUTERS - DC and AC & L AOA (B4 and B5)

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

SURF POSN IND (J23)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify circuit breakers STABILIZER SERVO LB, RC, LA, and RD (H16 through H19) are closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify circuit breaker IND LT - PFCS ADS/DH (G8) is closed.

(2) On pilots overhead PFCS panel, zone 210, verify the following switchlights are latched: STABILIZER A, B, C, and D and Pitch 1 and 2.

(3) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic systems A, B, C, and D (Ref. 29-11-00).

(5) Verify MACH FEEL indicator on the pilots overhead flight control panel indicates approximately 0.4 MACH.

(6) Slowly operate control column through three full pitch cycles. Verify stabilizer control system operates smoothly (no binding).

(7) Pull either control column fully aft (nose-up). Verify the following:

(a) Stabilizer leading edge positions down a minimum of 11 degrees. (Use surface position indicator on pilots main instrument panel.)

(b) Elevator positions approximately 25 degrees up from faired with stabilizer.

NOTE: Elevator position is not displayed on surface position indicator. Check elevator position by visually verifying that elevator positions up from faired with stabilizer.

(c) STAB pointers on surface position indicator, follow control column movement.

(8) Release control column. Control column must return to approximately trim position.

(9) Push either control column fully forward (nose down). Verify the following:

(a) Stabilizer leading edge positions full up (pointer on surface position indicator should be full down).

(b) Elevator fairs with stabilizer.

(c) STAB pointers on surface position indicator follow control column movement.

(10) Release control column.

(11) Pull PITCH DISC handle and lock. Verify handle legend comes on.

(12) Unlatch STABILIZER A and B switchlights on PFCS panel (to depressurize A and B servos). Verify the following:

(a) INOP legends in A and B switchlights on PFCS panel come on.

(b) FLT CONT PANELS legend on pilots caution and warning panel flashes.

(c) AFT CPLR OPEN legend on PFCS panel comes on.

(d) No stabilizer movement with inputs through Captains column.

(e) Normal stabilizer movement using First Officers column.

(13) Latch A and B switchlights on PFCS panel (to repressurize A and B servos). Verify the following:

(a) INOP legends in A and B switchlights go off.

(b) AFT CPLR OPEN legend goes off.

(14) Unlatch STABILIZER C and D switchlights on PFCS panel (to depressurize C and D servos). Verify the following:

(a) INOP legends in C and D switchlights come on.

(b) AFT CPLR OPEN legend on PFCS panel comes on.

(c) FLT CONT PANELS legend on pilots caution and warning panel flashes.

(d) No stabilizer movement with inputs through First Officers control column.

(e) Normal stabilizer movement using Captains control column.

(15) Unlock PITCH DISC handle and allow handle to retract into panel. Verify handle legend goes off.

(16) Latch C and D switchlights. Verify the following:

(a) INOP legends in C and D switchlights go off.

(b) AFT CPLR OPEN legend goes off.

(c) FLT CONT PANELS legend on pilots caution and warning panel goes off.

(d) Normal stabilizer positioning using Captains and First Officers control column inputs.

(17) Check individual operation of the two aft coupler actuators as follows:

(a) Open circuit breaker NO. 1 AFT COUPLER (CB1-B9).

(b) Unlatch STABILIZER A and B switchlights on PFCS panel. Verify AFT CPLR OPEN legend comes on.

(c) Latch STABILIZER A and B switchlights. AFT CPLR OPEN legend must go off.

(d) Close circuit breaker NO. 1 AFT COUPLER (CB1-B9).

(e) Open circuit breaker NO. 2 AFT COUPLER (CB1-B27).

(f) Unlatch STABILIZER A and B switchlights. AFT CPLR OPEN legend must come on.

(g) Latch STABILIZER A and B switchlights. AFT CPLR OPEN legend must go off.

(h) Close circuit breaker NO. 2 AFT COUPLER (CB1-B27).

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-00-00).

B. Stabilizer Servo Hydraulic Integrity Test

This test determines that the stabilizer servo and actuator hydraulic lines are not crossed.

(1) Verify the following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1, zone 210:

FCES COMPUTERS - DC AC & L AOA (B4 and B5)

SURF POS IND (J23)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

STAEILIZER SERVO LB, RC, LA, and RD (H16 through H19)

FLIGHT STATION MISC - R AOA (F1)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

IND LT - PFCS ADS/DH (G8)

(2) Turn on electrical power (Ref. 24-00-00).

(3) Verify all four STABILIZER switchlights on PFCS panel are latched.

(4) Verify PITCH DISC handle on center console is against console (control columns coupled together).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

NOTE: It is extremely important that only the hydraulic systems specified for each individual test be pressurized, and that only the hydraulic sources specified be used.

(5) Turn on only hydraulic system A. Use ground test cart or engine-driven pump.

(6) Position pitch trim wheel to 0-degrees trim.

(7) Move either control column full aft. Verify stabilizer moves to leading edge down position (11 degrees or more). Use surface position indicator.

CAUTION: DO NOT MOVE CONTROL COLUMN FORWARD. IF HYDRAULIC LINES ARE IMPROPERLY CONNECTED, THE CONTROL COLUMN WOULD BE DRIVEN AFT BY THE SURFACE IN LESS THAN 2.5 SECONDS WITH A FULL FORWARD BUNGEE FORCE AUTHORITY OF 100 POUNDS. MOVING CONTROL COLUMN AFT WILL CHECK FOR IMPROPERLY CONNECTED HYDRAULIC LINES BY CAUSING THE CONTROL COLUMN TO DRIVE FORWARD.

(8) Shut off hydraulic system A.

NOTE: When both stabilizers are depressurzied, stabilizer will move to the +1 degree position against the actuator stops.

(9) Pressurize only hydraulic system B. Use ground test cart, ATM, or AC pump.

(10) Move control column full aft. Verify stabilizer moves to leading edge down position (11 degrees or more).

CAUTION: DO NOT MOVE CONTROL COLUMN FORWARD.

(11) Turn off hydraulic system B.

(12) Pressurize only hydraulic system C. Use ground test cart, ATM, or AC pump.

(13) Move control column full aft. Verify stabilizer moves to leading edge down position (11 degrees or more).

CAUTION: DO NOT MOVE CONTROL COLUMN FORWARD.

(14) Turn off hydraulic system C.

(15) Pressurize only hydraulic system D. Use ground test cart or engine-driven pump

(16) Move control column full aft. Verify stabilizer moves to leading edge down position (11 degrees or more).

CAUTION: DO NOT MOVE CONTROL COLUMN FORWARD.

(17) Turn off hydraulic system D if no longer required.

(18) Turn off electrical power (Ref. 24-00-00).

C. Operational Check of Shutdown Function

This test verifies the proper operation of servo valve malfunction monitor (servo shutdown function), servo solenoid shutoff valves, servo actuation channels, and comparator cross-tie interlock system.

NOTE: Steps 4C(1) through 4C(19) test the C and D (First Officers) malfunction monitor. Steps 4C(20) through 4C(30) test the A and B (Captains) malfunction monitor. Steps 4C(33) through 4C(53) test the cross-tie interlock system.

R During servo shutdown test some movement of the
R control column may be experienced. This movement has
R no adverse effect on the servo shutdown function.

(1) Verify the following circuit breakers are in their required condition:

(a) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

FCES COMPUTERS - DC (B4) and AC & L AOA (B5)

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify the following circuit breakers are closed:

STABILIZER SERVO LB, RC, LA, RD (H16 through H19)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify the following circuit breaker is closed:

IND LT - PFCS ADS/DH (G8)

C (d) On Flight Engineer/Second Officers overhead
C circuit breaker panel, CB2, verify the following
C circuit breaker is open:

C T/O aural WRN (H7)

(2) Turn on electrical power (Ref. 24-00-00).

(3) Pull up and lock PITCH DISC handle on pilots center console to disconnect forward disconnect.

(4) On pilots overhead PFCS panel, turn off all control servos except stabilizer by unlatching the one RUDDER, four AILERON, and six SPOILER switchlights.

(5) Unlatch STABILIZER A and B switchlights. Verify that A and B INOP legends and AFT CPLR OPEN legend are on.

NOTE: If STABILIZER switchlight INOP legends on PFCS panel do not come on, this can be due to residual pressure in servo preventing bypass valve from operating. Accomplish following to ensure that hydraulic pressure is bled off: Cycle switchlights on and off, move control column back and forth a small amount, or turn on servos turned off in Step 4C(4) for several minutes then turn servos off.

(6) On pilots overhead circuit breaker panel CB1, zone 210, open the following circuit breakers to ensure that aft couple remains in open position during test:

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

(7) Latch STABILIZER A and B switchlights. Verify all stabilizer switchlights (A, B, C, D) are latched and that all INOP legends are on. (AFT CPLR OPEN legend remains on.)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

NOTE: The following steps require a MINIMUM of 2,500 psig hydraulic pressure when hydraulic pressure is called for. When test specifies no hydraulic power, wait for pressure to go to zero before proceeding.

(8) Turn on hydraulic system B and, six seconds later, hydraulic system A. Verify that A and B INOP legends go off.

(9) Position pitch trim wheel to 4 degrees. Verify stabilizer moves to 4 degrees. Use surface position indicator.

(10) Verify captains control of surface by moving Captains control column.

(11) Verify both couplers are open (First Officers control column movement does not position surface).

(12) Firmly hold Captains control column at the trim position so stabilizer cannot move during Steps 4C(13) and 4C(14).

(13) Move First Officers column a minimum of four inches forward of Captains control column and hold. (This will stroke monitor spool.)

NOTE: Do not move or stroke First Officers control column after positioning control column in accordance with Step 4C(13).

(14) Turn on hydraulic system C and, six seconds later, hydraulic system D. The C and D INOP legends may go off momentarily but then must come back on to indicate that C and D servos are maintained in shutdown condition.

NOTE: If the C and D INOP legends do not come on, release the First Officers column. The C and D INOP legends must then come on. (If either legend does not come on see 27-41-00, Fault Isolation.)

(15) Release both control columns.

(16) Check servo status as follows:

(a) Verify C and D servos are shut down by holding Captains control column at the trim position and determining that surface cannot be moved with First Officers control column.

(b) Verify A and B servos are operational by moving the surface with Captains control column.

(c) Unlatch STABILIZER A and B switchlights and verify legends for A and B do not come on and INOP legends for C and D remain on.

(17) Reactivate C and D stabilizer servo as follows:

(a) Turn off hydraulic systems C and D. Wait until pressure decays to zero, and then wait one additional minute.

(b) Turn on hydraulic systems C and D. The C and D INOP legends must go off to indicate right stabilizer servo (First Officers) is now active. The A and B INOP legends must come on.

NOTE: If C and D INOP legends do not go off after turning on hydraulic System C and D, pressure in servo may not have decayed to zero; this prevents the bypass/shutoff valve from repositioning. To recheck, repeat Step 4C(17)(a) and, to ensure system pressure C and D decays to zero, activate both inboard ailerons by latching AILERON L INBD and R INBD switchlights on PFCS panel, then rotate First Officers control wheel left and right and move control column fore and aft four inches several times. Unlatch

AILERON L INBD and R INBD switchlights on PFCS panel, then repeat Step 4C(17)(b).

(18) Latch A and B switchlights.

(19) Turn off A and B hydraulic systems (Ref. 29-11-00).

NOTE: Steps 4C(20) through 4C(30) test the A and B (Captains) malfunction monitor.

(20) Verify hydraulic systems C and D are turned on, and C and D INOP legends are off, the AFT CPLR OPEN legend is on, and the stabilizer is at 4 degrees (use surface position indicator).

(21) Verify First Officers control of surface by moving First Officers control column.

(22) Verify both couplers are open (Captains control column movement does not position surface).

(23) Firmly hold First Officers control column at trim position so the stabilizer cannot move during Steps 4C(24) and4C(25).

(24) Move Captains control column a minimum of four inches forward of First Officers control column and hold. (This will stroke monitor spool.)

NOTE: Do not move or stroke captains control column after positioning control column in accordance with Step 4C(24).

(25) Turn on hydraulic system B and, six seconds later, hydraulic system A. The A and B INOP legends may go off momentarily but then must come back on to indicate that A and B servos are maintained in shutdown condition.

NOTE: If the A and B INOP legends do not come on, release Captains column. The A and B INOP legends must then come on. (If either INOP legend does not come on, see 27-41-00, Fault Isolation.)

(26) Release both control columns.

(27) Check servo status as follows:

(a) Verify A and B servos are shut down by holding the First Officers control column at the trim position

and determining surface cannot be moved with Captains control column.

(b) Verify C and D servos are operational by moving the surface with the First Officers control column.

(c) Unlatch the STABILIZER C and D switchlights and verify INOP legends for C and D do not come on and INOP legends for A and B remain on.

(28) Reactivate A and B stabilizer servos as follows:

(a) Turn off hydraulic systems A and B. Wait until pressure decays to zero and then wait one additional minute.

NOTE: As the pressure drops in hydraulic systems A and B, all four INOP legends may come on and the stabilizer may move to the leading edge full up position (+1 degree on position indicator).

(b) Turn on hydraulic systems A and B (stabilizer must return to approximately 4 degrees). The A and B INOP legends must go off to indicate that left stabilizer servo (Captains) is now active. The C and D INOP legends must come on.

NOTE: If the A and B INOP legends do not go off after turning on hydraulic systems A and B, hydraulic pressure in the servo may not have decayed to zero; this prevents the bypass/shutoff valve from repositioning. To recheck, repeat Step 4C(28)(a) and, to ensure that system A and B pressure decays to zero, activate both inboard ailerons by latching AILERON L INBD and R INBD switchlights on PFCS panel, then rotate the Captains control wheel left and right and move control column fore and aft 4 inches several times. Unlatch AILERON L INBD and R INBD switchlights on PFCS panel, then repeat Step 4C(28)(b).

(29) On the pilots overhead circuit breaker panel, close the aft coupler circuit breakers:

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

(30) Depress C and D switchlights. The C and D INOP legends will go off.

(31) Release PITCH DISC handle on pilots center console and allow handle to retract into panel.

C (32) Close T/O aural WRN circuit breaker CB2H7.

NOTE: Steps 4C(33) through 4C(54) test the cross-tie interlock system.

(33) Inspect cross-tie cable, servo bellcranks and cross-tie spring cartridge for excessive wear (Ref. Fig. 507). If any of the six spring cartridge case tines are worn to over 25 percent of their cross sectional area or if more than two tines are worn, replace the spring cartridge (Ref. 27-41-24, 401). Tines that are bent inward toward spring may be straightened. Any other distortion (Ref. Fig. 507) is cause for replacement of spring cartridge.

(34) Visually verify smooth operation of cross-tie cable, servo bellcranks and cross-tie spring cartridge while stroking cables as follows:

(a) Unlatch C and D switchlights on PFCS panel; verify that cable strokes to the left (looking forward).

(b) Latch C and D switchlights; verify cable returns to neutral.

(c) Unlatch A and B switchlights; verify cable strokes to the right (looking forward).

(d) Latch A and B switchlights; verify cable returns to neutral.

(35) Unlatch switchlights A and B. The A and B INOP legends must come on.

(36) Unlatch switchlights C and D. The C and D INOP legends must not come on, verifying functional comparator prevents shutdown of second servo after one servo is shut down. Move control column to confirm right servo (C and D) is operational.

(37) Latch all four STABLIZER switchlights. The A and B INOP legends must go off.

(38) Unlatch switchlights C and D. The C and D INOP legends must come on.

(39) Unlatch A and B switchlights. The A and B INOP legends must not come on. Move control column to verify left servo is operational.

(40) Latch all four STABILIZER switchlights. The C and D INOP legends must go off.

(41) Verify cross-tie bungee is functioning by simultaneously unlatching all four STABILIZER switchlights. Only the C and D INOP legends must come on. Move control column to verify left servo (A and B) is operational.

(42) Latch all four STABILIZER switchlights. The C and D INOP legends must go off.

(43) Unlatch A and C switchlights. The A and C INOP legends must come on.

(44) Unlatch D switchlight. The A INOP legend must go off, and D INOP legend must come on.

(45) Latch D switchlight. The D INOP legend must go off, and A INOP legend must come on.

(46) Unlatch B switchlight. The B INOP legend must come on, and C INOP legend must go off.

(47) Latch B switchlight. The B INOP legend must go off, and C INOP legend must come on.

(48) Latch A and C switchlights. The A and C INOP legends must go off.

(49) Unlatch B and D switchlights. The B and D INOP legends must come on.

(50) Unlatch C switchlight. The C INOP legend must come on, and B INOP legend must go off.

(51) Latch C switchlight. The C INOP legend must go off, and B INOP legend must come on.

(52) Unlatch A switchlight. The A INOP legend must come on, and D INOP legend must go off.

(53) Latch A switchlight. The A INOP legend must go off, and D INOP legend must come on.

(54) Latch B and D switchlights. The B and D INOP legend must go off.

(55) Turn off all hydraulic power if no longer required (Ref. 29-11-00).

(56) Turn off electrical power if no longer required (Ref. 24-00-00).

5. Rigging Check and Adjustment

Rigging check and adjustment practices are presented separately for each part of the stabilizer control system. Each part may be rigged individually without disturbing the remainder of the system. The preparation and completion check procedures must be performed before and after any rigging check and adjustment. The following are the individual procedures:

PARAGRAPH	PROCEDURE
5A	Preparation
5B	Control Column Rigging
5C	Primary Cables Rigging
5D	Stabilizer Servo Control Linkages Rigging
5E	Stabilizer Servo Functional Comparator and Cross-tie Control System Rigging
5F	Stabilizer Servo Pressure Phasing Check
5G	Stabilizer Servo Left to Right Input Hysteresis and Adjustment Check
5H	Stabilizer Quick Rig Check
5I	Completion Check

CAUTION: DO NOT RIG STABILIZER CONTROL SYSTEM WITH SERVO FEEDBACK ARMS DISCONNECTED FROM STABILIZER, OR INTERNAL DAMAGE TO SERVO MAY RESULT.

NOTE: Before making a rigging check or adjustment, allow aircraft structure and cable temperature to stabilize. Do not operate air conditioning equipment while rigging the stabilizer control system.

After making a push rod adjustment, check for minimum thread engagement by verifying rod end thread is visible at inspection hole.

After adjusting dual push rods, to prevent preloading the push rod bearings, verify connecting bolts fit freely through both push rods.

After making a turnbuckle adjustment, check for minimum thread engagement by verifying no more than three threads are exposed on cable terminal. Also verify cable terminals do not block hole in center of turnbuckle and prevent proper engagement of locking clip.

Some cables are covered with polyolefin clear tubing to protect cables from corrosive spillage in galley and waste areas. When checking cable tension, verify tensiometer is NOT positioned on the polyolefin tubing area of the cable as results will be erroneous.

A. Preparation

(1) Shut off all four hydraulic systems (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

B. Control Column Rigging

(1) Open following access doors (Ref. 6-40-00):

(a) 112AB to forward electronic service center

(b) 316BB and 316CB to stabilizer push rods in afterbody

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(2) Disconnect forward end of push rods (1) and (2) (Ref. Fig. 501) from bellcranks (3) and (4) (located just aft of rear pressure bulkhead).

(3) Pull PITCH DISC handle on pilots center console and lock.

(4) Check adjustment of aft stop on Captains and First Officers control columns as follows:

(a) Tape protractor to aft face of control column.

(b) With control column against forward fixed stop, zero protractor.

(c) Move control column aft until control column contacts aft adjustable stop. Protractor must read 28 degrees. If not, remove column base cover and adjust stop.

(5) Release PITCH DISC handle and allow to retract into panel. Verify control columns are coupled together.

(6) Install rig pin R9 in bottom of Captains control column and bracket (this is the minus 4-degree rig position). (Install rig pin R9 by working from inboard hole in floor structure, through the control column and into hole in the outboard bracket.)With rig pin R9 installed in the control column, verify the following:

(a) Rig pin R3 fits freely through the Captains cable drive arm (7) and bracket. If not, adjust length of Captains pitch bungee (9).

NOTE: Witness hole for bungee rod end may be mislocated .21 inch too far aft. If rod end thread is not visible through witness hole, rod end is still in safety provided a maximum of 12 threads (.50 inch) protrude forward of nut.

(b) Rig pin R3 fits freely through the First Officers cable drive arm (8). If not, adjust length of First Officers pitch bungee (10).

NOTE: Witness hole for bungee rod end may be mislocated .21 inch too far aft. If rod end thread is not visible through witness hole, rod end is still in safety provided a maximum of 12 threads (.50 inch) protrude forward of nut.

(7) Remove all rig pins.

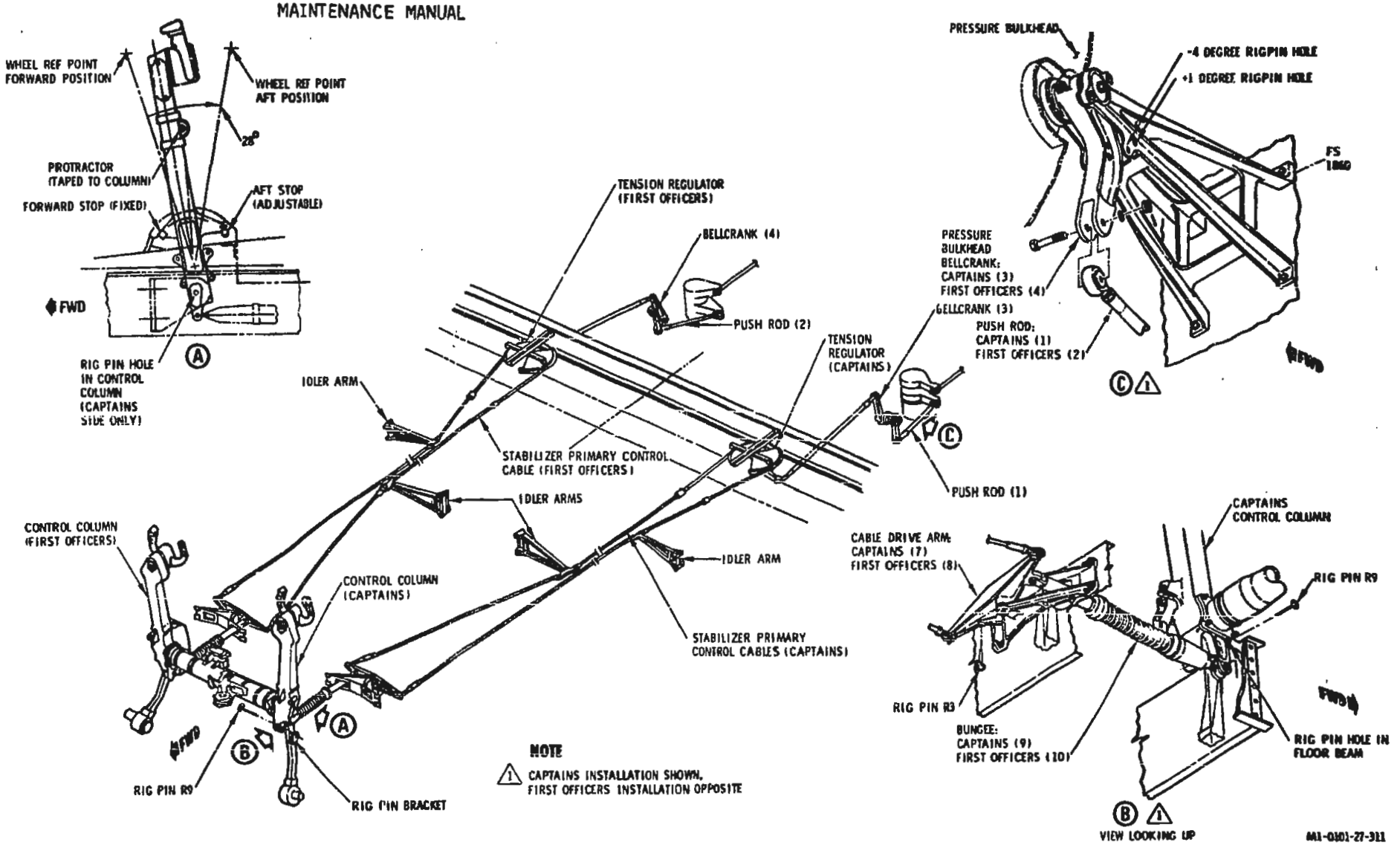
NOTE: If rigging check of primary cables is to be performed, disregard Steps 5B(8) and 5B(9) at this time.

(8) Reconnect push rod (1) to pressure bulkhead bellcrank (3), and push rod (2) to pressure bulkhead bellcrank (4).

(9) Close access doors opened in Step 5B(1).

C. Primary Cables Rigging

(1) Open following access doors and panels (Ref. 6-40-00):



R Control Column - Rigging Check and Adjustment
R Figure 501

EFFECTIVITY: ALL

001B

(a) 112AB to forward electronic service center

(b) 316BB and 316CB to stabilizer pressure bulkhead bellcranks in afterbody

(c) 824 (C-3 door) to aft cargo compartment

(d) 161AL (aft cargo compartment center aft bulkhead) to aft waste tank area

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(2) Disconnect forward end of push rods (1) and (2) (Ref. Fig. 502) from pressure bulkhead bellcranks (3) and (4).

(3) Install rig pins R3 in Captains and First Officers cable drive arms (7) and (8). Verify following:

(a) Rig pins (R2) fit freely through bracket and Captains tension regulator arm (15) and First Officers tension regulator arm (16).

(b) Cable tension conforms to temperature compensation chart (Ref. Fig. 502).

(c) The forward idler bellcrank is 4.82 (±0.38) inches aft of floor beam (measured between center of forward cable attach bolt and aft face of floor beam web).

(d) The aft idler bellcrank is 7.17 (±0.38) inches aft of the floor beam (measured between center of forward cable attach bolt and the aft face of floor beam web).

(4) If any of the above requirements cannot be met, adjust turnbuckles (17), (18), and (23) for Captains cable system, and (19), (20), and (24) for First Officers cable system.

NOTE: If cables are adjusted, remove all rig pins and slowly cycle control column fully forward and aft a minimum of five times to stabilize cables, then recheck cable rig in accordance with Step 5C(3).

(5) Remove all rig pins.

(6) Reconnect and safety push rod (1) to bellcrank (3), and push rod (2) to bellcrank (4).

(7) Close access doors opened in Step 5C(1).

D. Stabilizer Servo Control Linkages Rigging

(1) Open following access doors (Ref. 6-40-00):

(a) 316DB to stabilizer autopilot servo in afterbody

(b) 316BB and 316CB to stabilizer servo control linkages in afterbody

(c) 317AB and 317CB to stabilizer servos in afterbody

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(2) Verify stabilizer leading edge is in the plus 1-degree, full-up position (aircraft nose-down). (With no hydraulic pressure, stabilizer will move to the full stabilizer leading edge up (plus 1-degree) position.)

(3) Position pitch trim wheel to full nose-down trim.

(4) Disconnect dual push rods (25) and (26) (Ref. Fig. 503) from right servo input bellcrank (27).

(5) Disconnect dual push rods (28) and (29) from left servo input bellcrank (30).

(6) To safe the stabilizer, install Bertea rig pins through both left and right servo input arms (47) and (48), and into servo to lock servo in plus 1-degree position (Ref. Fig. 503, Sheet 2, View A).

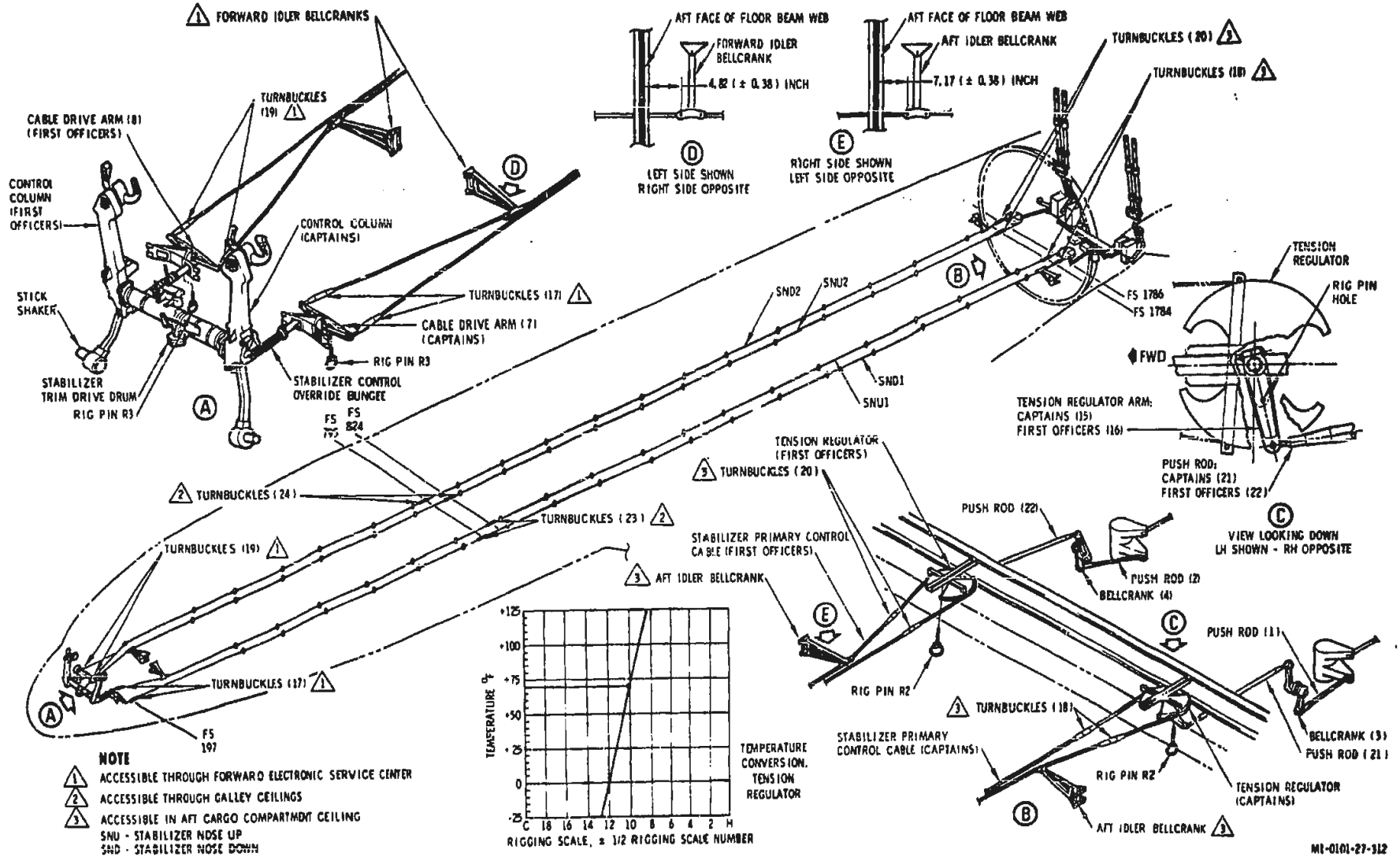
(7) Position pitch trim wheel to 4 degrees. Verify 4-degree trim position by verifying a rig pin R3 can be inserted in the pitch aft trim cable drum (Ref. 27-42-00, Fig. 501).

(8) Install rig pin R3 through autopilot servo output arm (31) (top arm) and into servo. If necessary, move controls to install rig pin.

CAUTION: THE FOLLOWING STEP 5D(9) IS CRITICAL; A HALF-TURN ERROR IN ROD END ADJUSTMENT OF PUSHRODS (33) AND (34) MAY RESULT IN IMPROPER OPERATION.

DO NOT PERFORM ANY RIGGING UNTIL STEP 5D(9) IS ACCOMPLISHED.

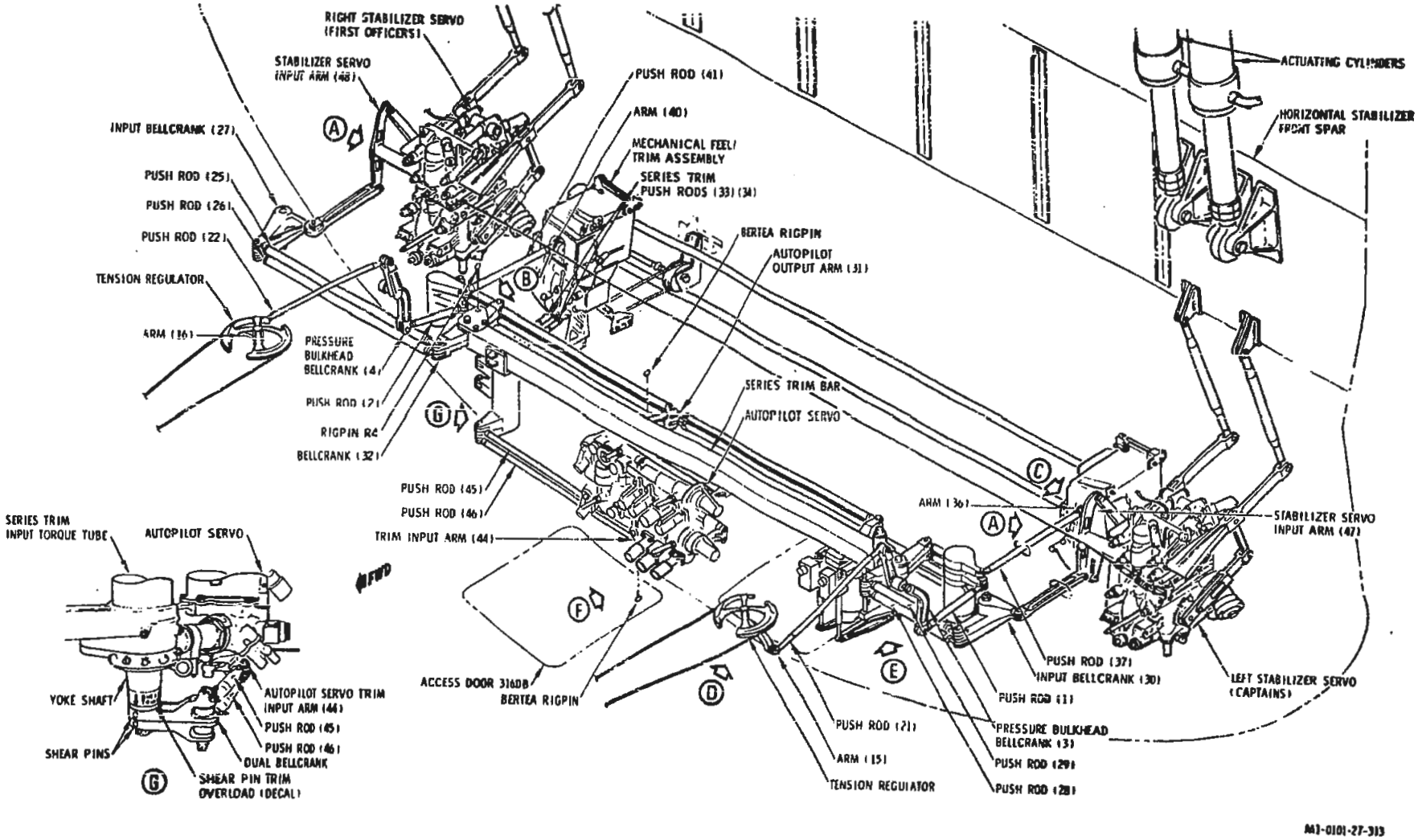
(9) Install rig pin R4 through series trim bar and bellcrank (32) (Ref. Fig. 503, Sheet 2, View B).



R Primary Cables - Rigging Check and Adjustment
R Figure 502

EFFECTIVITY: ALL

001B

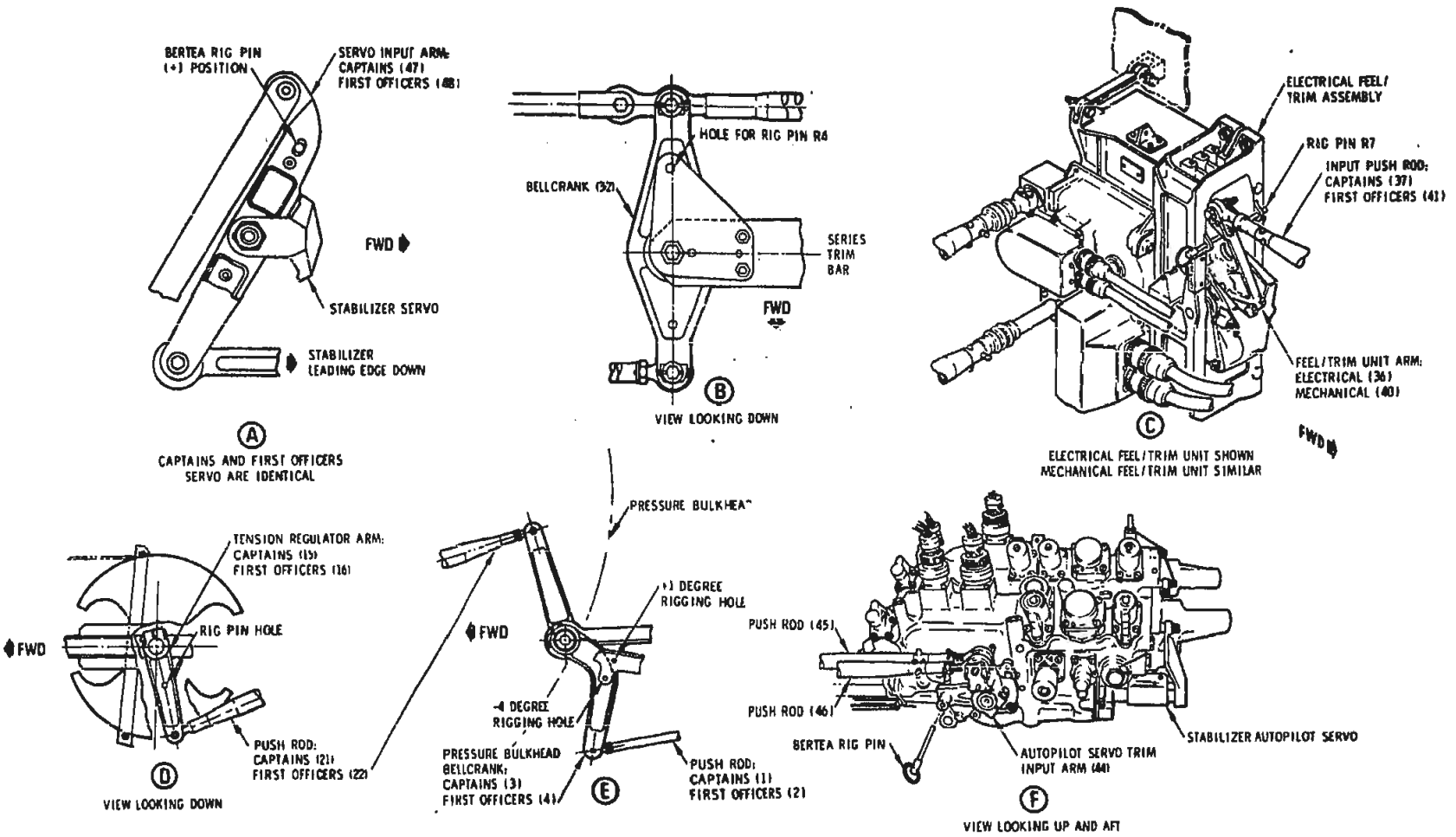


A41-0101-27-313

Stabilizer Servo Control Linkages - Rigging Check and Adjustment
Figure 503 (Sheet 1)

R
R
001B

EFFECTIVITY: ALL



M1-0102-27-314

Stabilizer Servo Control Linkages - Rigging Check and Adjustment
Figure 503 (Sheet 2)

Adjust series trim dual push rods (33) and (34) to allow installation of rig pin R4 in series trim bar.

NOTE: Adjustment of pushrods (33) and (34) can be facilitated by removing rig pin R4 from the series trim bar and rotating crank assemblies to clear pushrods.

(10) With rig pins installed in accordance with Steps 5D(8) and 5D(9) and pitch trim at 4 degrees, verify the following:

(a) Rig pin R7 fits freely through the mechanical (right) feel/trim unit and arm (40) (Ref. Fig. 503, Sheet 2, View C). If not, adjust push rod (41).

(b) Rig pin R7 fits freely through the electrical (left) feel/trim unit and arm (36). If not, adjust push rod (37).

(c) Bertea rig pin fits freely through autopilot servo trim input arm (44) and into bottom of servo. If not, adjust dual push rods (45) and (46) (Ref. Fig. 503, Sheet 2, View F).

(d) Rig pin R4 fits freely through Captains pressure bulkhead bellcrank (3) and lower (-4 degree) hole of bracket. If not, adjust push rod (1) (Ref. Fig. 503, Sheet 2, View E).

(e) Rig pin R4 fits freely through First Officers pressure bulkhead bellcrank (4) and lower (-4 degree) hole of bracket. If not, adjust push rod (2).

NOTE: Two shear pins (rivets) connect the dual bellcranks to the autopilot servo series trim input torque tube (Ref. Fig. 503, Sheet 1, View G). These pins are designed to shear if the autopilot servo jams. The pins will also shear if pushrods (45) and (46) are badly out of adjustment. The misadjusted pushrods will allow the autopilot servo input arm (44) to contact the internal stop before the feel/trim assembly trim limits are reached, thus overloading the shear pins. Sheared pins will cause heavy autopilot engage transients.

To verify shear pin integrity, apply

push-pull force (of approximately 35 to 45 pounds) to pushrods (45) and (46) or to bellcranks. Determine there is no movement between bellcranks and yoke shaft. If there is movement between bellcranks and yoke shaft, replace shear pins.

(11) With rig pin R4 installed in Captains pressure bulkhead bellcrank (3) and bracket minus 4-degree hole, rig pin R2 must fit freely through Captains tension regulator bracket and arm (15) (Ref. Fig. 503, Sheet 2, View D). If not, adjust push rod (21).

(12) With rig pin R4 installed in First Officers pressure bulkhead bellcrank (4) and bracket minus 4-degree hole, rig pin R2 must fit freely through First Officers tension regulator bracket and arm (16). If not, adjust push rod (22).

(13) Remove all rig pins except those in stabilizer servo input arms (47) and (48).

(14) Position pitch trim wheel in flight station to zero degrees trim.

(15) Install rig pins R4 in both the Captains and First Officers pressure bulkhead bellcranks (3) and (4) and upper (+1 degree) hole of bracket. Push on control column to align holes in pressure bulkhead bellcranks.

(16) Verify Bertea rig pins are installed through both left and right stabilizer servo input arms (47) and (48) and into servo.

(17) On left (Captains) side, adjust dual push rods (28) and (29) [removed in Step (5)] to fit between connecting bellcranks. This is a preliminary adjustment. Pushrods (28) and (29) will be fine tuned during the pressure phasing check (Paragraph F).

NOTE: Push rods (25), (26), (28), and (29) have fine and coarse adjustments. The rod ends are both right-hand threads, but the thread pitch is different. A coarse adjustment is made by removing a rod end bolt and rotating the rod end. A fine adjustment is made by loosening the jam nuts on both rod ends and rotating the push rod.

(18) On right (First Officers) side, adjust dual push rods (25) and (26) [removed in Step 5D(4)] to fit between connecting bellcranks. After adjustment, verify equal

length of dual push rods by ensuring that connecting bolts fit freely through both rod ends.

(19) Rotate push rod (26) one-half turn in either direction to preload bearings slightly (do not turn rod ends). DO NOT PRELOAD MORE THAN ONE-HALF TURN.

(20) Remove ALL rig pins.

NOTE: Dual pushrods (28) and (29) on left (Captains) side are adjusted during servo pressure phasing, Paragraph F.

(21) Perform Paragraphs E and F in sequence. Pressure phasing (Para. F) must be the last check and adjustment made on stabilizer control system.

E. Stabilizer Servo Functional Comparator and Cross-tie Control System Rigging

(1) Open access doors 316BB, 316CB and 317AB (Ref. 6-40-00) to gain access to stabilizer servos.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: VERIFY THERE ARE NO RIG PINS IN ANY PART OF STABILIZER CONTROL SYSTEM, ESPECIALLY IN THE STABILIZER SERVO INPUT ARM AND SERVO.

(2) Turn on all four hydraulic systems A, B, C, and D (Ref. 29-11-00).

NOTE: The hydraulic pressure requirements are as follows:

With four systems turned on, the minimum hydraulic pressure in each hydraulic system must be 2700 psi, steady state.

The sum of the system hydraulic pressures on one side must be within 400 psi of the sum of hydraulic pressures on the other side. As an example, A and B each are 2700 psi and C and D each are 2900 psi; the sum on one side of the airplane, A + B, equals 5400 while, on the other side, C + D equals 5800. Since 5400 is within 400 psi of 5800, the pressures are acceptable.

(3) Verify index pin on left servo comparator arm (55) is between mid-position and the outboard etched line on servo boss (Ref. Fig. 504, View C).

(4) If the left servo comparator arm is correct, verify the index pin on the right servo comparator arm (56) is between the mid position and the outboard etched line, as close to the outboard etched line (red zone) as possible (Ref. Fig. 504, View D).

NOTE: If the right comparator arm is not properly positioned, pushrod (57) is grossly out of adjustment (minor mis-adjustment of pushrod (57) will only affect the left comparator arm).

(5) If left comparator arm is mis-located, adjust as follows:

(a) Note position of the left servo comparator arm (55) index pin.

(b) Turn off all hydraulic power.

(c) Inspect the cross-tie cable (Ref. Fig. 504). Verify the cable is under the pulley keeper pins.

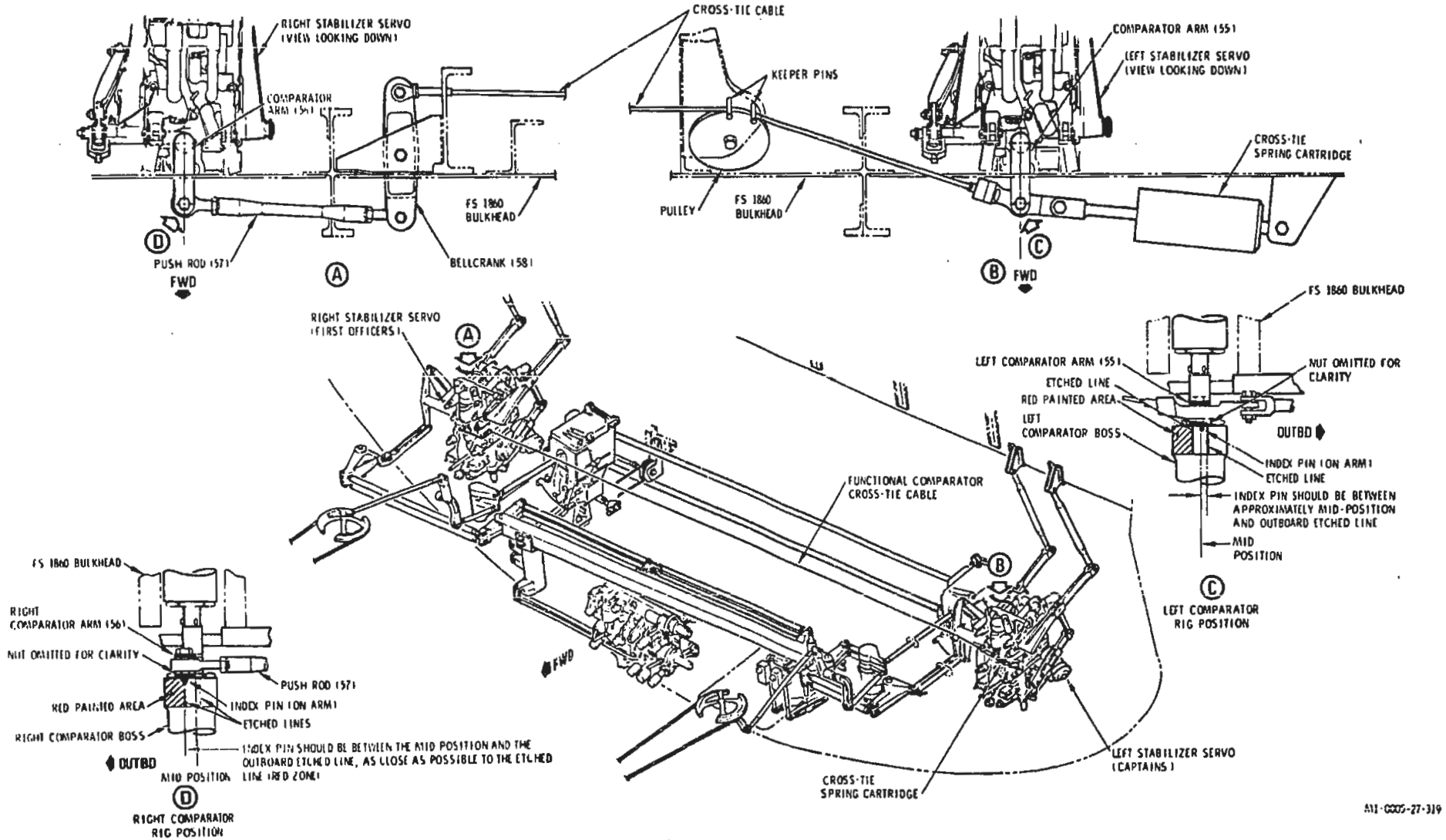
(d) Disconnect one end of pushrod (57) and adjust: lengthen to move left servo comparator arm inboard, shorten to move comparator arm outboard. One full turn of rod-end will change pushrod length 0.044 inch and move the left index pin 0.029 inch.

(e) Reconnect pushrod.

(f) Turn on all four hydraulic systems.

(g) Recheck adjustment as outlined in Steps 5E(3) and 5E(4).

(h) Perform the Stabilizer Servo Functional Comparator Cross-tie Interlock System Test (Para. 4C); this



R Stabilizer Servo Functional Comparator and Cross-tie Control System
R Rigging Check and Adjustment
R Figure 504

EFFECTIVITY: ALL

001B

test will verify correct adjustment of pushrod (57).

(6) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(7) Close access door opened in Step 5E(1).

CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH FULL STABILIZER THROWS TO CHECK FOR ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE STABILIZER SERVO OPERATING LINKAGE. CORRECT INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR ASSOCIATED STIFFENER.

F. Stabilizer Servo Pressure Phasing Check

NOTE: The pressure phasing check verifies correct "hydraulic" rigging between the left and right stabilizer servos to ensure that the hydraulic pressure differentials between the servos are within acceptable limits. This is accomplished by noting the stabilizer movement as one servo is shut down and the stabilizer comes to rest after an initial jump.

Stabilizer movement can be determined by using the BF75 attitude indicator tool, six inch scales (decimal scale preferred), or by using masking tape and marking the tape before and after the servo is shut off to measure the difference. Use form (Fig. 506) to record data.

When using masking tape or six inch scales, tape lock-wire on stabilizer fairing leading edge and use as pointer.

If using masking tape or scales, the tape or scales can be installed at the three locations on the left side of the fuselage before starting test (Ref. Fig. 505).

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 AFT COUPLER and NO. 2 AFT COUPLER (to prevent aft coupler from opening).

(2) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: VERIFY THAT THERE ARE NO RIG PINS IN THE STABILIZER CONTROL SYSTEM, ESPECIALLY IN THE STABILIZER SERVO INPUT ARM AND SERVO.

(3) Turn on hydraulic systems A, B, C, and D (Ref. 29-11-00).

NOTE: For servo pressure phasing check, the hydraulic pressure requirements are as follows:

With four systems turned on, the minimum hydraulic pressure in each hydraulic system must be 2700 psi, steady state. The hydraulic flow capability must be compatible with the requirements of the test (1 in./sec column rate at -10 degrees stabilizer angle requires approximately 7.5 gpm per system; -10 degrees is highest flow requirement).

The sum of the system hydraulic pressures on one side must be within 400 psi of the sum of hydraulic pressures on the other side. As an example, A and B each are 2700 psi and C and D each are 2900 psi; the sum on one side of the airplane, A + B, equals 5400 while, on the other side, C + D equals 5800. Since 5400 is within 400 psi of 5800, the pressures are acceptable.

(4) Slowly cycle control column fully forward and aft five times to normalize servos.

R (5) Move stabilizer to minus 6-degree position with pitch
R trim wheel in flight station. On APFDS panel engage A/P A to CMD and then to CWS.

R (6) Verify measuring device is installed to measure stabilizer movement.

R (7) Pull Captains control column aft approximately two
R inches, then slowly return column to trim position by
R relaxing the pull. To keep from overshooting, do not
R return faster than one inch per second.

R (8) Mark or record stabilizer left leading edge position. Shut down left servo by unlatching the STABILIZER A and B switchlights on PFCS panel. Note the stabilizer left
R leading edge movement and direction of movement on measuring device. Verify INOP legends on A and B switchlights come on.

NOTE: INOP legend is actuated by a pressure switch on the stabilizer servo to indicate hydraulic pressure is shut off at servo. If INOP legend does not come on, determine cause.

R (9) If movement is more than 0.050 inch, turn off all hydraulic power (Ref. 29-11-00) and adjust left servo dual push rods (28) and (29) equally (Ref. Fig. 503). If stabilizer leading edge moved down, shorten push rods; if stabilizer leading edge moved up, lengthen push rods.

NOTE: Connecting and disconnecting of pushrods (28) and (29) is easier if manual pitch trim wheel is in 0-degree position.

(a) To adjust pushrods (28) and (29), disconnect outboard end of lower pushrod (28) from bellcrank (30) and swing clear. Adjust upper pushrod (29) to meet requirements of Steps 5F(8) and 5F(9). Then adjust lower pushrod to match length of upper pushrod and connect to bellcrank. After adjustment, verify equal length of pushrods by ensuring that bolts fit freely through both rod ends. Then rotate pushrod (28) one-half turn to preload bearings slightly (do not turn rod ends). DO NOT PRELOAD MORE THAN ONE-HALF TURN.

NOTE: Pushrods (28) and (29) have fine and coarse adjustments. The rod ends are both right-hand threads, but the thread pitch is different. A coarse adjustment is made by removing a rod end bolt and rotating the rod end. A fine adjustment is made by loosening the jamnuts on both rod ends and rotating the pushrod as a turnbarrel. One full turn of the pushrod (as a turnbarrel) will move surface 0.10 inch. When making a fine adjustment watch coarse thread to

determine if pushrod is shortening or lengthening.

(10) After pushrod adjustment, turn on hydraulic systems A, B, C, and D (Ref. 29-11-00) and repeat Steps 5F(5) through 5F(9).

(11) Latch STABILIZER A and B switchlights on PFCS panel.

(12) Move stabilizer to 0-degrees and then to minus 10 degrees with trim wheel. At both positions, repeat Steps 5F(7), 5F(8) and 5F(9). Stabilizer movement should not be more than 0.40 inch. If movement in either position exceeds 0.40 inch, check for the following possible causes [do not adjust pushrods (28) and (29)]:

(a) Hydraulic supply pressure on all four systems is not 3000 (±100) psi (this is extremely important).

(b) Aft coupler is open (should be closed)

(c) Functional comparator and crosstie control system is misrigged (See Para. 5E)

(d) Bent pushrods in stabilizer afterbody linkage

(e) Loose or worn linkage connections in stabilizer afterbody linkage

(13) Latch STABILIZER A and B switchlights on PFCS panel.

(14) Remove tags and close circuit breakers opened in Step 5F(1).

(15) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(16) Turn off electrical power if no longer required (Ref. 24-00-00).

G. Stabilizer Servo Left to Right Input Hysteresis and Adjustment Check

NOTE: The hysteresis check determines if excessive looseness or friction is present in the stabilizer control system. This is accomplished by positioning the stabilizer to three positions and checking
R stabilizer movement when one servo is turned off. Use form (Fig. 506) to record data.

Before accomplishing the hysteresis check, the pitch

servo control mechanisms must be properly rigged (Para. D and E) and the servo pressure phasing (Para. F) check must be accomplished first.

R Stabilizer movement can be determined by using the BF75 attitude indicator tool, a six inch scale (decimal scale preferred), or by using masking tape and marking the tape before and after the servo is shut off and then measuring the difference.

When using the masking tape or six inch scales, tape lock-wire on stabilizer fairing leading edge and use as a pointer.

If using the 6-inch scale, or masking tape, the scales or tape can be positioned on the fuselage in the six locations (three on each side) before starting test (Ref. Fig. 505).

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 AFT COUPLER (B9) and NO. 2 AFT COUPLER (B27) (to prevent aft coupler from opening).

(2) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A, B, C, and D (Ref. 29-11-00).

NOTE: For hysteresis and adjustment check, the hydraulic pressure requirements are as follows:

With four systems turned on, the minimum hydraulic pressure in each hydraulic system must be 2700 psi, steady state. The hydraulic flow capability must be compatible with the requirements of the test (1 in./sec column rate

at -10 degrees stabilizer angle requires approximately 7.5 gpm per system; -10 degrees is highest flow requirement).

The sum of the system hydraulic pressures on one side must be within 400 psi of the sum of hydraulic pressures on the other side. As an example, A and B each are 2700 psi and C and D each are 2900 psi; the sum on one side of the airplane, A + B, equals 5400 while, on the other side, C + D equals 5800. Since 5400 is within 400 psi of 5800, the pressures are acceptable.

(4) Slowly cycle control column fully forward and aft five times to normalize servos.

(5) Move stabilizer leading edge to 6-degree position (aircraft NOSE UP) (as indicated on the Captains pitch trim wheel indicator) with the electrical trim thumb wheel. (Verify stabilizer position on surface position indicator on pilots center instrument panel.)

(6) Install one of the following measuring devices:

(a) BF75 attitude indicator tool

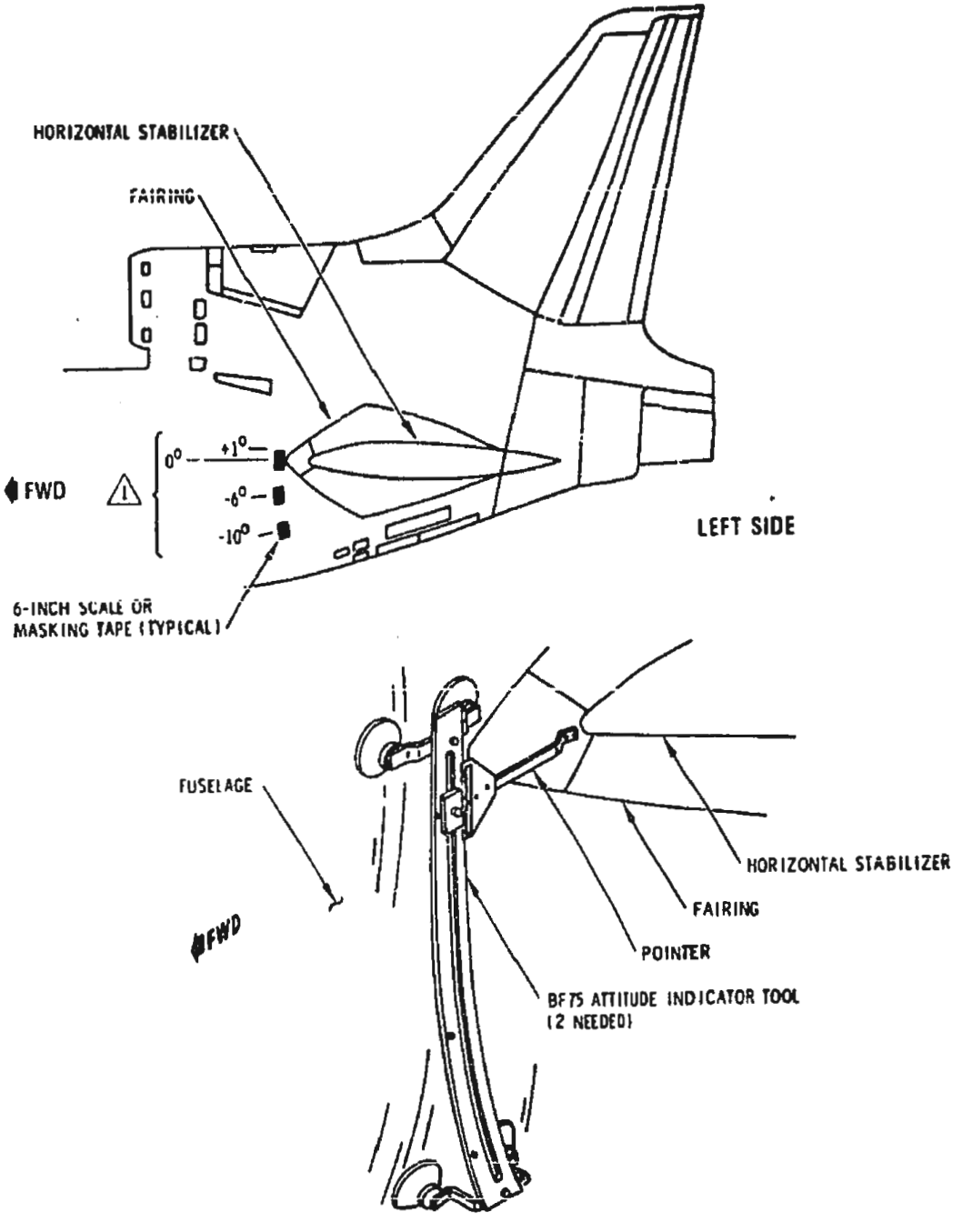
(b) Six inch scale taped on fuselage adjacent to stabilizer fairing leading edge. Tape lock-wire on stabilizer fairing leading edge for use as a pointer.

(c) Masking tape on fuselage adjacent to stabilizer fairing leading edge. Tape is to be marked before and after shut off. Tape lock-wire on stabilizer fairing leading edge for use as a pointer.

(7) Pull Captains control column aft approximately two inches, then slowly return column to trim position by relaxing the pull. To keep from overshooting, do not
R return faster than one inch per second. Engage A/P A
R to CMD and then to CWS (on APFDS panel).

R (8) Mark or record stabilizer right and left leading edge
R position. Shut down left servo by unlatching the
R stabilizer A and B switchlights on PFCS panel. Measure
R (and record) the stabilizer movement and the direction
R of movement of the right and left leading edges. Verify that INOP legend on A and B switchlights come on. AFT CPLR OPEN legend MUST NOT come on.

NOTE: INOP legend are actuated by switches on stabilizer servo to indicate hydraulic pressure



NOTE

1 6-INCH SCALE OR MASKING TAPE CAN BE INSTALLED BEFORE TURNING ON HYDRO PRESSURE. LEADING EDGE OF STABILIZER FAIRING MOVES APPROXIMATELY 3.1 INCH PER DEGREE WITH HYDRO OFF, STABILIZER IS AT +1 DEGREE

M1-0102-27-157

Stabilizer Pressure Phase and Hysteresis Check
Figure 505

AIRCRAFT:	DATE:	STATION:
HYDRAULIC PRESSURE SOURCE:		

HYD PRESS. INDICATIONS:	SYS A	SYS B	SYS C	SYS D

STABILIZER SERVO PRESSURE PHASING CHECK

STABILIZER TRIM POSITION	STABILIZER SERVO SHUT DOWN	LEFT STABILIZER LEADING EDGE MOVEMENT
-6 DEG	A–B (LEFT)	_____ (0.050 INCH MAX)
0 DEG	A–B (LEFT)	_____ (0.40 INCH MAX)
-10 DEG	A–B (LEFT)	_____ (0.40 INCH MAX)

STABILIZER SERVO LEFT TO RIGHT HYSTERESIS CHECK

STAB TRIM POSITION	CONTROL COLUMN AND FORCE DIRECTION	STAB SERVO SHUT DOWN	STABILIZER LEADING EDGE MOVEMENT (MOTION UP = "+"; MOTION DOWN = "–")		ALGEBRAIC DIFFERENCE (1)
			LEFT STAB	RIGHT STAB	
-6 DEG (STEPS 4–10)	NONE	A–B (LEFT)	_____ (0.05 INCH MAX)	_____ (0.05 INCH MAX)	_____ (0.08 INCH MAX)
2 DEG (STEPS 11–17)	CAPT PULL	A–B (LEFT)	_____	_____	_____ (0.40 INCH MAX)
-10 DEG (STEPS 18–24)	CAPT PUSH	A–B (LEFT)	_____	_____	_____ (0.40 INCH MAX)
-10 DEG (STEPS 25–29)	FO PUSH	C–D (RIGHT)	_____	_____	_____ (0.40 INCH MAX)
-10 DEG (STEPS 30–34)	NONE	A–B (LEFT)	_____	_____	_____ (0.40 INCH MAX)
-10 DEG (STEPS 35–38)	NONE	A–B (LEFT)	_____	_____	_____ (0.40 INCH MAX)

(1) IF MOTION IS UP ON ONE SIDE AND DOWN ON OTHER, ADD THE TWO VALUES. IF MOTION IS IN THE SAME DIRECTION (BOTH UP OR DOWN) SUBTRACT THE SMALLER VALUE FROM THE LARGER

M1–0007–27–485

R Stabilizer Servo Pressure Phasing and Hysteresis
R Check Recording Form
R Figure 506

shutoff at SERVO. If INOP legend does not come on, determine cause.

(9) Find the algebraic difference of the movement at the stabilizer right and left leading edges. (If the movement is up on one side and down on the other, add the two values. If the movement is in the same direction, i.e., both sides up or down, subtract the smaller value from the larger value.)

The difference of the movement on the two sides must not exceed 0.080 inch, and neither side must exceed 0.050 inch movement. If either of the above is exceeded, check servo pressure phasing in accordance with Paragraph 5F.

(10) Latch stabilizer A and B switchlights on PFCS panel. Verify the INOP legends on the A and B switchlights go off. Disengage A/P A (on APFDS panel).

R R (11) Move stabilizer to 2 degrees with the electrical trim thumb wheel.

(12) Pull Captains column against the aft column stop and firmly hold it against stop. (The required force will be approximately 90 pounds.)

NOTE: Do not pull on First Officers column to assist, since doing so will affect the test results.

(13) Verify measuring device is installed to measure stabilizer movement at this location.

(14) Mark or record stabilizer right and left leading edge position. Shut down left servo by unlatching the stabilizer A and B switchlights on the PFCS panel. Verify INOP legends on A and B switchlights come on. Measure (and record) the stabilizer movement and the direction of the movement of the right and left leading edge fairings. Record either the final at rest position or the initial "jump" position whichever is less.

(15) Relax pull force and allow control column to slowly return to trim position no faster than one inch per second.

(16) Find the algebraic difference of the movement at the right and left leading edges; as in Step 5G(9). If difference is less than 0.40 inches, continue to Step 5G(17). If the difference is greater than 0.40 inches,

check for backlash in the following components in the order listed; repair or replace components as required:

(a) Forward torque tube and pitch disconnect mechanism (Ref. 27-41-03). (Move control columns in opposition to each other; check for backlash at control column flange attachment to torque tube and at disconnect clutch teeth.)

(b) Backlash in the forward override bungees or worn attaching bushings (Ref. 27-41-06, Fig. 401).

(c) Loose series trim push rod bearings (33) and (34) (Ref. 27-41-00, Fig. 503).

(d) Check aft pitch coupler. The rollers on the levers attached to the electrical actuators must be free to rotate and not be engaging coupler releasing collar (Ref. 27-41-13, Fig. 401).

(e) Check for backlash in aft pitch coupler by loading the Captains output arms against the First Officers output arms. Check in both directions.

(f) Check for looseness in the series trim bar assembly and its supporting yoke assemblies at both ends (Ref. 27-41-00, Fig. 503, Sheet 1).

(g) Loose mechanical pitch feel/trim assembly mounting bolts (Ref. 27-41-17, Fig. 401).

(h) Worn or broken bearings in any of the pushrods, bellcranks, and supporting brackets of the servo mechanism controls (Ref. 27-41-00, Fig. 503).

(17) Latch stabilizer A and B switchlights. Verify INOP legends go off.

(18) Move stabilizer to 10 degrees (aircraft NOSE UP) with the electrical trim thumb wheel.

(19) Push Captains column forward against the forward control column stop and firmly hold it against the stop (the required force will be approximately 90 pounds).

NOTE: Do not push on First Officers column to assist; to do so will affect the test results.

R (20) Verify measuring device is installed to measure stabilizer movement at this location.

(21) Mark or record stabilizer right and left leading edge position. Shut down left servo by unlatching the stabilizer A and B switchlights on the PFCS panel. Verify the INOP legends on the A and B switchlights come on. Measure and record the stabilizer movement and the direction of movement of the right and left leading edge fairings. Record either the final at rest position or the initial "jump" position whichever is less.

(22) Relax push force and allow control column to slowly return to trim position no faster than one inch per second.

(23) Find algebraic difference of the movement at the right and left leading edges as in Step 5G(9). If the difference is less than 0.40 inches, continue to Step 5G(24). If the difference is greater than 0.40 inches, check for backlash as outlined in Step 5G(16).

(24) Latch stabilizer A and B switchlights. The A and B INOP legends must go off.

(25) Push First Officers control column forward against the forward control column stop and firmly hold it against the stop.

NOTE: Do not push on Captains column to assist; to do so will affect the test results.

(26) Mark or record stabilizer right and left leading edge position. Shut down right servo by unlatching the stabilizer C and D switchlights on the PFCS panel. Verify the INOP legends on the C and D switchlights come on. Measure (and record) the stabilizer movement and the direction of movement of the right and left leading edge fairings.

(27) Relax push force and allow control column to slowly return to trim position no faster than one inch per second.

(28) Find the algebraic difference of the jump as in Step 5G(9). The difference should be less than 0.40 inches.

NOTE: The value obtained in this test should be within 0.20 inches of value in Step 5G(23). Disregard the direction of motion when comparing values; i.e., the value in Step 5G(23) may be due surface moving up and the value in this test may be due to down motion; only the difference in values should be compared. A value of 0.40 in

Step 5G(23) will require a value of 0.20 to 0.40 in this test; whereas, a value of 0.20 in Step 5G(23) permits a range of algebraic difference from 0.00 to 0.40 for this test to meet requirements. If the difference is greater than the limits in this Step 5G(23), check for backlash as outlined in Step 5G(16).

(29) Latch stabilizer C and D switchlights. The C and D INOP legends must go off.

(30) Verify measuring device is installed to measure stabilizer jump at this location.

(31) Pull Captains column aft approximately two inches, then slowly relax the pull on the column permitting it to return to trim no faster than one inch per second.

(32) Mark or record stabilizer right and left leading edge position. Shut down left servo by unlatching the stabilizer A and B switchlights on the PFCS panel. Verify the INOP legends on the A and B switchlights come on. Measure (and record) themovement at both surfaces.

(33) Find the algebraic difference of the movement as in Step 5G(9). The difference should be less than 0.40 inches.

(34) Latch stabilizer A and B switchlights. The INOP legends must go off.

(35) Push Captains control column forward approximately two inches and slowly relax the push force permitting it to return to trim no faster than one inch per second.

(36) Mark or record stabilizer right and left leading edge position. Shut down left servo by unlatching the stabilizer A and B switchlights. Verify INOP legends on the A and B switchlights come on. Measure (and record) movement at both surfaces.

(37) Find the algebraic difference of the movement as in Step 5G(9). The difference should be less than 0.40 inches. The value obtained in this test should be within 0.20 inches of the value measured in Step 5G(33). Disregard the direction of motion when comparing values. If the values are not within the above limits [also if Step 5G(33) is greater than 0.40 inches] check for backlash as follows; repair or replace components as required:

(a) Check pitch trim travel range on trim wheel. The trim wheel should move 0 degrees to minus 10 degrees.

(b) Check for backlash in the pushrods, bellcranks, and support bracketry between LH and RH power servos (Ref. 27-41-00, Fig. 503).

(c) Verify aft pitch coupler is closed. The rollers on the levers attached to the electrical actuators must be relatively free to rotate. If too tight, adjust the rod ends on the actuators till the rollers are free (Ref. 27-41-13, Fig. 401).

(d) Check for looseness in series trim bar supporting yoke assemblies at both ends (Ref. 27-41-00, Fig. 503, Sheet 1).

(e) Check remaining components called out in Step 5G(16).

(f) Verify that hydraulic supply pressure meets requirement of Step 5G(3) NOTE.

(38) Latch stabilizer A and B switchlights on PFCS panel. A and B INOP legends must go out.

(39) Remove tags and close circuit breakers opened in Step 5G(1).

(40) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(41) Turn off electrical power if no longer required (Ref. 24-00-00).

(42) Remove measuring devices from stabilizer fairing and fuselage.

H. Stabilizer Quick Rig Check

This procedure can be used to determine that the horizontal stabilizer neutral rig position and total displacement is within tolerance. If the horizontal stabilizer neutral position or displacement is out of tolerance, check rigging of the system in accordance with sections B through G.

NOTE: The travel of the stabilizer leading edge can be measured to determine stabilizer angle. Tool PN BF75 (Ref. 27-41-00, Adjustment and Test, Fig. 505) can be used or stabilizer fairing leading edge can be measured directly. The stabilizer fairing leading

edge moves approximately 3.0 inches per degree of stabilizer motion. With hydraulic power off, the stabilizer (and the fairing) is at +1 degree. Starting from +1 degree, the stabilizer fairing leading edge moves as follows to the angles noted:

+1 degree - 0.0 inches (Full aircraft nose-down, also *hydro off position*)

-4 degrees - 14.74 (±0.5) inches (neutral position)

-13.8 degrees - 43.53 inches (Full aircraft nose-up position)

(1) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic system A, B, C, and D (Ref. 29-11-00).

(3) Slowly cycle control column full forward and aft several times to stabilize control system.

(4) On pilots overhead panel, verify MACH indicator on MACH FEEL panel reads minimum (.4) MACH.

(5) Position trim wheel to 4 degree trim position with the pitch electrical trim thumb wheel.

(6) From the forward electronic service center, install rig pin (R9) in bottom of Captains control column and bracket (this is the 4-degree neutral rig position). (Install rig pin R9 by working from inboard hole in floor structure, through the control column and into hole in outboard bracket.)

WARNING: DO NOT TURN OFF HYDRAULIC POWER WITH RIG PIN IN CONTROL COLUMN OR DAMAGE TO CONTROL COLUMN CAN RESULT.

(7) With rig pin R9 installed in the Captains control column, stabilizer should be in the neutral position [stabilizer fairing leading edge moves down 14.74 (±0.5) inches down from the stabilizer leading edge full up position].

(8) Remove rig pin R9 from the Captains control column.

(9) Position control column full aft. Verify stabilizer fairing leading edge moves down from the full up position a minimum of 43.53 inches.

(10) Slowly return control column to neutral.

(11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

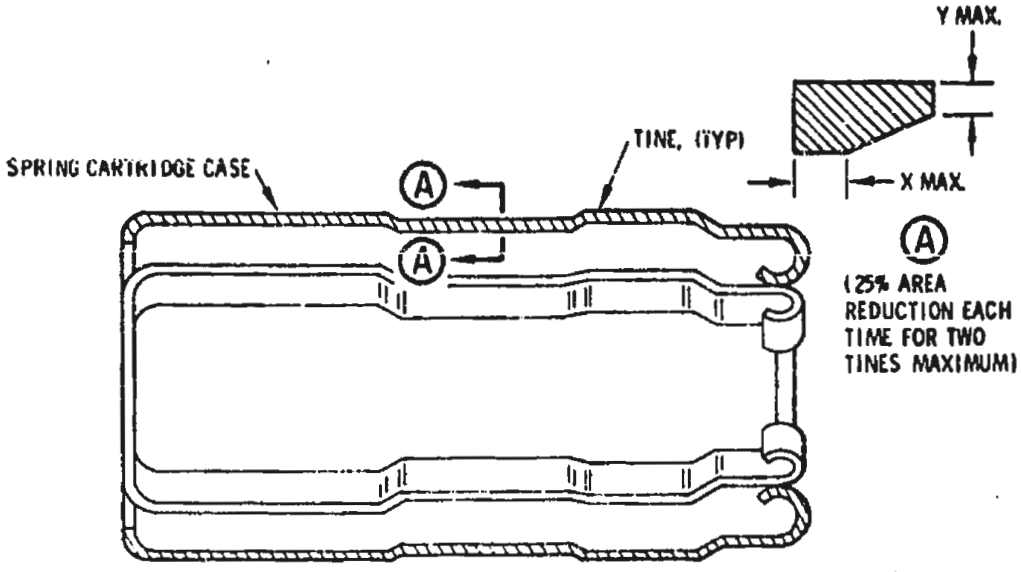
(12) Turn off electrical power if no longer required (Ref. 24-00-00).

(13) If the horizontal stabilizer neutral position and minimum displacement is within tolerance, then the horizontal stabilizer is in acceptable rig. However, the above check does not verify left to right stabilizer servo phasing (Stabilizer Servo Pressure Phasing Check, Paragraph F.), or check for excessive looseness or friction in the control system (Stabilizer Servo Left to Right Input Hysteresis and Adjustment Check, Paragraph G.).

I. Completion Check

(1) Remove tags installed on hydraulic panels in Step 5A(2).

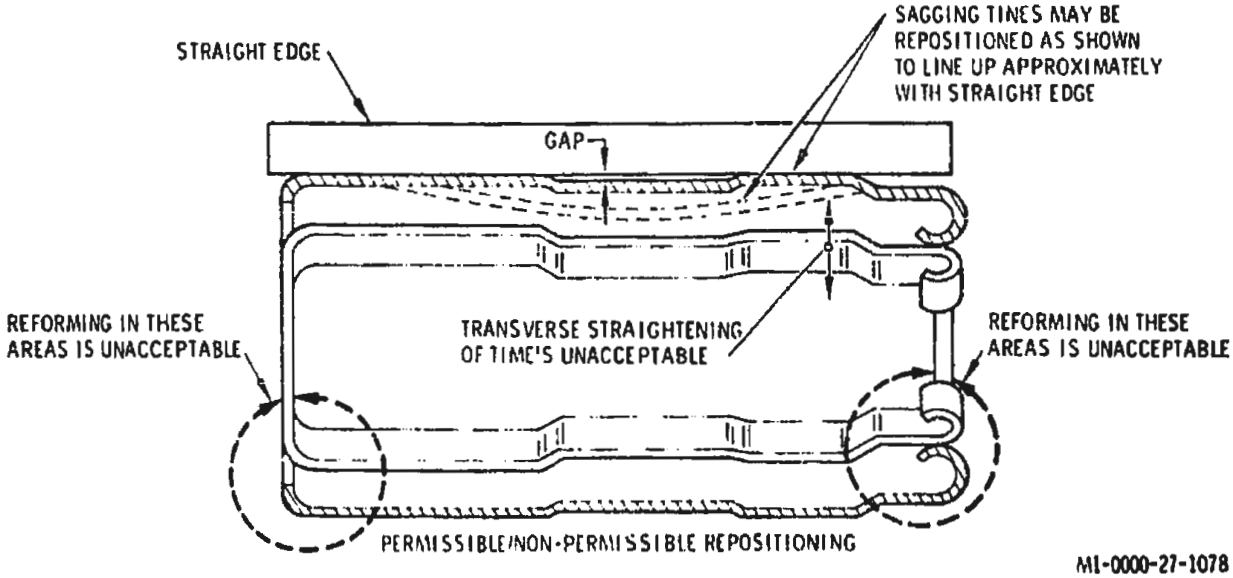
(2) Perform Operational Test of Horizontal Stabilizer Control System (Ref. Para. 4A).



TABULATION

X DIM. MIN.	Y DIM. MIN.	X DIM. MIN.	Y DIM. MIN.	X DIM. MIN.	Y DIM. MIN.
0.005	0.030	0.050	0.022	0.090	0.012
0.010	0.028	0.055	0.021	0.095	0.011
0.015	0.028	0.060	0.020	0.100	0.009
0.020	0.027	0.065	0.019	0.105	0.007
0.025	0.026	0.070	0.018	0.110	0.005
0.030	0.025	0.075	0.016	0.115	0.003
0.040	0.024	0.080	0.015	0.120	0.001
0.045	0.023	0.085	0.013		

INSPECTION CRITERIA


STRAIGHT EDGE
SAGGING TINES MAY BE REPOSITIONED AS SHOWN TO LINE UP APPROXIMATELY WITH STRAIGHT EDGE
GAP
REFORMING IN THESE AREAS IS UNACCEPTABLE
TRANSVERSE STRAIGHTENING OF TINES UNACCEPTABLE
REFORMING IN THESE AREAS IS UNACCEPTABLE
PERMISSIBLE/NON-PERMISSIBLE REPOSITIONING

MI-0000-27-1078

R Stabilizer Servo Cross-tie Spring Cartridge Case
R Figure 507

R EFFECTIVITY: ALL
R
001B

HORIZONTAL STABILIZER CONTROL SYSTEM - INSPECTION AND CHECK

1. General

This procedure can be used as an aid in troubleshooting the pitch control system to determine that system friction and surface travel are within tolerance. If the horizontal stabilizer does not move to the indicated minimum angle or control system friction is excessive, perform hysterisis check as outlined in 27-41-00, Adjustment and Test, Para. 5G.

2. Equipment and Materials

Horizontal Stabilizer Attitude Indicator, PN BF75, or equivalent

Force Gage, Chatillon 0 to 100 pounds, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Inspection/Check

NOTE: The travel of the stabilizer leading edge can be measured to determine stabilizer angle. Tool PN BF75 (Ref. 27-41-00, Adjustment and Test, Fig. 505) can be used or stabilizer fairing leading edge can be measured directly.

R The stabilizer fairing leading edge moves approximately
R 3.0 inches per degree of stabilizer motion. With
R hydraulic power off, the stabilizer (and the fairing) is
R at +1 degree. Starting from +1 degree, the stabilizer
R fairing leading edge moves as follows to the angles
R noted:

R +0.6 degrees - 1.18 inches

R 0.0 degrees - 2.95 inches

R -4 degrees - 14.74 inches

-10 degrees - 32.40 inches

-12 degrees - 38.26 inches

-13.8 degrees - 43.53 inches

R R R R NOTE: Due to the control column unbalance force it may be necessary to engage A/P A or B to CMD (on APFDS panel) after selecting trim point in order to get a correct measurement.

A. Stabilizer Control System Friction and Surface Travel Check

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic system A, B, C, and D (Ref. 29-11-00).

(3) Slowly cycle control column full forward and aft several times to stabilize control system.

(4) On pilots overhead panel, verify that MACH indicator on MACH FEEL panel does not read above minimum.

(5) Position trim wheel to -4 degree trim position with the pitch electrical trim thumb wheel. Stabilize the control system by slowly cycling the control column forward and aft several times. (The stabilizer fairing tip travel from the +1 degree position to -4 degree position is 14.75 ±0.5 inches.)

NOTE: When checking control column forces, apply force as close to center of control wheel hub as possible.

Control column maximum force must be read before control column or stabilizer servo stops are

contacted. A sudden increase in force indicates that a stop has been contacted.

R (6) Move control column through full forward and aft travels with force gage. Control column force and travel must be as follows:

R (a) Breakout force (forward or aft) - 5.0 pounds maximum. Breakout force is force required on control column to just start stabilizer movement. Force should be applied very slowly. Breakout force will appear high if not applied correctly.

R (b) Aft travel force - 53 pounds min to 83 pounds max.

R (c) Stabilizer leading edge down position - -13.8
R degrees min.

R (d) Forward travel force - 50 pounds min to 75 pounds
R max.

R (e) Stabilizer leading edge up position - +0.6 degree
R min.

R (7) Allow control column to return to trim position.

R (8) Position trim wheel to -10 degree trim position with
R pitch trim thumb wheel. Stabilize the control column
R by slowly cycling the control column forward and aft
R several times. (The stabilizer tip travel from +1
R degree position to the -10 degree position is 32.40
R ±0.74 inches).

R (9) Move control column through full forward and aft
R travels with force gage. Control column force and
R travel must be as follows:

R (a) Aft travel force - 25 pounds min to 34 pounds max.

R (b) Stabilizer leading edge down position -13.8
R degrees min.

R (c) Forward travel force - 56 pounds min to 69 pounds
R max.

R (d) Stabilizer leading edge up position -0.2 degrees
R max.

R (10) Allow control column to return to trim position.

R (11) Adjust stabilizer feel system for maximum MACH as
R follows:

R R (a) Open and tag circuit breakers No. 1 and No. 2 TRIM AGMT AC and DC (CB1-A7, A8, A25, and A26).

R R (b) Open access door 317BB in lower afterbody to gain access to feel/trim assemblies (Ref. 6-40-00).

R (c) Manually rotate upper (MACH SYNC) coupler shaft in HI SPEED direction until stop is contacted. (HI SPEED direction noted on decal where MACH SYNC coupler shaft enters mechanical and electrical feel/trim assemblies.)

R (12) Position manual trim wheel to zero degree trim. Stabilize the control system by slowly cycling the control column forward and aft several times. (The stabilizer fairing tip travel from +1 degree position to zero degree position is 2.95 ±0.5 inches.)

R (13) Move control column through full forward and aft travels with force gage. Control column force and travel must be as follows:

R (a) Aft travel force - 65 pounds min to 90 pounds max.

R (b) Stabilizer leading edge down position - -10 degrees min.

R (c) Forward travel force - 43 pounds min to 75 pounds max.

R (d) Stabilizer leading edge up position - +1 degree.

R (14) Allow control column to return to trim position.

R (15) Position pitch manual manual trim wheel to -4 degrees trim. Stabilize the control system by slowly cycling the control column fore and aft several times. (The stabilizer fairing tip travel from +1 degree to -4 degrees is 14.74 ±0.5 inches.)

R (16) Move control column through full forward and aft travels with force gage. Control column force and travel must be as follows:

R (a) Aft travel force - 60 pounds min to 90 pounds max.

R (b) Stabilizer leading edge down position - -13.8 degrees min.

R (c) Forward travel force - 50 pounds min to 80 pounds max.

R (d) Stabilizer leading edge up position - +0.6 to +1.0
R degree.

R (17) Allow control column to return to trim position.

R (18) Close circuit breakers opened in Step 4A(11)(a). Verify that MACH indicator needle on MACH FEEL panel moves to minimum indication (approximately .4 MACH).

R (19) Turn off hydraulic power (29-11-00).

R (20) Turn off electrical power (24-41-00).

R (21) Close access door.

CONTROL COLUMN ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pins - 5/16-inch diameter: 3, 4, and 5 inches long (R3, R4, and R5); 1/2-inch diameter: 7-1/2 inches long (R9)

Aileron Support Tool, BF90, or equivalent

R Pitch Feel/Trim Assembly Lock Set, BA68, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
27-11-01	Control Wheel - Removal and Installation
27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

The procedure for removal and installation of either Captains or First Officers control columns are identical except where noted.

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

VERIFY THAT AFT PITCH COUPLER IS CLOSED. WITH ELECTRICAL POWER ON AND CIRCUIT BREAKER IND LT PFCS/ADS/DH (CB3-G8) CLOSED, THE AFT CPLR OPEN LIGHT ON OVERHEAD PFCS PANEL SHOULD BE OFF. IF ELECTRICAL POWER IS NOT AVAILABLE, VERIFY THAT COUPLER ACTUATORS ARE IN EXTENDED POSITION (9.78 ± 0.030 INCH BETWEEN CONNECTING BOLTS).

A. Removal

(1) On the pilots overhead circuit breaker panel CB1, verify that the following circuit breakers are opened and tagged:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - SPEED CONT (A2)

FCES - COMPUTERS DC (B4)

FCES - COMPUTERS AC & L AOA (B5)

FCES - STICK SHAKE (B6)

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

NO. 2 SYSTEMS - SPEED CONT (A2C)

ESSENTIAL COMMUNICATIONS BUS

AUDIO CONTROL - CAPT & F/E (A12)

AUDIO CONTROL - F/O & OBS (A13)

AUDIO CONTROL - FLT INTPH AMPL (A14)

5 VAC INSTRUMENT LIGHTING

EYE LCT & APPRCH CHART (L19)

On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that the following circuits breakers are opened and tagged:

FLIGHT STATION MISC

R AOA (F1)

STICK SHAKE (F2)

On the Flight Engineer/Second Officers aft circuit breaker panel CB3, verify that the following circuit breakers are opened and tagged:

AUDIO CONT

CAPT & F/E (C16)

F/O & OBS (C17)

(2) On the center console, depress the MIC SEL - INT Switch on both the Captains and First Officers audio selector panels. Tag these panels to prevent inadvertent operation of the selector switches.

(3) Manually position both left and right inboard ailerons to neutral (±8°) to unload control system and install aileron support tool 690 on one actuating cylinder of both inboard ailerons.

(4) Position pitch trim wheel to 0 degrees.

(5) Open access door 317CB (Ref. 6-40-00) to right stabilizer servo and feel/trim assembly. Install BA68 lock set on right feel/trim assembly. Simultaneously push on feel/trim assembly output bellcrank and tighten lock set knob to unload feel spring so that rig pin R4 can be installed through stabilizer servo input arm and servo to lock servo in +1 degree position (Ref. Fig. 401).

(6) Move pilots seat at control column fully aft. Remove the shield and shroud from the base of control column.

(7) Pull up on the PITCH DISC handle on center console to separate the control columns.

(8) Open access door 112AB to forward electronic service center.

(9) Remove stick shaker guard by removing guard mounting screws.

(10) Disconnect the electrical connectors to the stick shaker and to the control column wire harness. Remove wire harness clamp. Cap and secure the electrical connectors.

(11) Disconnect the pitch control override bungee at the control column.

(12) Disconnect the control wheel interconnecting pushrod from the aft roll output bellcrank.

(13) Disconnect the torque limiter input pushrod from the forward roll output bellcrank.

R (14) Remove the stick shaker support arm (with stick shaker
R attached) from the control column by removing attaching
R bolts.

R (15) Support the control column. Remove four bolts holding control column to the torque tube and carefully remove control column.

(16) Remove loose shroud from control column.

B. Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

VERIFY THAT THE AFT PITCH COUPLER IS CLOSED (SEE PARA. 3 WARNING).

(1) Verify that circuit breakers opened in Step A(1) are opened and tagged.

(2) Verify that tags are installed on Captains and First Officers audio select panels [Step A(2)].

(3) Verify that rig pin is installed in the right stabilizer servo input arm.

(4) Verify that both inboard ailerons are positioned to neutral (±8°) and aileron support tools are installed.

(5) Position control column shroud on control column.

(6) Position control column in mounted position. Install bolts, washers, and nuts that attach control column to torque tube.

(7) Remove console right side trim panel to gain access to the roll disconnect.

(8) Adjust roll controls as follows:

(a) Insert rig pin R3 through both roll disconnect arms and disconnect bracket.

(b) Insert rig pin R5 through the roll output bellcranks and control column of replaced control column.

(c) Connect control wheel interconnecting pushrod to the aft roll output bellcrank on control column with bolt, washer, nut, and cotter pin. Adjust interconnecting pushrod to fit between pinned bellcranks.

R CAUTION: IF INTERCONNECTING PUSHROD FROM ROLL
R DISCONNECT TO FIRST OFFICERS ROLL OUTPUT
R BELLCRANK WAS REMOVED, VERIFY THAT PUSHROD IS
R INSTALLED WITH FIXED ROD END CONNECTED TO
R ROLL OUTPUT BELLCRANK. A REVERSED PUSHROD
R COULD RESTRICT RIGHT ROLL TRAVEL.

(d) With rig pin in roll output bellcranks and control column, verify that index mark on the control wheel is at the neutral position (Ref. Table 501, 27-11-00). If not, adjust vertical pushrod in control column.

(e) Insert rig pin R3 through bracket and torque limiter on same side as replaced control column.

(f) If First Officers control column is being replaced, pull up and lock ROLL DISC handle on center console to eliminate lost motion.

(g) Connect the torque limiter input pushrod to the forward roll output bellcrank on control column with bolt, washer, nut, and cotter pin. Adjust the input pushrod to fit between the pinned bellcranks.

(h) Release ROLL DISC handle and allow handle to retract against center console. Verify that control wheels are coupled.

(i) Remove the three rig pins from the flight station roll controls.

(9) Adjust pitch controls as follows:

(a) Disconnect forward end of pushrod from bellcrank (located just aft of rear pressure bulkhead) on both Captains and First Officers side (Ref. Fig. 401). Tag pushrods to prevent tampering with pushrod adjustment.

NOTE: Pressure bulkhead pushrods are disconnected so that the pitch control system rigging can be dry-rigged at the -4 degree position.

(b) Pull up and lock PITCH DISC handle on center console to separate control columns.

(c) Tape protractor to aft face of control column. With control column against forward fixed stop, zero protractor.

(d) Move control column aft until column contacts adjustable stop. Protractor must read 28 degrees. If not, adjust stop. Remove protractor.

(e) Position control column to install rig pin (R9) through bracket and bottom of Captains control column (-4 degree position).

(f) Position cable system to install rig pin (R3) through bracket and pitch cable drive arm on same side as replaced control column (-4 degree position).

(g) Connect pitch override bungee to control column with bolt, washer, nut, and cotter pin. Connecting bolt should fit freely through bungee and control column with no load on bungee. If not, adjust length of bungee.

R NOTE: Witness hole for bungee rod end may be
R mislocated 0.21 inch too far aft. If rod
R end thread is not visible through witness
R hole, rod end is still in safety provided a
R maximum of 12 threads (0.50 inch) protrude
R forward of nut.

(h) Remove all rig pins from pitch control system.

(i) Release PITCH DISC handle and allow handle to retract against center console. Verify that control columns are coupled.

(10) Install stick shaker support arm (with stick shaker attach) to control column with bolts, washers, nuts, and cotter pins.

(11) Connect the electrical connectors to the stick shaker and to the control column wire harness. Install wire harness clamp.

CAUTION: CAREFULLY INSPECT CONTROL COLUMN BASE AREA TO VERIFY THERE ARE NO TOOLS OR EQUIPMENT IN AREA.

(12) Install the stick shaker guard to floor structure with bolts, washers, and nuts at the forward end, and with screws and washers at the aft end.

(13) Install control column shroud to base with attaching screws.

(14) Install shield to control column with attaching screws.

CAUTION: CAREFULLY INSPECT ROLL DISCONNECT AREA TO VERIFY THERE ARE NO TOOLS OR EQUIPMENT IN AREA.

(15) Install center console right side trim panel.

(16) Connect pitch control pushrod to aft pressure bulkhead bellcrank on both Captains and First Officers side with bolt, washer, nut, and cotter pin. Verify that pushrod length has not been tampered with (rod end lockwires are intact). Remove tags from pushrods.

(17) Remove rig pin from right stabilizer servo input arm.

(18) Remove feel/trim assembly lock set by rotating lock knob to relieve force on feel/trim output bellcrank. Remove lock set.

(19) Verify that there are no rig pins in any part of roll and pitch control system.

(20) Remove aileron support tools.

(21) Remove tags from Captains and First Officers audio selector panels and from hydraulic control panels.

(22) Remove tags and close circuit breakers opened in Step A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(23) Turn on electrical power (Ref. 24-41-00).

(24) Turn on hydraulic system B and C (Ref. 29-11-00).

(25) Slowly cycle control column full forward and aft several times. Verify that pitch control system operates smoothly throughout control range. Visually verify that flight station controls and rear pressure bulkhead linkages clear all structure and equipment while cycling control system.

(26) Slowly cycle control wheel from full left roll to full right roll several times. Verify that roll control system operates smoothly throughout control range. Visually verify that flight station control linkages clear all structure and equipment while cycling control system.

(27) Perform aileron Quick Rigging Check (Ref. 27-11-00).

(28) Perform Horizontal Stabilizer Control System check (Ref. 27-41-00).

(29) Check stick shakers as follows:

(a) On pilots overhead circuit breaker panel CB1, verify that following circuit breakers are closed:

FCES - COMPUTERS

DC (B4)

AC & L AOA (B5)

STICK SHAKE (B6)

(b) On overhead PFCS panel verify following: If Captains control column was replaced, STALL WARN switchlight No. 1 is depressed (in), switchlight No. 2 is released (out); if First Officers control column was replaced, STALL WARN switchlight No. 2 is depressed (in), switchlight No. 1 is released (out).

(c) On PFCS panel, depress STALL WARN TEST switch; verify that replaced control column vibrates. Release switch.

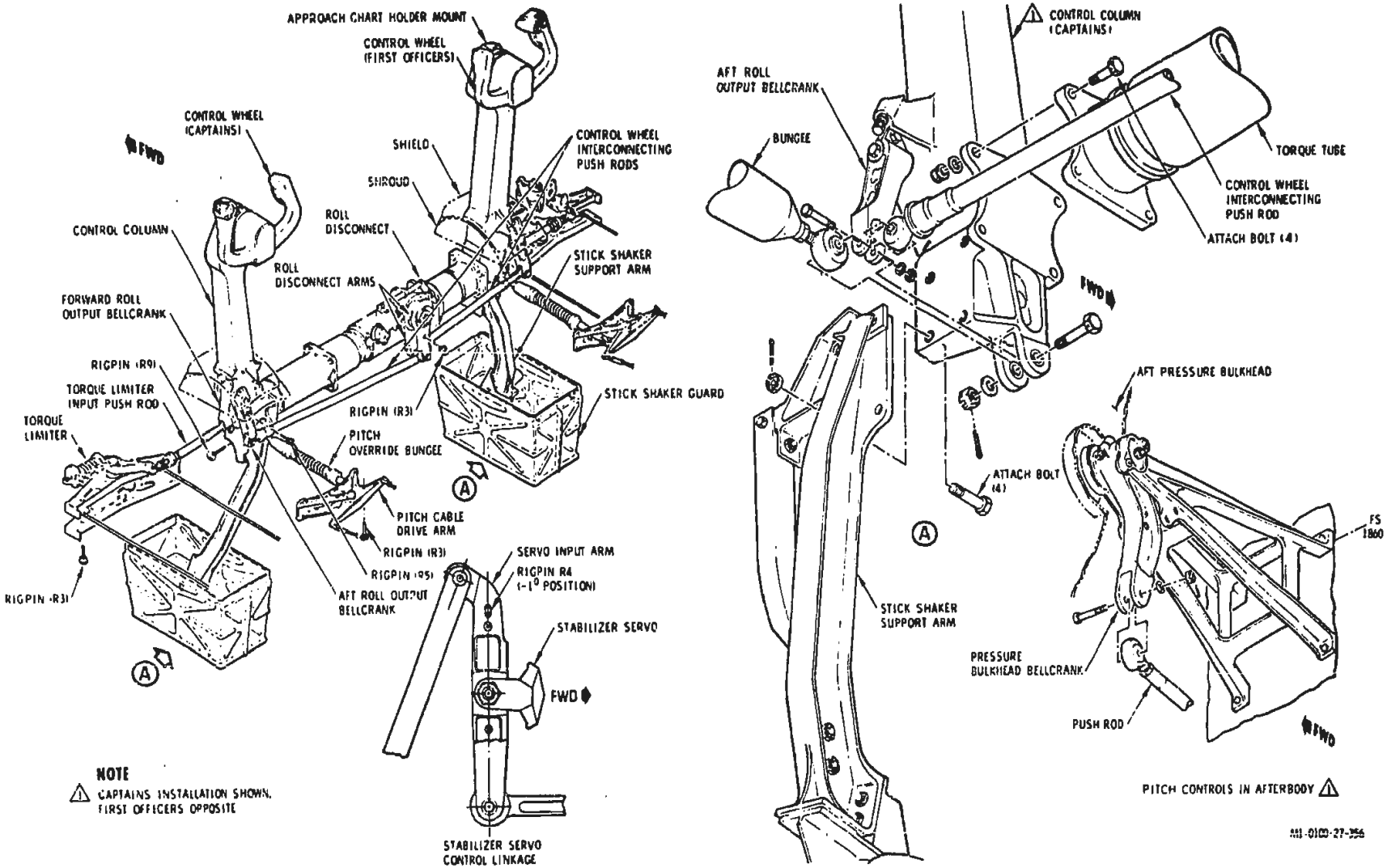
(d) On PFCS panel, position STALL WARN switchlights to normal position.

(30) Perform functional test of control wheel circuits (Ref. 27-11-01).

(31) Shut off hydraulic power (Ref. 29-11-00).

(32) Shut off electrical power (Ref. 24-41-00).

(33) Close access doors to stabilizer servo and forward electronic service center.



Control Column - Removal and Installation
Figure 401

PITCH DISCONNECT MECHANISM - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pins, 5/16-inch diameter by 3 inches long (R3), and 5 inches long (R5)

Aileron Support Tool, BF90, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Cotter Pin MS-24665-86

2. Referenced Procedures

	21-41-00	External Power/Ground System - Removal and Installation
	25-11-01	Captains Seat Assembly - Removal and Installation
	25-11-02	First Officers Seat Assembly - Removal and Installation
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-39	Roll Disconnect Handle Light Switch - Removal and Installation
	27-41-38	Pitch Disconnect Handle Light Switch - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices
	31-22-00	Aural Warning Unit - Adjustment and Test

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Manually position both inboard ailerons to neutral and install aileron support tool (Ref. Fig. 401).

(Ailerons are positioned to neutral to unload control wheel linkage.)

NOTE: Inboard aileron neutral index is a red paint-filled dimple on the No. 3 torque box. Align aileron lower surface with neutral index.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

R On aircraft without SB27-162,
R inboard aileron neutral is with aileron faired.

R On aircraft with SB27-162,
R inboard aileron neutral is with aileron 1.5
R degrees up from faired.

(2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers IND LT - PILOTS (J2), THROT STAND (M5), and T/O AURAL WRNG (H7).

(3) Remove Captains and First Officers seats (Ref. 25-11-01 and 25-11-02).

(4) Remove the forward and aft trim panels on the left and right sides of the center console (Ref. Fig. 401).

(5) Remove the Captains and First Officers floor plate between control column and center console.

(6) On both sides of console, remove the U-channel support (next to floor) by removing attaching screws. Disconnect any cable clamps attached to U-channel.

(7) Remove the Captains pitch trim control as follows (Ref. Fig. 401):

(a) Tag for identification and disconnect trim control wires at throttle stand terminal modules.

(b) Remove three nuts securing trim control to throttle stand. Disconnect cable clamp from throttle stand. Remove trim control.

(8) On the left side of console, disconnect the wiring module board from the throttle stand by removing the four attaching bolts and nuts. Protect wiring module with rags and tie out of way.

(9) Remove the clear plastic shield over the pitch and roll disconnect by removing four attaching screws.

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(10) On center console, pull up the ROLL DISC handle and turn it 90 degrees to the right to lock. (This will actuate the roll control disconnect to allow removal of the pushrods from the roll disconnect arms.)

(11) Disconnect the captains interconnecting pushrods from the roll disconnect arms. (Operate either control wheel to rotate and separate the roll disconnect arms so that the pushrod connecting bolts can be removed).

(12) Disconnect the First Officers interconnecting pushrods from the roll disconnect arms. (Operate either control wheel to rotate and separate the roll disconnect arms so that the pushrod connecting bolts can be removed).

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(13) Release ROLL DISC handle and allow handle to retract against console. Verify that roll clutch teeth are engaged. (Position roll disconnect arms to engage clutch teeth.)

(14) Disconnect the roll disconnect actuation cable from the roll disconnect arm.

(15) Disconnect the pitch disconnect actuation cable from the pitch disconnect arm.

(16) Tag for identification, then disconnect electrical wires to roll and pitch disconnect handle light switches. Roll disconnect switch is located on top of roll disconnect. Pitch disconnect switch is located on bottom of pitch disconnect.

NOTE: On aircraft 001-023, roll and pitch disconnect switch wires are routed to terminal module in forward electronic service center (FESC) at FS 175, WL, 180, BL 25R.

On aircraft 024-999, roll disconnect switch wires are routed to terminal module mounted on console structure just forward and to the left of roll disconnect.

Pitch disconnect switch wires incorporate poke-home connectors.

(17) On the right side, remove four bolts, washers, and nuts attaching pitch disconnect flange to First Officers torque tube flange. Remove two bottom bolts from below through forward electronic service center (FESC).

(18) With one man supporting right side of pitch disconnect, remove four bolts, washers, and nuts attaching pitch disconnect flange to Captains torque tube flange. Remove pitch disconnect (with roll disconnect attached) from left side of console.

NOTE: To provide clearance to remove pitch disconnect from between torque tubes, move First Officers torque tube and control column outboard. Captains control column bearing is fixed; First Officers control column bearing is not fixed and will allow First Officers torque tube and control column to move sideways 3/16 inch.

(19) Remove roll disconnect from pitch disconnect by removing four attaching bolts.

B. Installation

(1) Verify that all hydraulic power is turned off (Ref. 29-11-00).

(2) Install roll disconnect on replacement pitch disconnect mounting pad with four bolts and tighten.

(3) From left side of console position pitch disconnect in mounted position between control columns. Install the four bolts, washers, and nuts that connect the pitch disconnect to the captains torque tube. Install the bolts so that the bolt heads face outboard.

(4) Slide First Officers control column and torque tube inboard to contact pitch disconnect flange. Install the four bolts, washers, and nuts that attach the pitch disconnect to the First Officers torque tube. Install the bolts so that the bolt heads face inboard.

(5) Connect the electrical wires to the disconnect handle switch on top of the roll disconnect and on the bottom
R of pitch disconnect [Ref. Step 3A(16)].

(6) Attach the pitch disconnect actuation cable to the pitch disconnect arm with bolt, washer, and nut. Install cotter pin in nut. Check pitch disconnect cable adjustment as follows (Ref. Fig. 401):

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(a) Pull up PITCH DISC handle and turn handle 90 degrees to the right to lock in the extended position.

(b) Verify that pitch disconnect clutch teeth are separated a minimum of 0.020 inch. If not, accomplish Steps (c) through (g).

CAUTION: VERIFY THAT PITCH DISCONNECT HANDLE CABLE ANCHOR CONTAINS TWO COTTER PINS TO RETAIN CABLE BALL IN ANCHOR (REF. FIG. 401).

(c) Remove lock-wire from threaded coupling locknut on bottom of PITCH DISC handle.

(d) Loosen locknut and disengage locking washer.

(e) Adjust threaded coupling so that clutch teeth are separated a minimum of 0.020 inch.

(f) Engage lockwasher; tighten locknut and lock-wire to tab on lockwasher.

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(g) Cycle PITCH DISC handle through several cycles then pull up and lock handle in extended position by turning the handle 90 degrees to the right. Recheck pitch disconnect clutch teeth separation of 0.020 inch.

(7) Remove tag and close circuit breaker IND LT - PILOTS (CB2-J2).

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(8) Verify proper operation of handle light. With PITCH DISC handle against console, handle light must be out. With handle in extended position, handle light must be on. If not, adjust switch actuation cam (Ref. 27-41-38). After completing rigging and handle light check, release PITCH DISC and allow handle to retract against console.

(9) Attach roll disconnect actuation cable to roll disconnect arm with bolt, washer, and nut. Install cotter pin in nut. Check roll disconnect cable adjustment as follows (Ref. Fig. 401).

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(a) Pull up ROLL DISC handle and turn handle 90 degrees to the right to lock in the extended position.

(b) Verify that the roll disconnect clutch teeth are separated a minimum of 0.020 inch (Ref. Fig. 401). If not, accomplish Steps 4A(2)(c) through (e).

(c) Remove lock-wire from cable terminal locknut at bottom of ROLL DISC handle.

(d) Loosen locknut and thread cable terminal in swivel plate to provide 0.020 inch clutch teeth separation. Tighten locknut.

(e) Lock-wire locknut to top holes of cable anchor.

CAUTION: VERIFY THAT BOTTOM HOLE IN CABLE ANCHOR CONTAINS A COTTER PIN TO RETAIN CABLE BALL IN ANCHOR (REF. FIG. 401).

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(f) Cycle ROLL DISC handle through several cycles then pull up and lock handle in extended position by turning handle 90 degrees to the right. Recheck

roll disconnect clutch teeth separation of 0.020 inch.

(10) Verify proper operation of handle light. With ROLL DISC handle against console, light must be out. With handle in extended position, handle light must be on. If not, adjust switch actuation cam (Ref. 27-11-39).

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(11) Pull up ROLL DISC handle and turn handle 90 degrees to right to lock in extended position.

(12) Install Captains and First Officers interconnecting pushrods as follows:

(a) Connect First Officers interconnecting pushrod to the roll disconnect forward arm with bolt, washer, and nut. Install cotter pin through nut. (Bolt head must face aft.)

CAUTION: VERIFY THAT ADJUSTABLE END OF FIRST OFFICERS INTERCONNECTING PUSHROD IS CONNECTED TO ROLL DISCONNECT ARM. IF INSTALLED BACKWARDS, CONTROL WHEEL RIGHT ROTATION CAN BE LIMITED. (LATER AIRCRAFT HAVE REDESIGNED PUSHROD, PN 1579762, THAT CAN BE INSTALLED EITHER WAY WITHOUT LIMITING CONTROL WHEEL ROTATION.)

(b) Connect Captains interconnecting pushrod to the roll disconnect aft arm with bolt, washer, and nut. Install cotter pin through nut. (Bolt head must face forward so that bolt heads from forward and aft arms are facing each other.)

(c) Remove shield from bottom of both control columns.

(d) Remove shroud from both control column bases. Slide shroud up control column to expose roll output bellcranks.

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(e) Release ROLL DISC handle and allow handle to retract against console. Verify that roll disconnect clutch teeth have engaged.

(f) Insert rig pin (R3) through both disconnect arms and disconnect. Rig pins (R5) should fit freely through both Captains and First Officers roll output bellcranks and control column. If not, adjust interconnecting pushrods. (If an adjustment is made, verify that pushrod locknuts are tightened and lock-wired.)

(g) Remove all rig pins.

(h) Install shrouds and shields on both control columns.

(13) Install clear plastic shield over pitch and roll disconnect with four screws and washers.

(14) On the left side of console, install wiring module board to throttle stand with four screws and nuts.

(15) Install Captains pitch trim control as follows:

CAUTION: IF THE PITCH TRIM INTERCONNECTING SHAFT CONTAINS A LONG AND A SHORT SPLINE, VERIFY THAT THE SHAFT IS INSTALLED WITH THE SHORT SPLINE END ENGAGED IN THE FIRST OFFICERS TRIM CONTROL GEARBOX. IF THE SHAFT IS REVERSED, THE SHAFT CAN DISENGAGE FROM CAPTAINS TRIM CONTROL. SB 27-097 INSTALLS A RIVET AND WASHERS ON LONG SPLINE TO ALLOW INTERCONNECTING SHAFT TO BE INSTALLED EITHER WAY. LATER AIRCRAFT HAVE REDESIGNED PUSHROD WITH SHORT SPLINE ON BOTH ENDS.

(a) Position First Officers pitch trim control pointer to the closest whole number.

(b) Position Captains pitch trim control pointer to the same trim setting as the First Officers trim control.

(c) Engage Captains trim control to the interconnecting shaft spline and the three mounting studs on the throttle stand. Verify that both trim control settings are identical.

(d) Install the three trim control mounting nuts.

(e) Attach trim control electrical cable clamp to throttle stand.

(f) Install the trim control electrical wires to the throttle stand terminal modules.

(16) Verify that all rig pins are removed from control systems.

(17) Remove aileron support tool from both inboard aileron.

(18) Remove tags and close circuit breakers opened in Step A(2).

(19) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(20) Turn on hydraulic systems B and C (Ref. 29-11-00).

(21) Slowly operate control wheels through several full left and right roll applications. Verify freedom of movement and that roll controls operate smoothly with no binding or excessive lost motion between control wheels. Verify that roll disconnect arms clear all structure and equipment. Verify that roll disconnect clutch teeth make contact with each other to ensure there is no lost motion in the disconnect.

(22) Slowly cycle control column through several full pitch applications. Verify freedom of movement and that control system operates smoothly with no binding or excessive lost motion between control columns. Verify that pitch and roll disconnects clear all structure and equipment. Especially note that the pitch and roll disconnect switch cables clear all structure and equipment, and are not put under any load during any part of the pitch stroke. Verify that pitch disconnect clutch teeth make contact against each other to ensure there is no lost motion in the disconnect.

(23) Operate speedbrake control lever. Visually verify that control lever clears any electrical cables in throttle stand.

CAUTION: SUDDEN RELEASE OF THE ROLL DISC HANDLE WILL CAUSE THE HANDLE TO SNAP BACK TO ITS NORMAL (ENGAGED) POSITION RESULTING IN POSSIBLE DAMAGE TO ITS SUPPORT CASTING.

(24) Pull up the PITCH DISC handle and turn handle 90 degrees to the right to lock. Verify that the PITCH DISC handle light comes on and that the pitch disconnect has actuated to separate the control columns as follows:

(a) Hold one control column and rotate the other control column.

(b) Verify that each control column can operate independently of the other.

(c) Release control columns.

(25) Release PITCH DISC handle and allow handle to retract against console. Verify that handle light goes out and that control columns are coupled together.

(26) Pull up the ROLL DISC handle and turn handle 90 degrees to the right to lock. Verify that the ROLL DISC handle light comes on and that the roll disconnect has actuated to separate the control wheels as follows:

(a) Hold one control wheel and rotate the other control wheel.

(b) Verify that each control wheel can operate independently of the other.

(c) Release control wheels.

(27) Release ROLL DISC handle and allow handle to retract against console. Verify that handle light goes out and that control wheels are coupled together.

(28) Check pitch trim control system as follows:

(a) Operate Captains pitch trim control wheel from full NOSE UP to full NOSE DOWN. Verify that pitch trim control system operates normally and that pitch control system (and control column) follow trim inputs. (A rachet-type oscillation of force is normal when operating the pitch trim wheel.)

(b) Check operation of aural warning switch in Captains pitch trim control [Perform Aural Warning

Unit Test (Ref. 31-22-00). Accomplish only the Unsafe Takeoff Test (Para. C)].

(29) Turn off hydraulic power (Ref. 29-11-00).

(30) Turn off electrical power (Ref. 24-41-00).

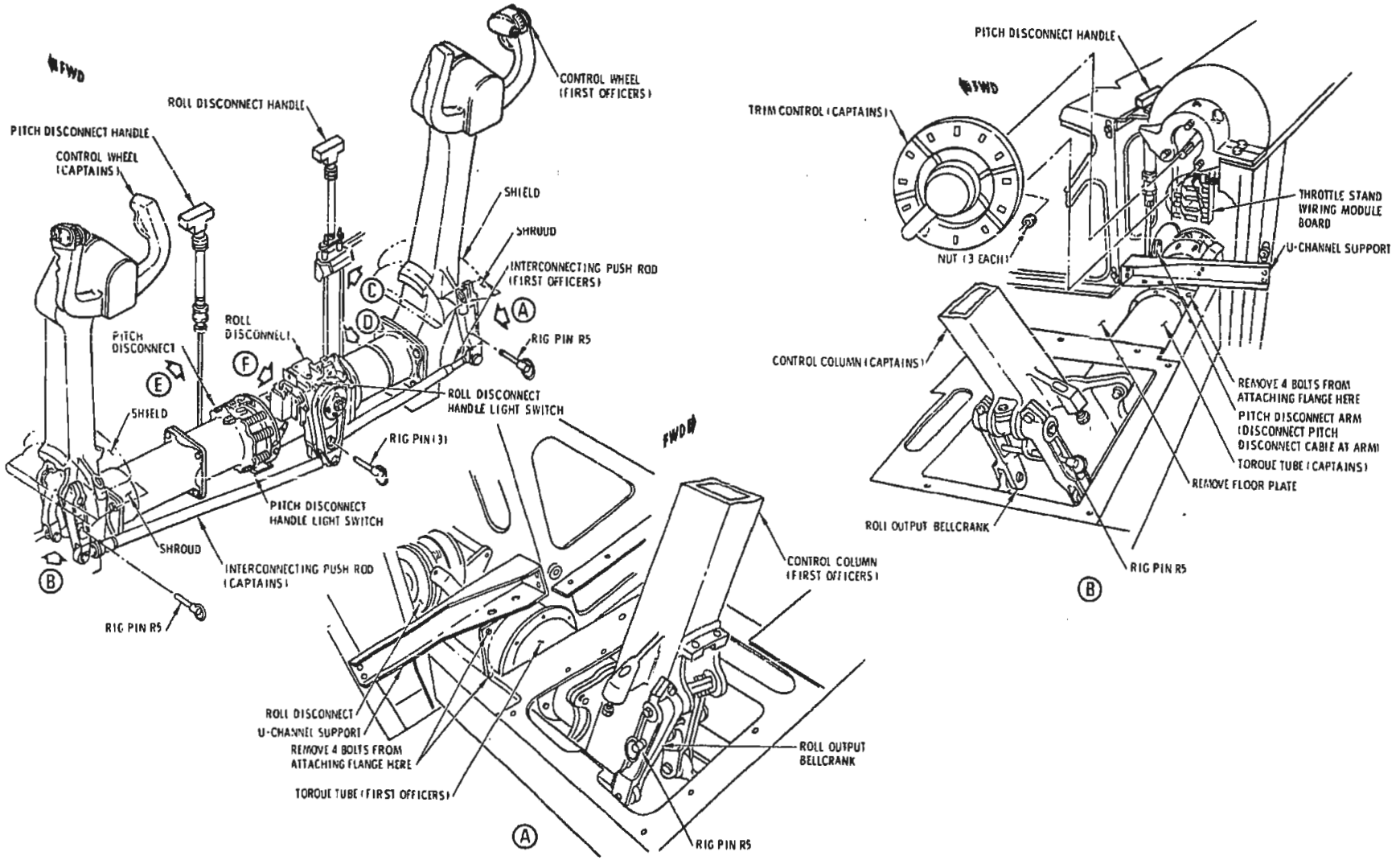
(31) Install U-channel support on both sides of console. Attach cable clamps to U-channel where required.

(32) Install Captains and First Officers floor plate.

(33) Check that console area is clear of all tools and equipment.

(34) Install console trim panels.

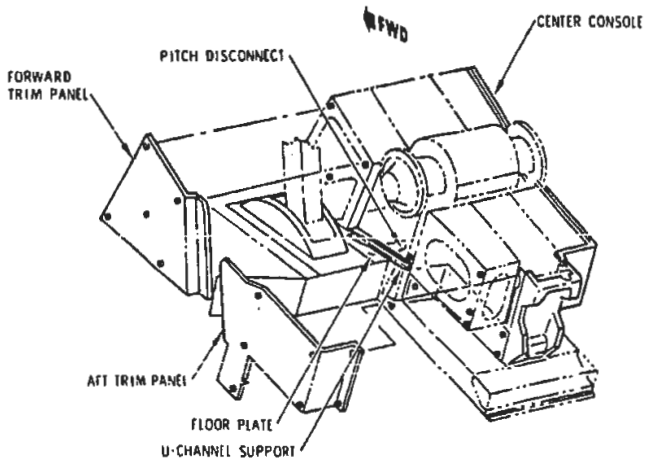
(35) Install Captains and First Officers seats (Ref. 25-11-01, and 25-11-02).



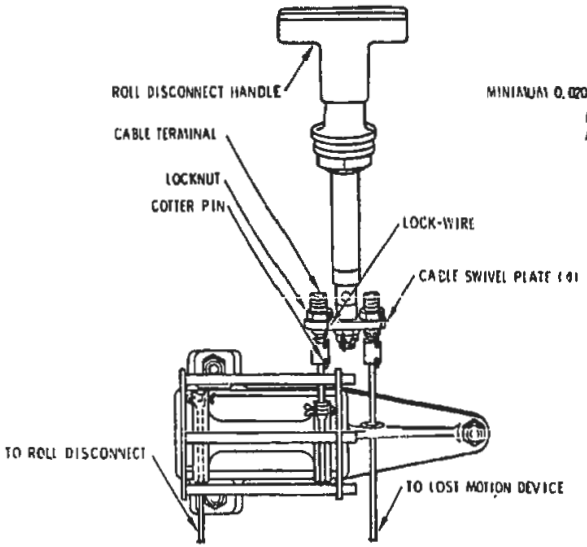
AM-D100-27-397

R Pitch Disconnect Mechanism - Removal and Installation
R Figure 401 (Sheet 1)

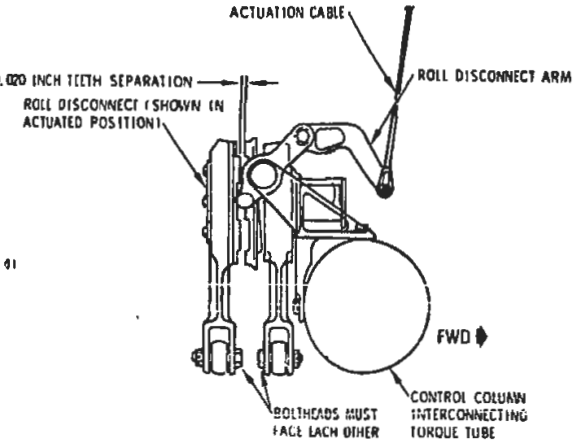
R EFFECTIVITY: ALL
R
R
0018



CENTER CONSOLE ACCESS PANELS

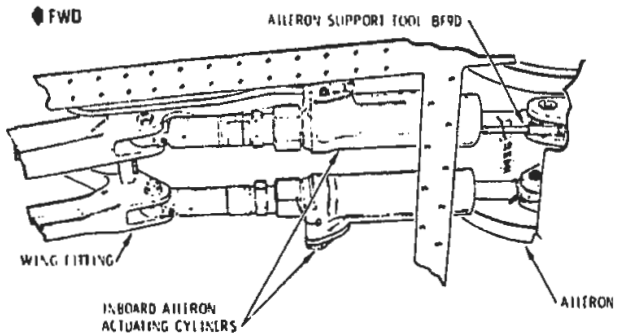


Ⓒ ROLL DISCONNECT HANDLE
VIEW LOOKING FORWARD

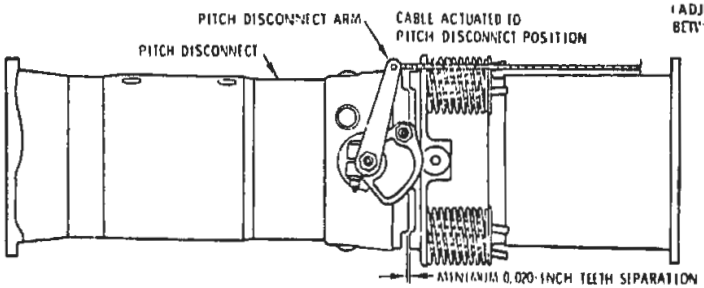


Ⓓ

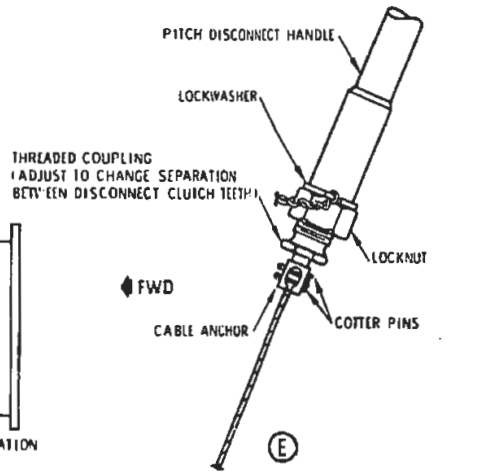
ROLL DISCONNECT CABLE RIGGING



INSTALLATION OF AILERON SUPPORT TOOL



Ⓕ PITCH DISCONNECT (LOOKING AFT)



Ⓔ PITCH DISCONNECT CABLE RIGGING

AU 0100 27-398

R Pitch Disconnect Mechanism - Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: ALL

0016

PITCH DISCONNECT MECHANISM - ADJUSTMENT AND TEST

1. Adjustment/Test

These procedures must be used to perform an operational test (Ref. Para. 3) and a rigging check and adjustment (Ref. Para. 4) of the pitch disconnect mechanism.

2. Equipment and Materials

Cotter Pin, MS24665-151

Lock-wire, QQ-W-390, Cond. A 0.020 diameter, or equivalent

Pull Scale, capable of indicating 50 lb. pull

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Test

A. Pitch Disconnect Mechanism

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 210, verify circuit breaker IND LT - PILOTS (J2) is closed.

(2) Verify that all hydraulic power is shut off (Ref. 29-11-00).

(3) Turn on electrical power (Ref. 24-41-00).

(4) Attach a pull scale to the PITCH DISC handle and measure force required to pull handle to the extended position. Maximum allowable force at any point in travel between retracted position and the extended
R position where handle can be rotated locked is 45 lbs.

(5) Lock handle in extended position and verify handle light is on.

(6) Verify that control columns are decoupled by holding one column in the full forward position and pulling aft

on the other column. Verify that disconnect teeth are not contacting by noting that control column movement is free without friction or detent-like force.

NOTE: Operating the control columns unsymmetrically requires compressing the pitch override bungee. Bungee override force is approximately 44 pounds at control wheel.

(7) With control columns held unsymmetrically, release PITCH DISC handle and allow handle to retract into panel.

(8) Slowly release force on control columns. When control columns are symmetrical, a loud thump will indicate engagement of the spring-loaded dog clutch. Verify that PITCH DISC handle lights go off.

(9) Verify that control columns are coupled by holding one control column and pulling aft on the other control column.

NOTE: Stabilizer push lights on PFCS panel on pilots overhead may come on. If lights do not go off after control column are recoupled, unlatch switchlight (OFF legend on), then relatch switchlight (legend lights off).

(10) Shut off electrical power (Ref. 24-41-00).

5. Rigging Check and Adjustment

A. Pitch Disconnect Mechanism

(1) Remove center console left trim panels (Ref. Fig. 501).

(2) Verify that all hydraulic power is shut off (Ref. 29-11-00).

(3) Verify that control columns are full forward (against pitch-down stop).

NOTE: After hydraulic power is shut off, it will take approximately 5 minutes for stabilizer (and control column) to drift to the full pitch down position.

R (4) Attach a pull scale to the PITCH DISC handle and
R measure force required to separate the clutch teeth.
R If the force exceeds 35 lbs repair or replace pitch
R disconnect assembly.

R (5) Pull up and lock PITCH DISC handle in extended (disconnect decoupled) position. Handle light will come on.

CAUTION: TO ENSURE CABLE BALL RETENTION IN CABLE ANCHOR, VERIFY THAT TWO COTTER PINS ARE INSTALLED IN CABLE ANCHOR.

R (6) Verify that disconnect clutch teeth are separated by a minimum of 0.020 inch. If not, adjust as follows:

(a) Remove lock-wire from cable threaded coupling locknut on bottom of handle.

(b) Loosen locknut and disengage locking washer.

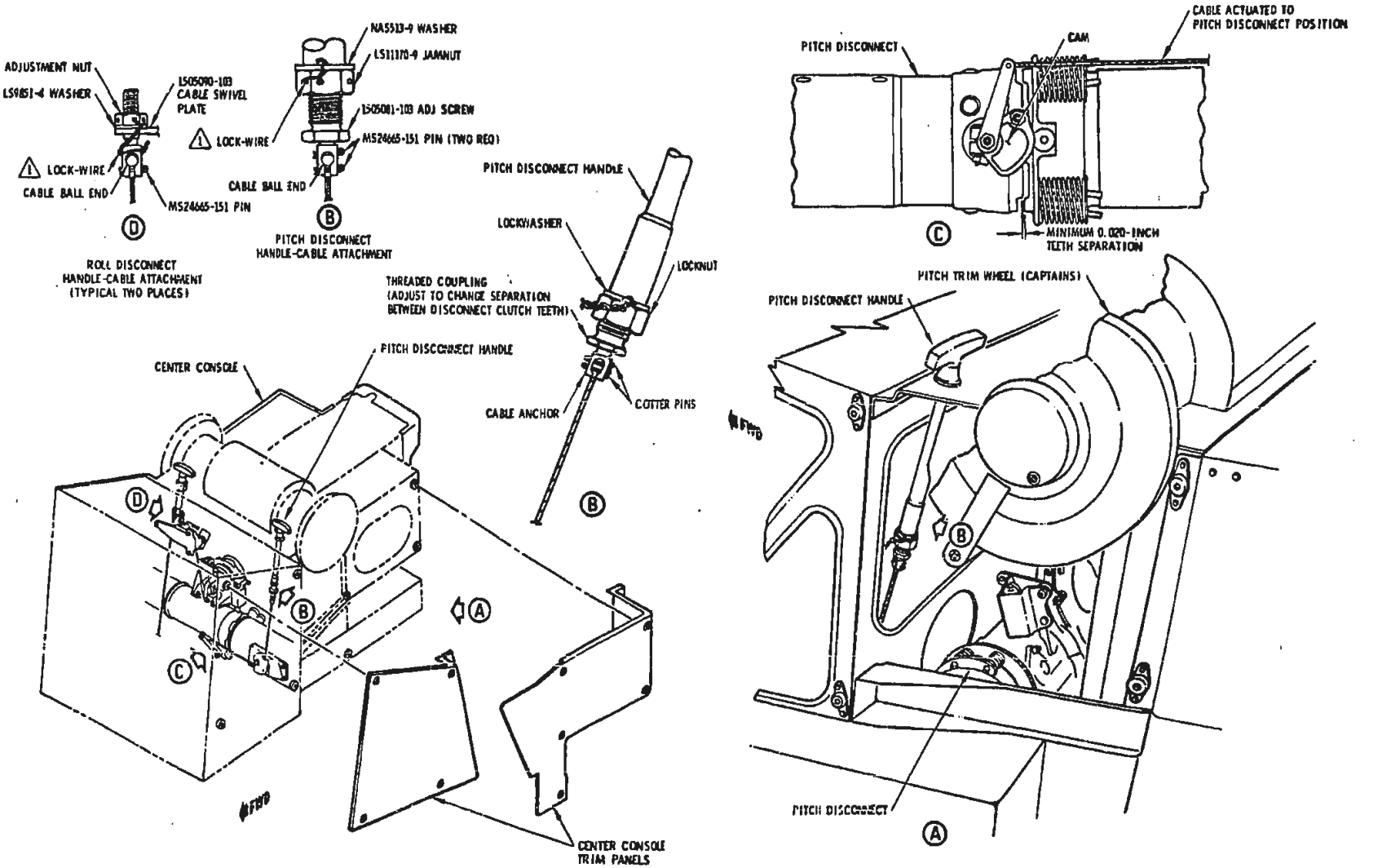
(c) Adjust threaded coupling so that with handle pulled out and locked, the clutch teeth are separated by a minimum of 0.020 inch.

(d) Engage lockwasher, tighten locknut and lockwire.

R (e) With pitch disconnect handle in the stowed
R position and the control column in the -4 degree
R position, up to 1/2 inch slack in pitch disconnect
R cable is acceptable.

R (7) Install center console trim panels.

R (8) If a cable adjustment is made, perform an operational test (Ref. Para. 4).



M1-0003-27-175

CR Pitch Disconnect Mechanism - Rigging Check and Adjustment
CR Figure 501

EFFECTIVITY: ALL

001B

PITCH CONTROL OVERRIDE BUNGEE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig Pins, 5/16-inch diameter by 3 inches long (R3), and 1/2-inch diameter by 7.5 inches long (R9) (Part of rig pin Kit B734)

Tamper Proof Sealer, EC1252

2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
	21-61-02	ECS Zone 1 Temperature Controller - Removal and Installation
	22-31-07	Speed Control Computer - Removal and Installation
	22-10-11	AFCS/MLG Accessory Unit - Removal and Installation
	24-31-01	Transformer Rectifier - Removal and Installation
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-41-06	Pitch Control Override Bungee and Aft Coupler - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRUALIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL
R SYSTEM FCES COMPUTERS, AC & AOA (B5).

(2) Position the pitch trim control wheel to 0 NOSE DOWN and placard.

R (3) Open access door 112AB (Ref. 6-40-00).

(4) To remove Captains pitch bungee, remove speed control computer (Ref. 22-31-07) and AFCS/MLG accessory unit (Ref. 22-10-11).

(5) To remove First Officers pitch bungee, remove environmental control system temperature controller (Ref. 21-61-02) and essential transformer rectifier (Ref. 24-31-01).

(6) Remove drip shield from ceiling structure by removing attaching hardware.

(7) Disconnect bungee electrical connectors.

(8) To allow bungee removal, remove two bolts that connect clevis tube to bungee fitting (Ref. Fig. 401).

NOTE: On earlier aircraft, the clevis tube was attached to bungee fitting with HI-LOCKS or rivets. On these aircraft, remove HI-LOCKS, or drill out rivets to disassemble bungee. After removing bungee, line drill through the clevis tube and bungee fitting with a 0.1900 to 0.1916-inch drill and install NAS5203U20 bolts, AN960C10 washers, and LH7559-3 nuts. (Bolts must be a snug fit in holes.)

(9) Remove bungee clevis and rod-end attaching bolts. Remove bungee.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

(2) Check that new bungee length between attaching hole centers is the same as removed bungee. If not, adjust
C new bungee rod end. [Use a pin (not wire) in probing
C witness hole in bungee cap.]

CR CAUTION: BUNGEE MUST BE INSTALLED WITH ELECTRICAL LEADS
CR (CABLE CLAMP) ON BOTTOM OF BUNGEE. CABLE CLAMP
CR CAN BE ROTATED OR REPOSITIONED TO OPPOSITE HOLE TO
CR FACILITATE INSTALLATION.

(3) Position bungee in floor beam opening as follows:

(a) Disassemble bungee between clevis tube and bungee fitting (Ref. Fig. 401).

(b) Place bungee in floor beam opening with electrical leads on bottom of bungee.

(c) Reassemble bungee clevis tube and bungee fitting.

(d) Torque clevis tube attach bolts to 25-30 lb-in.

(e) Install bungee between control column and cable driver arm with attaching hardware. Bungee rod-end goes forward. Assure clamp-up bushing is installed in clevis end (Fig. 401).

C
C

(4) Connect bungee electrical connectors.

(5) Install drip shield with attaching hardware.

(6) After installing Captains pitch bungee, install speed control computer (Ref. 22-31-07) and AFCS/MLG accessory unit (Ref. 22-10-11).

(7) After installing First Officers pitch bungee, install environmental control sytem Zone 1 temperature controller (Ref. 21-61-02) and essential transformer rectifier (Ref. 24-31-01).

(8) Remove placards from pitch trim wheel and hydraulic control panels (Ref. 29-11-00).

(9) Remove tag and close circuit breaker opened in Step 2A(1).

(10) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(11) Turn on either of the four hydraulic power systems (A,B,C, or D).

(12) Check bungee rigging as follows:

(a) If checking First Officers bungee, verify that pitch disconnect handle is retracted against console and pitch disconnect is coupled.

(b) Install rig pin R9 in bottom of Captains control column and bracket. (There are no rig pin provisions in bottom of First Officers control column.)

NOTE: Control column must be at 4 degrees.

(c) Verify that rig pin R3 fits freely through cable driver arm connected to replacement bungee. If not, adjust length of bungee at rod-end (forward) attachment. [Use a pin (not wire) in probing witness hole in bungee cap.]

C
C

NOTE: Witness hole for bungee rod end may be mislocated 0.21 inch too far aft. If rod end thread is not visible through witness hole, rod end is still in safety provided a maximum of 12 threads (0.50 inch) protrude forward of nut.

(d) Remove rig pins from control column and cable drive arm.

CAUTION: DO NOT TURN OFF HYDRAULIC PRESSURE WITH RIG PINS IN ANY PART OF STABILIZER CONTROL SYSTEM OR DAMAGE TO CONTROL COMPONENTS MAY RESULT.

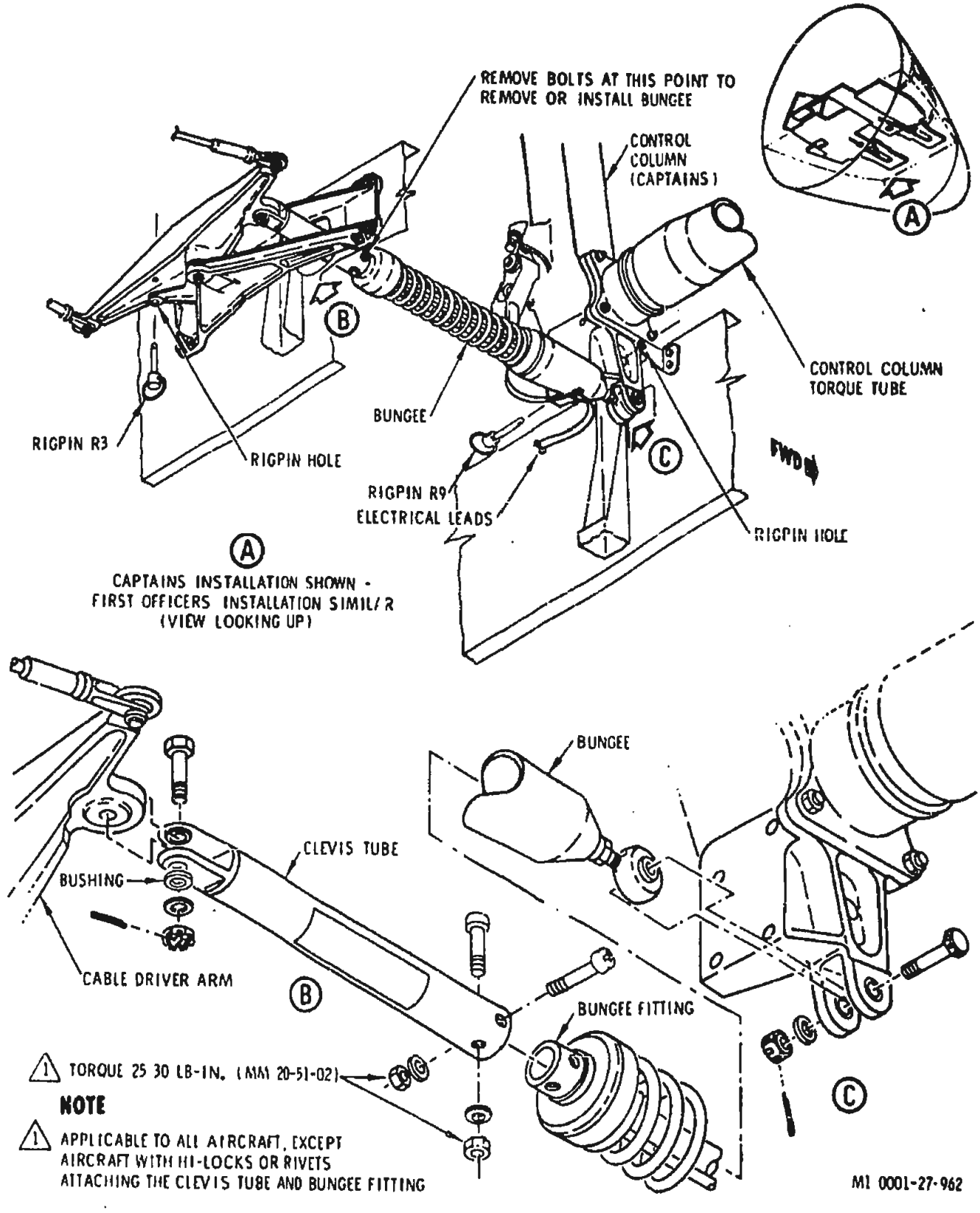
(13) Cycle control column full forward and aft three times. Visually verify that bungee clears structure and that bungee electrical cable is unobstructed.

(14) Check operation of bungee monitor switches. Perform Pitch Control Override Bungee and Aft Coupler Adjustment and Test (Ref. 27-41-06, Adjustment/Test). Accomplish only those steps necessary to check replaced bungee.

(15) Turn off hydraulic power (Ref. 29-11-00).

(16) Turn off electrical power (Ref. 24-41-00).

(17) Close access door 112AB (Ref. 6-40-00).



CR CR Pitch Override Bungee - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

PITCH CONTROL OVERRIDE BUNGEE AND AFT COUPLER ADJUSTMENT AND TEST

1. General

This procedure provides an operational test of the pitch control jam warning system. Jam sensing is provided by dual switches in the pitch control override bungee (Ref. 27-41-06) and dual switches in the aft pitch coupler (Ref. 27-41-12). Both pitch control override bungee switches and the aft pitch coupler switches must be actuated to supply the proper jam logic to the FCES computer.

2. Equipment and Materials

Wooden Blocks, 2 x 3 x 3-5/8 and 2 x 3 x 6 inches for blocking orward cable drive arm

3. Referenced Procedures

	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-41-00	Horizontal Stabilizer System - Fault Isolation
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Adjustment/Test

A. Operational Test

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

No. 1 AFT COUPLER (B9)

No. 2 AFT COUPLER (B27)

FCES - COMPUTERS

DC (B4)

AC & L AOA (B5)

(2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

FLT STATION MISC

R AOA (F1)

STABILIZER SERVO

LB (H16)

RC (H17)

LA (H18)

RD (H19)

(3) On Flight Engineer/Second Officers aft circuit breaker panel CB3, verify that the following circuit breaker is closed:

IND LT

PFCS ADS/DH (G8)

(4) Turn on electrical power (Ref. 24-41-00).

(5) Verify normal operation of both electrical actuators on the aft coupler as follows:

R R (a) Open circuit breakers NO. 1 AFT COUPLER (CB1-B9) and T/O AURAL WRNG (CB2-H7).

(b) Release (out) STABILIZER A and B switchlights on the PFCS overhead panel. Verify that the AFT CPLR OPEN light on PFCS panel comes on.

(c) Depress (in) STABILIZER A and B swithclight on the PFCS panel. Verify that the AFT CPLR OPEN light on PFCS panel goes out.

(d) Close circuit breaker CB1-B9 and open circuit breaker NO. 2 AFT COUPLER (CB1-B27).

R R R (e) Repeat Steps 4A(5)(b) and 4A(5)(c). If AFT CPLR OPEN light does not come on, refer to 27-41-00 fault isolation.

R (f) Close circuit breakers CB1-B27 and CB2-H7.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on all four hydraulic systems (Ref. 29-11-00). AC pumps and power transfer units can be used.

(7) Trim stabilizer to -4 degrees.

(8) On PFCS MONITOR panel, release (out) PITCH 2 switchlight; PITCH 2 switchlight OFF light must come
R on. Verify that PITCH 1 switchlight OFF light is off.

(9) To check Captains control path, enter forward electronic service center, zone 112, and block Captains cable drive arm (aft of forward override bungee) to prevent cable drive arm motion. Install blocks between cable drive arm and floor beam at both ends of cable drive arm (Ref. Fig. 501).

(10) Apply pitch-down (push) force of 70 to 95 pounds to Captains control wheel. Verify the following:

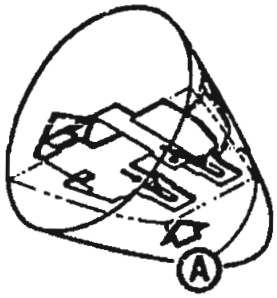
NOTE: Apply the push (or pull) force at a point corresponding to the center of the control wheel grip. The grip center is located 29.5 inches above the control column pivot center. (The chart holder plug on top of the control wheel hub is located at approximately the control wheel grip center.)

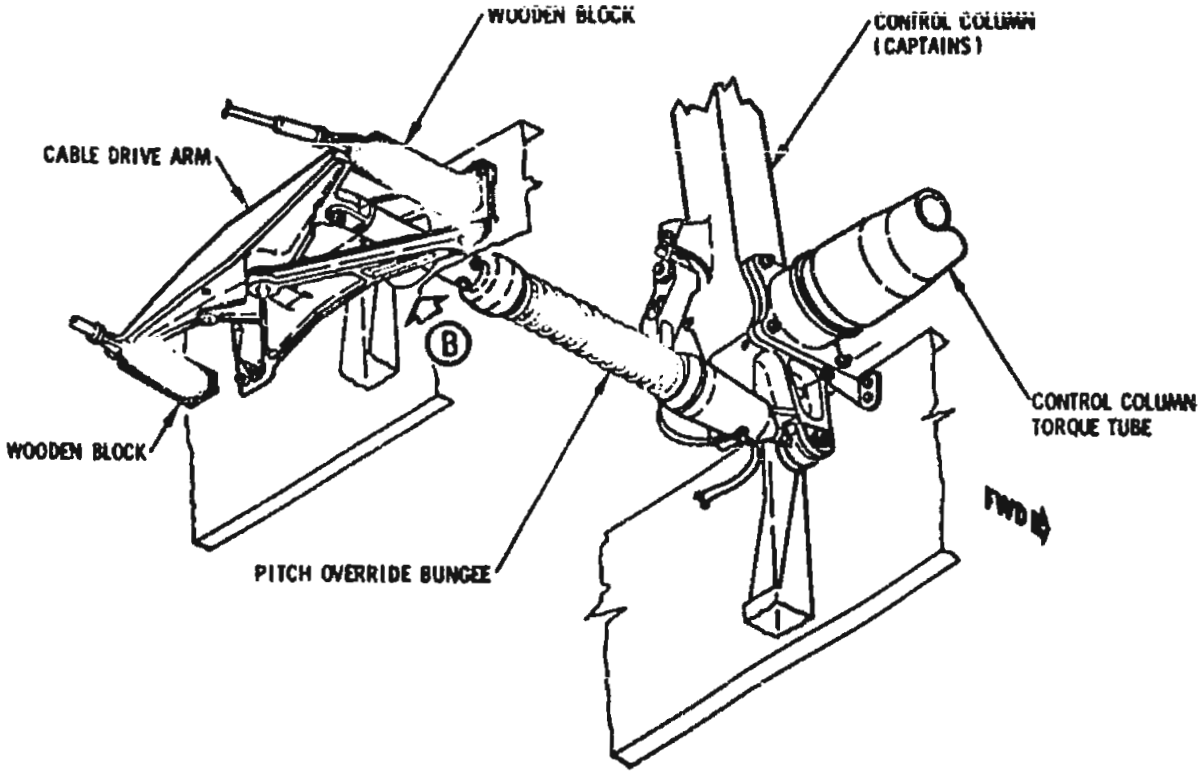
(a) On PFCS panel, the STABILIZER A and B PUSH lights come on.

(b) The FLT CONT PANELS light on pilots caution and warning panel (CAWP) flashes.

(11) Release control column.

(12) On PFCS panel, release STABILIZER A and B pushlights. Verify the following:





A

CAPTAINS INSTALLATION SHOWN - FIRST OFFICERS INSTALLATION OPPOSITE
(VIEW LOOKING UP)

M1-3100-27-118

R Installation of Pitch Cable Drive Arm Blocking Tool
R Figure 501

EFFECTIVITY: ALL

001B

R (a) The STABILIZER A and B PUSH lights go off.

(b) The STABILIZER A and B INOP lights come on.

(c) The PULL PITCH DISC light comes on.

(d) The AFT CPLR OPEN light comes on.

(13) Depress STABILIZER A and B pushlights. Verify the following:

R (a) The AFT CPLR OPEN light goes off.

(b) The STABILIZER A and B PUSH lights come on.

R (c) The STABILIZER A and B INOP lights go off.

R (d) The PULL PITCH DISC light goes off.

(14) Release PFCS MONITOR PITCH 1 switchlight. Verify the following:

(a) PITCH 1 OFF light comes on.

R (b) STABILIZER A and B PUSH lights go off.

R (15) Depress PFCS MONITOR PITCH 1 switchlight. Verify that
R PITCH 1 OFF light goes off.

(16) Apply pitch-up (pull) force of 70 to 95 pounds to Captains control wheel. Verify following:

(a) STABILIZER A and B PUSH lights come on.

(b) FLT CONT PANELS light on CAWP flashes.

(17) Release control column.

(18) On PFCS panel, release STABILIZER A and B pushlights. Verify the following:

R (a) The STABILIZER A and B PUSH lights go off.

(b) The STABILIZER A and B INOP lights come on.

(c) The PULL PITCH DISC light comes on.

(d) The AFT CPLR OPEN light comes on.

(19) Depress STABILIZER A and B pushlights. Verify the following:

R (a) The AFT CPLR OPEN light goes off.

(b) The STABILIZER A and B PUSH lights come on.

R (c) The STABILIZER A and B INOP lights go off.

R (d) The PULL PITCH DISC light goes off.

(20) Release PFCS MONITOR PITCH 1 switchlight. Verify following:

(a) PITCH 1 OFF light comes on.

(b) STABILIZER A and B PUSH lights go off.

(21) Depress PFCS MONITOR PITCH 1 switchlight. Verify that
R PITCH 1 OFF light goes off.

R (22) Depress PFCS MONITOR PITCH 2 switchlight. Verify that
R PITCH 2 OFF light goes off.

(23) Release PFCS MONITOR PITCH 1 switchlight. Verify that PITCH 1 OFF light comes on.

(24) Apply pitch-down (push) force of 70 to 95 pounds to Captains control wheel. Verify the following:

(a) The STABILIZER A and B PUSH lights come on.

(b) The FLT CONT PANELS light on CAWP flashes.

(25) Release control column.

(26) On PFCS panel, release STABILIZER A and B pushlights. Verify the following:

R (a) The STABILIZER A and B PUSH lights go off.

(b) The STABILIZER A and B INOP lights come on.

(c) The PULL PITCH DISC light comes on.

(d) The AFT CPLR OPEN light comes on.

(27) Depress STABILIZER A and B pushlights. Verify the following:

R (a) The AFT CPLR OPEN light goes off.

(b) The STABILIZER A and B PUSH lights come on.

R (c) The STABILIZER A and B INOP lights go off.

R (d) The PULL PITCH DISC light goes off.

(28) Release PFCS MONITOR PITCH 2 switchlight. Verify the following:

(a) PITCH 2 OFF light comes on.

R (b) STABILIZER A and B PUSH lights go off.

(29) Depress PFCS MONITOR PITCH 2 switchlight. Verify that
R PITCH 2 OFF light goes off.

(30) Apply pitch-up (pull) force of 70 to 95 pounds to Captains control wheel. Verify the following:

(a) The STABILIZER A and B PUSH lights come on.

(b) The FLT CONT PANELS light on CAWP flashes.

(31) Release control column.

(32) On PFCS panel, release STABILIZER A and B pushlights. Verify the following:

R (a) The STABILIZER A and B PUSH lights go off.

(b) The STABILIZER A and B INOP lights come on.

(c) The PULL PITCH DISC light comes on.

(d) The AFT CPLR OPEN light comes on.

(33) Depress STABILIZER A and B pushlights. Verify the following:

R (a) The AFT CPLR OPEN light goes off.

(b) The STABILIZER A and B PUSH lights come on.

R (c) The STABILIZER A and B INOP lights go off.

R (d) The PULL PITCH DISC light goes off.

(34) Release PFCS MONITOR PITCH 2 switchlight. Verify the following:

(a) PITCH 2 OFF light comes on.

R (b) STABILIZER A and B PUSH lights go off.

R (35) Depress PFCS MONITOR PITCH 2 switchlight. Verify that
R PITCH 2 OFF light goes off.

R (36) Depress PFCS MONITOR PITCH 1 switchlight. Verify that
R PITCH 1 OFF light is off.

(37) Remove blocks from Captains cable drive arm.

(38) To check First Officers control path, block First Officers cable drive arm (just aft of the forward bungee).

R (39) Perform Steps 4A(8) through 4A(36) for First Officers control wheel (whenever STABILIZER A and B pushlights or indicator lights are called out, replace with C and D).

(40) Remove blocks from First Officers cable drive arm.

(41) Close access door to forward electronic service center.

(42) Trim stabilizer to 0 degrees.

(43) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(44) Shut off electrical power if no longer required (Ref. 24-41-00).

CABLE TENSION REGULATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Control Column and Trim Wheel Lock, PN BA80-101, or equivalent

Rig Pins: 5/16-inch diameter, 3 inches long (R3, 2 each), and 4 inches long (R4, 1 each)

Prop Block, Pacific Scientific PN 0501750-11, or equivalent (normally comes installed on replacement tension regulator)

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
6-50-00	Interior Access Doors and Panels
24-41-00	External Power/Ground System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

R R (1) Install control column and trim wheel lock (Ref. Fig. 401).

(2) Gain access to aft cargo compartment. Remove cargo compartment aft bulkhead center access panel 161-AL (Ref. 6-50-00).

(3) Install the prop block on the lockshaft between the crosshead and the pin on the lockshaft (Ref. Fig. 401). If necessary, squeeze tension regulator cables together to compress regulator springs and move crosshead away from pin so prop block can be installed. Lock-wire prop block in place.

WARNING: TENSION REGULATOR SPRINGS ARE UNDER HIGH COMPRESSION AND CAN CAUSE INJURY TO PERSONNEL IF THEIR ENERGY IS RELEASED. VERIFY THAT PROP BLOCK IS PROPERLY INSTALLED AND LOCK-WIRED.

(4) Gain access to cable turnbuckles by removing associated 8-inch round ceiling access panels: 165-ER and 165-FR for right tension regulator, 165-EL and 165-FL for left tension regulator (Ref. 6-50-00).

NOTE: Ceiling access panels are located just forward of aft bulkhead.

(5) Loosen cable turnbuckles until cable tension is removed.

(6) On the aft end of each cable sector, remove the cotter pin that retains the cable ball in the cable sector.

(7) Disengage each cable ball from the keyhole slot. It may require additional loosening of the cable turnbuckles to disengage cables from the regulator cable sectors.

(8) Disconnect output pushrod from tension regulator arm.

(9) Remove cable guard bolts (one on each side).

(10) Remove the tension regulator pivot bolt retaining pin from the lower support bracket.

(11) Remove the pivot bolt from the bottom and remove the tension regulator.

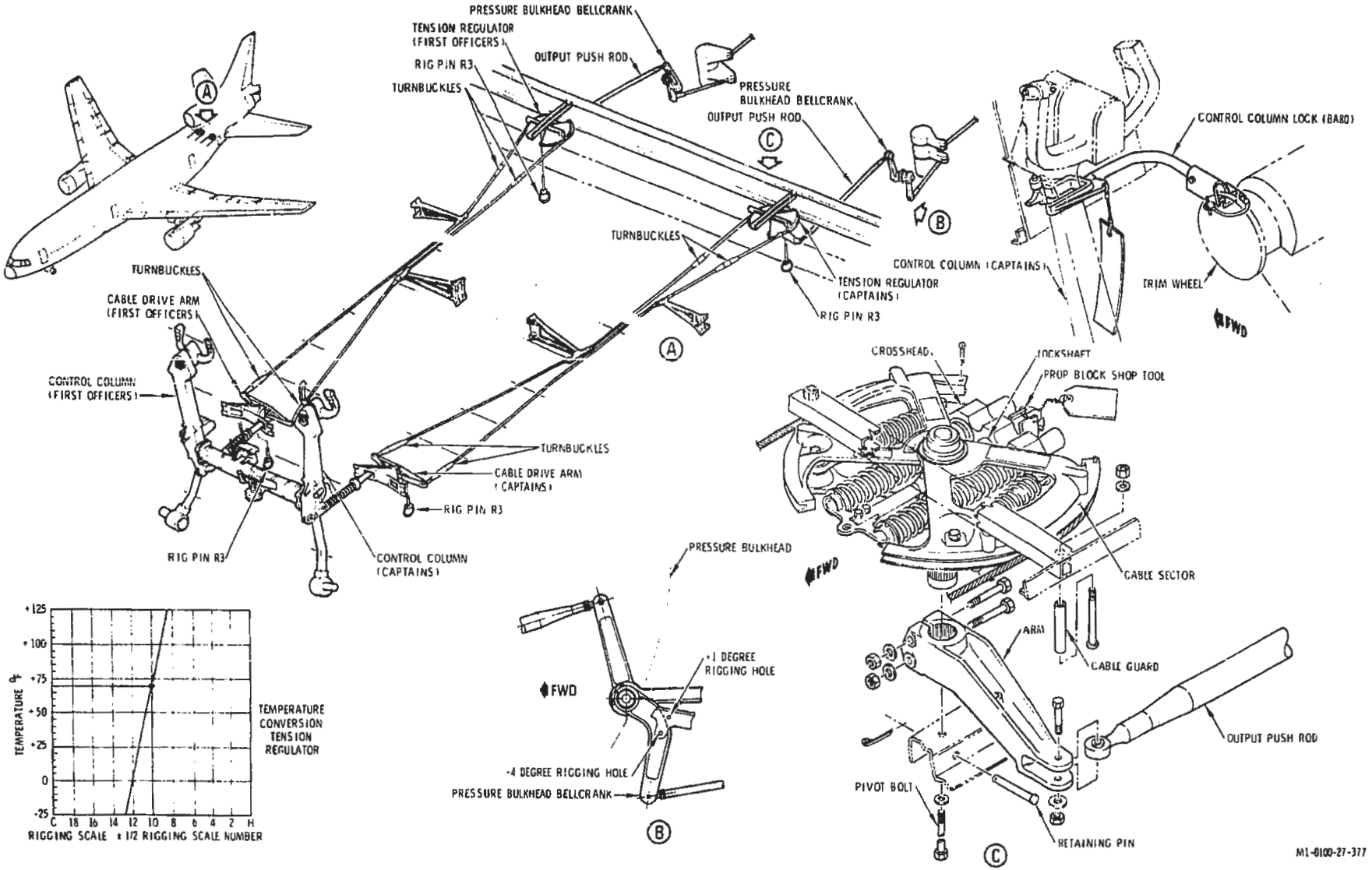
(12) Remove the two bolts through the tension regulator arm. Remove the arm from the tension regulator.

B. Installation

(1) Verify that all hydraulic power is shut off and that control column and trim wheel lock is installed.

CAUTION: DO NOT LUBRICATE ANY PART OF THE TENSION REGULATOR (ESPECIALLY THE LOCKSHAFT).

(2) Install arm on tension regulator spline shaft (arm and regulator spline shaft are aligned with a blank spline). Arm should be positioned vertically on spline shaft so that arm bolt holes are aligned with radial grooves in spline shaft. With the tension regulator in the installed position (spine shaft pointing down), the



R Cable Tension Regulator - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

arm offset should be in a downward direction. Install arm attach bolts.

(3) Position tension regulator in the installed position (arm down and pointing outboard). Install tension regulator pivot bolt from the bottom.

R R R R R NOTE: Allowable vertical play of cable tension regulator is between 0.00 and 0.040 inch. If 0.040 inch play is exceeded, a washer may be installed on the top end to reduce play to within acceptable limits.

(4) Install pivot bolt retaining pin in lower support bracket. Install cotter pin.

(5) Engage each cable ball in the respective cable sector keyhole slot.

(6) Install cotter pin in each sector to retain cable ball.

(7) Install cable guard pins (one on each side).

(8) On center console, pull up on PITCH DISC handle and lock in place to decouple control columns.

(9) If captains tension regulator is being replaced, remove control column and trim wheel lock.

(10) Open access door 112AB to forward electronic service center (Ref. 6-40-00).

(11) Position control column (on same side as replaced tension regulator) so that rig pin R3 can be installed in the cable drive arm. (Cable drive arm accessible from forward electronic service center.)

(12) Tighten cable turnbuckles until rig pin (R3) can be freely installed in the tension regulator arm, and the tension regulator pointer is positioned over the correct compensation scale number (Ref. temperature conversion chart Fig. 401).

NOTE: While tightening turnbuckles, periodically squeeze cables together to exercise tension regulator cable sectors and prevent tension regulator from locking up.

(13) Remove the prop block from the tension regulator lockshaft.

(14) Remove rig pins from cable drive arm and tension regulator arm.

(15) Exercise the cable system by cycling the control column for several full pitch up and down cycles.

(16) Recheck cable rigging by repeating Steps (11) and (12).

(17) Remove rig pins from cable drive arm and tension regulator.

(18) Connect output pushrod to tension regulator arm.

(19) Remove control column and trim wheel lock if still installed.

(20) Release PITCH DISC handle and allow handle to retract against console. (When control columns are symmetrical, a loud thump will indicate engagement of the pitch disconnect dog clutch.)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(21) Turn on electrical power (Ref. 24-41-00).

CAUTION: VERIFY THAT THERE ARE NO RIG PINS IN THE STABILIZER CONTROL SYSTEM.

(22) Turn on one hydraulic system for each stabilizer servo: A or B, and C or D (Ref. 29-11-00).

NOTE: When operating control columns, reverse direction slowly to prevent fuselage oscillations.

(23) Slowly operate control column on same side as replaced tension regulator and cycle stabilizer from full up to full down. Verify that controls operate smoothly without binding or chattering.

(a) During cycling of system, visually verify operation of replaced tension regulator. Tension regulator should operate smoothly without chatter.

(24) Recheck cable rig and output pushrod rig as follows:

(a) Install rig pin (R3) in cable drive arm on same side as replaced tension regulator.

CAUTION: DO NOT SHUT OFF HYDRAULIC POWER WITH RIG PINS INSTALLED IN ANY PART OF CONTROL SYSTEM. PERMANENT DAMAGE TO EQUIPMENT MAY RESULT.

(b) Rig pin (R3) must fit freely through replaced tension regulator arm, and tension regulator pointer must conform to temperature conversion chart (Ref. Fig. 401). If not, adjust turnbuckles.

(c) Remove access door on bottom of afterbody to gain access to pressure bulkhead bellcrank: 316BB, captains side, 316CB, first officer side (Ref. 6-40-00).

(d) With rig pin in tension regulator arm, rig pin must fit freely in the pressure bulkhead bellcrank minus 4-degree hole (lower hole) (Ref. Fig. 401). If not, adjust pushrod between tension regulator and pressure bulkhead bellcrank.

(e) Remove all rig pins.

(25) Verify that turnbuckle locking clips are installed and pushrod rod end is lock-wired.

(26) Close all access doors and install all access panels.

(27) Turn off hydraulic power (Ref. 29-11-01).

(28) Turn off electrical power (Ref. 24-41-00).

R R # CABLE TENSION REGULATOR INSPECTION AND CHECK

R 1. General

R The cable tension regulator is designed to maintain constant R tension on the stabilizer control cables under all temperature R conditions. This function is provided by the ability of the R crosshead to slide freely on the lockshaft when cable loads are R equal, and to lock on the lockshaft when cable loads are unequal R (input applied to system). Thus, the functioning of the R crosshead on the lockshaft is the key element of a proper R operating tension regulator (Ref. 27-41-09, Fig. 401).

R 2. Referenced Procedures

R 6-50-00 Interior Access Doors and Panels

R 24-41-00 External Power/Ground Service System - Maintenance R Practices

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 3. Inspection/Check

R A. Procedure

R (1) Gain access to aft cargo compartment. Remove cargo R compartment aft bulkhead center access panel 161-AL R (Ref. 6-50-00).

R (2) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY R HYDRAULIC SYSTEM:

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR R SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES R AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL R AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT R HYDRAULIC PRESSURE.

R (3) Turn on one hydraulic system for each stabilizer servo: R A or B and C or D (Ref. 29-11-00).

R (4) Slowly cycle control column from full pitch up to full pitch down. While pitch controls are being cycled, check operation of tension regulators for the following:

R (a) Tension regulator rotation must be smooth with no hesitation or chatter.

R (b) When controls are reversed, crosshead must lock to lockshaft without any slipping or chatter.

R (5) Release control column.

R (6) Check freedom of movement of the crosshead. Squeeze the cables together, just forward of each of the tension regulators. The cable sectors (Ref. 27-41-09, Fig. 401) and the crosshead must move smoothly with no chatter. Release cables.

R CAUTION: DO NOT LUBRICATE ANY PART OF TENSION REGULATOR. THE LOCKSHAFT MUST BE CLEAN AND FREE OF ANY OIL. OIL ON THE LOCKSHAFT COULD CAUSE LOCKSHAFT SLIPPAGE AND CHATTER.

R (7) Repeat Steps (4) and (5) to verify lockshaft operation.

R (8) Install aft bulkhead access panel.

R (9) Turn off hydraulic power (Ref. 29-11-00).

R (10) Turn off electrical power (Ref. 24-41-00).

AFT PITCH COUPLER - REMOVAL AND INSTALLATION

1. General

The following is a list of aft pitch coupler line replaceable units (LRU's):

R Aft Pitch Coupler Actuator, 27-41-13

Aft Pitch Coupler Jam Sensing Switch, 27-41-40

R Aft Pitch Coupler Open Switch, 27-41-43

2. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.040-inch diameter, or equivalent

Control Column and Trim Wheel Lock PN BA80-101, or equivalent

Sealing compound, LCM40-1218 Type I, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-41-06	Pitch Control Override Bungee and Aft Coupler - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices
20-51-04	Environmental Sealing of Model L-1011 Aircraft (PB75-425D)

4. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) Open access doors 316BB, 316DB, and 317AB in lower afterbody (Ref. 6-40-00).

(2) Position pitch trim wheel to 0.

(3) Install control column and trim wheel lock.

(4) To allow removal of the coupler input crank bolts, decouple aft pitch coupler as follows:

(a) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breakers NO. 1 AFT COUPLER (B9) and NO. 2 AFT COUPLER (B27) are closed.

(b) Turn on electrical power (Ref. 24-41-00).

(c) On overhead PFCS panel, zone 210, release (out) STABILIZER A and B switchlights. Verify that aft coupler actuators are in the decoupled (extended position).

NOTE: Dimensions between centers of aft coupler actuator attach bolt and jackscrew bolt are 9.78 (±0.030) inches extended (decoupled) and 9.0 (±0.030) inches retracted (coupled).

(d) Open and tag circuit breakers closed in Step A(4)(a).

(5) Disconnect Captains coupler input pushrods at end opposite of coupler (bellcrank outboard of coupler).

(6) On coupler, rotate lower input crank away from upper input crank to allow removal of the pushrod-to-crank connecting bolts (Ref. Fig. 401).

R CAUTION: DO NOT REMOVE INPUT CRANKS FROM SPLINED SHAFT. MIS-INDEXING OF CRANKS ON SPLINED SHAFT COULD CAUSE COUPLER MALFUNCTION.

(7) Disconnect Captains and First Officers dual pushrods from coupler input cranks.

(8) Disconnect electrical connectors from coupler and coupler actuators.

(9) Remove coupler lower mounting bolts, washers, and nuts.

(10) Remove coupler upper mounting bolts and washers, and remove coupler.

B. Installation (Ref. Fig. 401)

(1) On pilots overhead circuit breaker panel CB1, verify that circuit breakers NO. 1 AFT COUPLER (B9) and NO. 2 AFT COUPLER (B27) are open and tagged.

(2) Clean mounting surfaces on coupler and bulkhead to provide electrical bonding.

(3) Position coupler on bulkhead with mounting holes aligned.

(4) Install upper mounting bolts and washers from coupler side (Ref. Fig. 401).

(5) Install lower mounting bolts, washers, and nuts with nuts on coupler side.

(6) Torque mounting bolts 70 to 100 lb in.

R (7) Apply fillet seal around coupler mounting pads in accordance with PB75-425 (Ref. 20-51-04).

(8) Connect electrical connectors to coupler and coupler actuators.

(9) Remove tags and close circuit breakers opened in Step B(1).

(10) Verify that coupler actuators are in extended position (decoupled) [(Ref. Step A(4)(c)].

(11) On coupler, rotate lower input crank away from upper input crank to allow input pushrod connections.

(12) Connect right (First Officers) set of pushrods to upper input crank with bolt, washer, and nut; install cotter pin. Install flathead pin and cotter pin in cranks at both ends of connecting bolt.

(13) Connect left (Captains) set of pushrods to lower input crank with bolt, washer, and nut; install cotter pin. Install flathead pin and cotter pin in cranks at both ends of connecting bolt.

(14) Connect opposite end of left (Captains) pushrods to bellcrank with bolt, washer, and nut; install cotter pin. Install flathead pin and cotter pin in bellcranks at both ends of connecting bolt.

(15) Turn on electrical power (Ref. 24-41-00).

(16) Recouple coupler by depressing (latched in) STABILIZER A and B switchlights on PFCS panel. Verify that coupler actuators are in retracted position (9.0 ±0.030 inches between connecting bolt centers).

(17) Remove control column and trim wheel lock.

(18) Remove tags from hydraulic control panels.

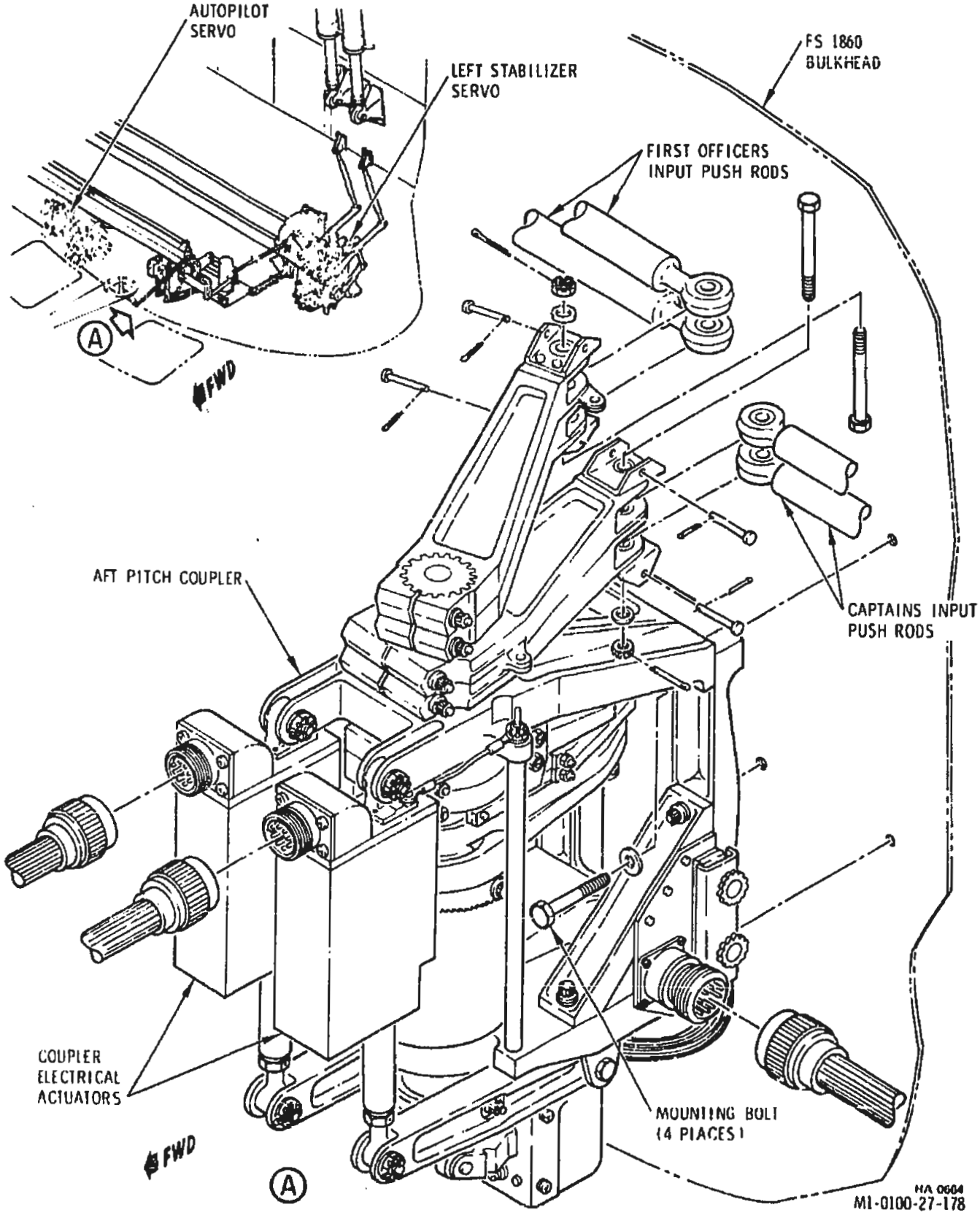
(19) Perform coupler operational test (Ref. 27-41-06, Adjustment and Test).

(20) Perform stabilizer servo pressure phasing check (Ref. 27-41-00, Adjustment and Test).

(21) Install and close access doors and panels.

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER STABILIZER SERVO OPERATING LINKAGE. CORRECT INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR ASSOCIATED STIFFENER (REF. SB53-160).

(22) Turn off electrical power if no longer required (24-41-00).



Aft Pitch Coupler - Removal and Installation
Figure 401

R # AFT PITCH COUPLER - ADJUSTMENT AND TEST

R 1. General

R The aft pitch coupler switches work in conjunction with the
R pitch control override bungee switches to supply jam warning
R logic to the FCES computer. The operational test of the aft
R pitch coupler is accomplished with the pitch control override
R bungee in section 27-41-06, Adjustment and Test.

AFT PITCH COUPLER ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.040-inch diameter, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

FCES - COMPUTERS - AC & L AOA

NO. 1 AFT COUPLER

NO. 2 AFT COUPLER

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker FLIGHT STATION MISC - R AOA.

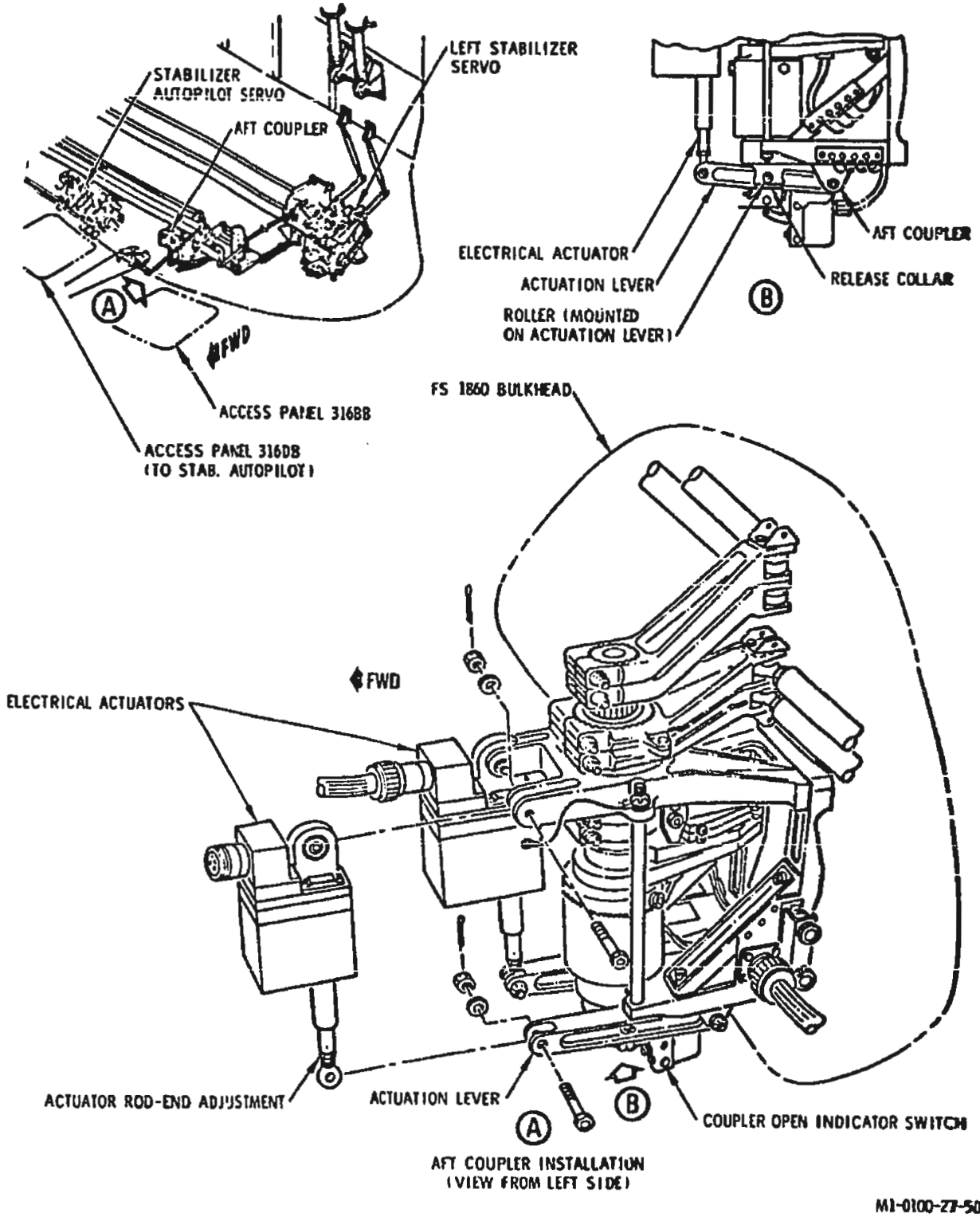
R R R (2) Remove access panel 316BB just forward of the left stabilizer servo to gain access to aft pitch coupler (Ref. 6-40-00).

R R (3) Disconnect electrical connector from aft pitch coupler actuator to be removed (Ref. Fig. 401).

(4) Disconnect electrical bonding jumper at actuator by removing end-fitting mounting bolt and washer on actuator. Reinstall bolt and washer on actuator.

(5) Remove cotter pin, nut, washer, and bolt attaching both ends of actuator to coupler, and remove actuator.

B. Installation



M1-0100-27-500

R Aft Pitch Coupler Acutator - Removal and Installation
R Figure 501

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Attach top end of actuator to coupler with bolt, washer, and nut. Install cotter pin.

NOTE: Bolts in Steps (2) and (3) may be installed with cotter pin hole in most convenient position.

(3) Attach rod end of actuator to actuator lever with bolt, washer and nut. Install cotter pin.

(4) Remove actuator end-fitting mounting bolt and washer. Use removed bolt and washer to connect electrical bonding jumper.

(5) Connect electrical connector to actuator. Lock-wire connector.

(6) Remove tags and close circuit breakers opened in Step 3A(1) except the following:

(a) For actuator No. 1 (left) installation, leave circuit breaker NO.2 AFT COUPLER open.

(b) For actuator No. 2 (right) installation, leave circuit breaker NO. 1 AFT COUPLER open.

(7) Turn on electrical power (Ref. 24-41-00).

(8) On PFCS monitor/control panel, zone 210, release (out) STABILIZER A and B switchlights. Verify that actuator rod extends to limit and actuator motor stops.

R NOTE: The extended actuator rod positions the coupler
R to the uncoupled condition, as indicated by the AFT CPLR OPEN annunciation on the PFCS monitor/control panel.

(9) Depress (latch in) STABILIZER A and B switchlights. Verify that actuator rod retracts and actuator motor stops at full retraction.

R (10) With actuator fully retracted, verify that the
R clearance between the roller on the actuation lever and
R the release collar is 0.040 (±0.030) inch. If not,
R adjust actuator rod-end length.

R (11) Turn off electrical power (Ref. 24-41-00).

R (12) Remove tag and close circuit breaker left open in Step
R B(6).

R (13) Install access panel 3160B.

ELECTRICAL PITCH FEEL/TRIM ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Control Column and Trim Wheel Lock PN BA80-101, or equivalent

Rig Pins: 5/16-inch diameter: 12.5 inches long (R12, 2 each), 6 inches long (R6, 1 each), 4 inches long (R4, 1 each)

2. Reference Procedures

R	6-40-00	External Access Doors and Panels
	12-23-00	Flight Controls Lubrication
	20-51-09	Application of Phosphate Ester Resistant Primer - LCP78-1131C (for coupler shaft repair)
	20-51-10	Application of Weather Resistant Polyurethane Enamel - LCP78-1133C (for coupler shaft repair)
	22-18-00	Trim Augmentation Computer - Adjustment and Test
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices
	51-21-02	Structural Repair Manual - Corrosion Prevention and Treatment (for coupler shaft repair)

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

R (1) Open access panels 316BB, 317BB, and 317CB (Ref.
R 6-40-00) to lower afterbody area (Ref. Fig. 401).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers:

NO. 1 SYSTEMS - TRIM AGMT - AC and DC (A7, A8)

(3) Install the control column lock.

(4) Tag control columns.

(5) Remove step over electrical pitch feel/trim assembly.

(6) Disconnect forward end of electrical feel/trim input pushrod at input bellcrank (forward side of FS 1860 bulkhead). To remove feel spring load while disconnecting input pushrod, push on electrical feel/trim output arm (Ref. Fig. 401).

(7) Remove guard covering trim and Mach sync coupler shafts.

R CAUTION: INSPECT BOTH COUPLER SHAFTS ADJACENT TO BOTH ENDS
R OF GUARD (REF. FIG. 402). IF EITHER COUPLER SHAFT
R IS GROOVED OR SCORED, SEE PARAGRAPH C FOR REPAIR
R INSTRUCTIONS.

(8) Disconnect lower (trim sync) coupler shaft at mechanical feel/trim assembly by removing coupler bolts.

(9) Slide shaft from mechanical feel/trim assembly, then from the electrical feel/trim assembly.

(10) Disconnect upper (Mach sync) coupler shaft at electrical feel/trim assembly by removing coupler bolts.

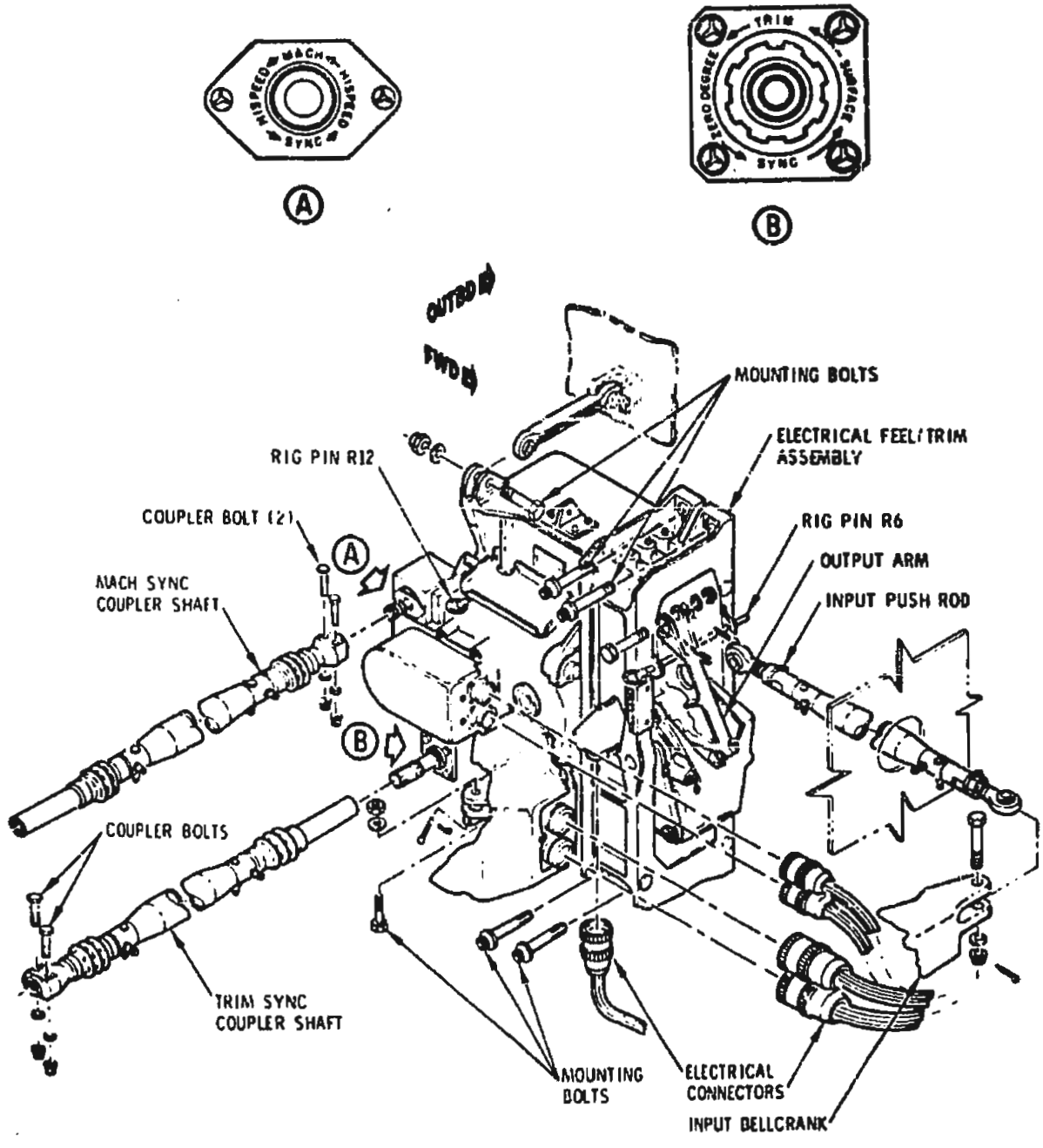
(11) Slide shaft from electrical feel/trim assembly, and then from the mechanical feel/trim assembly.

(12) Rotate electrical feel/trim assembly TRIM SYNC spline shaft (lower spline shaft) clockwise until output arm protrudes outside the assembly and the input pushrod attach bolt is accessible.

(13) Remove input pushrod from electrical feel/trim assembly output arm by removing connecting bolt.

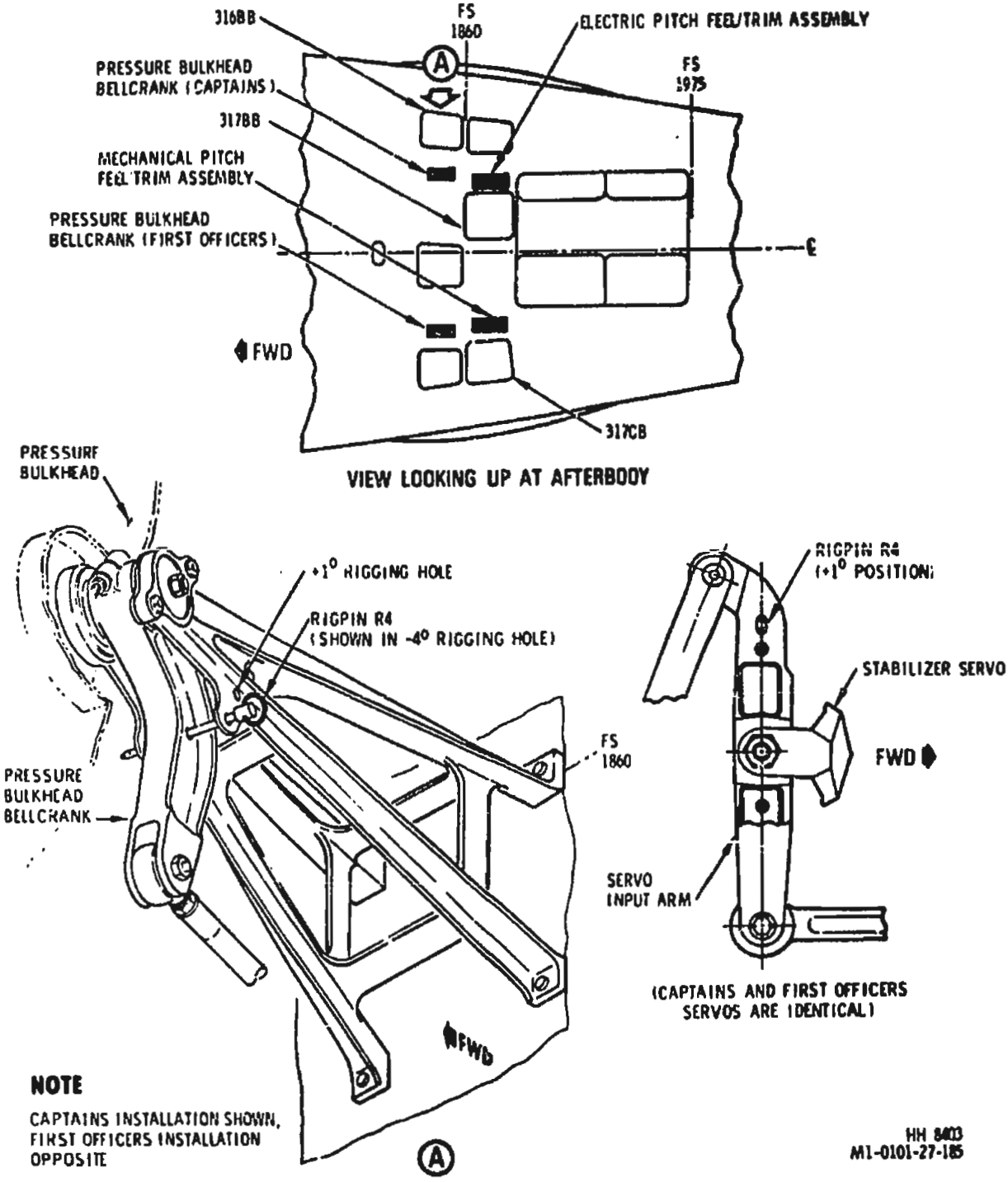
(14) Disconnect electrical connectors from electrical feel/trim assembly.

NOTE: Electrical feel/trim assembly weighs 63 pounds. Assembly can be removed by hand, however, a portable hoist hardpoint is located above the stabilizer actuators and a lifting lug is mounted to top of feel/trim assembly.

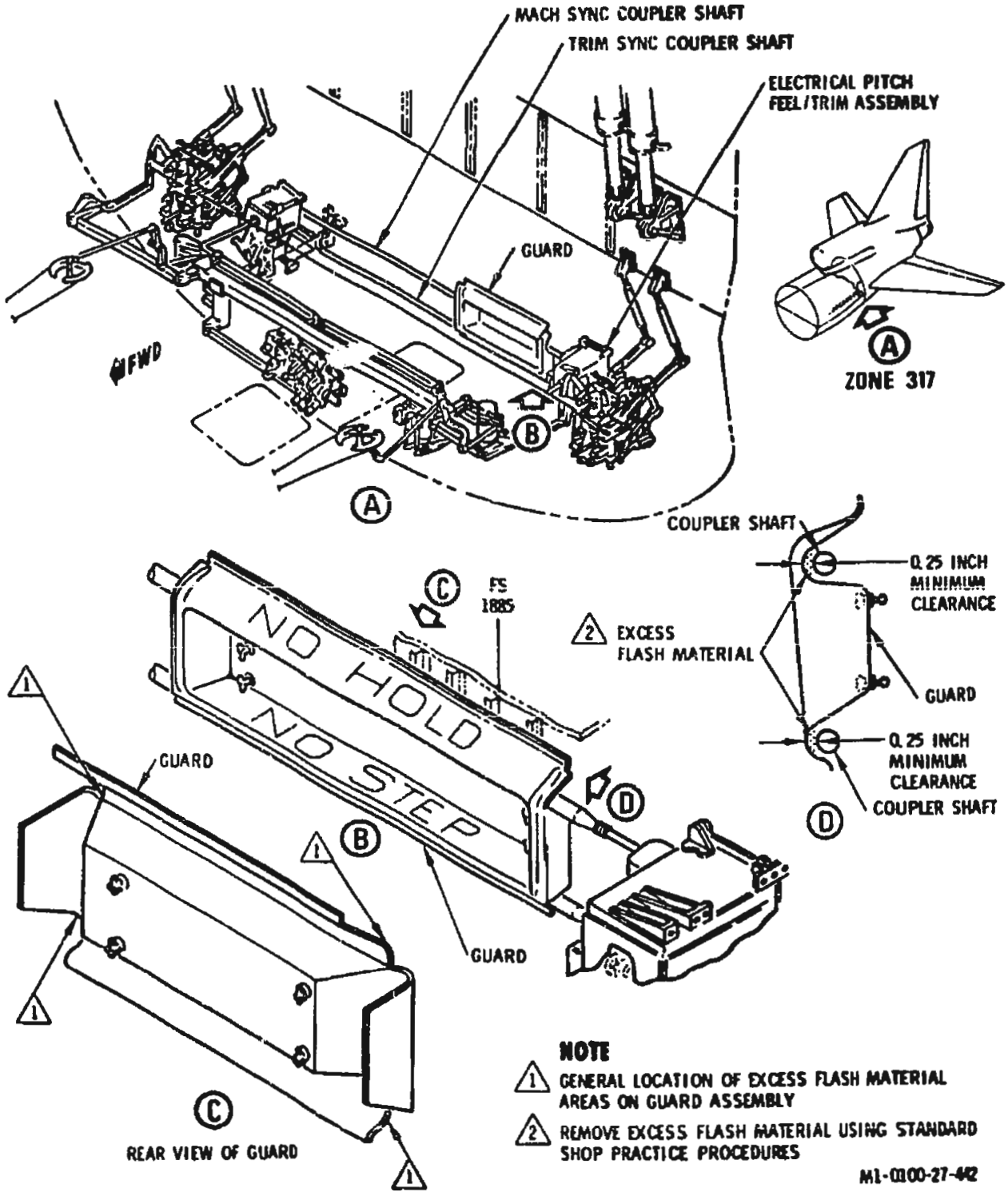


M1-0101-27-328

Electrical Pitch Feel/Trim Assembly - Removal and Installation
Figure 401 (Sheet 1)



Electrical Pitch Feel/Trim Assembly - Removal and Installation
Figure 401 (Sheet 2)



R
R

Coupler Shaft Guard Rework
Figure 402

EFFECTIVITY: ALL

001B

(15) Remove mounting bolts and remove electrical feel/trim assembly.

B. Installation (Ref. Fig. 401)

(1) Verify that control column lock is installed.

(2) Verify that all hydraulic power is turned off.

(3) Verify circuit breakers listed in Step A(2) are open and tagged.

(4) Before installation, lubricate one fitting on feel/trim assembly (Ref. 12-23-00).

(5) Position feel/trim assembly into mounting position and install mounting bolts.

(6) Rotate MACH SYNC spline shaft (top spline shaft) on mechanical feel/trim assembly to HIGH SPEED position as shown on spline shaft instruction plate (Ref. 27-41-17, Fig. 401, Sheet 2). Install rig pin (R12) in hole marked MACH FEEL SCHEDULER RIG HOLE on mechanical feel/trim assembly. Rotate MACH SYNC spline shaft in both directions to verify that rig pin has locked linkage against rotation in either direction.

(7) If electrical feel/trim assembly does not contain a rig pin (shipping pin) in the MACH FEEL SCHEDULER RIG HOLE, rotate MACH SYNC spline shaft (top spline shaft) on the electrical pitch feel/trim assembly to HIGH SPEED position as shown on spline shaft instruction plate (Ref. Fig. 401, Sheet 1). Install rig pin (R12) in hole marked MACH FEEL SCHEDULER RIG HOLE. Rotate MACH SYNC spline shaft in both directions to verify that rig pin has locked linkage against rotation in either direction.

R CAUTION: IF MACH SYNC SPLINE SHAFT ON EITHER THE ELECTRICAL
R OR MECHANICAL FEEL/TRIM ASSEMBLIES CAN BE ROTATED
R IN ONE DIRECTION, THE RIG PIN INSERTED IN THE MACH
R FEEL SCHEDULER RIG HOLE HAS NOT ENGAGED THE
R INTERNAL MACH FEEL ARM AND THE ARM IS OUT OF RIG.
R RECHECK RIGGING AS OUTLINED IN STEP (6) OR (7).

(8) Install Mach sync coupler shaft (longest shaft) between top spline shafts on mechanical and electrical feel/trim assemblies. Install coupler bolts.

(9) Remove rig pins from MACH FEEL SCHEDULER RIG HOLE on both feel/trim assemblies.

NOTE: If electrical feel/trim assembly has a MACH FEEL SCHEDULER rig pin and a rig pin in output arm (shipping pins on common strap), remove both rig pins.

R R R R R (10) Rotate electrical feel/trim assembly TRIM SYNC spline shaft (lower spline shaft) clockwise until output arm protrudes from the assembly. Connect input pushrod to electrical feel/trim assembly output arm with attaching hardware.

(11) Rotate electrical feel/trim assembly TRIM SYNC spline shaft counterclockwise to zero-degree position against internal stop.

(12) Rotate mechanical feel/trim assembly TRIM SYNC spline shaft clockwise to zero-degree position against internal stop.

(13) Install trim sync coupler shaft (shorter shaft) between lower spline shafts on electrical and mechanical feel/trim assemblies. Install coupler bolts.

(14) Install coupler shaft guard assembly as follows (Ref. Fig. 402):

(a) Position the guard assembly to the extreme lowest position.

(b) Secure the guard assembly with four camlock fasteners.

(c) Verify that clearance between each coupler shaft and both ends of guard assembly is 0.250 inch minimum. If not, remove excess flash material from guard assembly (Ref. Fig. 402).

CAUTION: VERIFY THAT BOTH INBOARD AND OUTBOARD EDGES OF GUARD CLEAR COUPLER SHAFTS BY A MINIMUM OF 0.250 INCH.

(15) Connect electrical connectors.

(16) Connect forward end of input pushrod to input bellcrank (forward of FS 1860 bulkhead). To remove feel spring load while connecting pushrod, push on feel/trim output arm.

(17) Remove rig pin from stabilizer servo input arm (if installed). Verify that there are no rig pins in any part of stabilizer control system.

(18) Install step over electrical feel/trim assembly with mounting screws.

(19) Remove tags and close circuit breakers opened in Step A(2).

(20) Remove hydraulic panel placards installed in Step 3.

(21) Remove control column tags.

(22) Check electrical feel/trim assembly as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on electrical power (Ref. 24-41-00).

R (b) Turn on all four hydraulic systems (Ref. 29-11-00).

(c) Cycle control column a minimum of three times to normalize pitch control system.

(d) Operate either pitch trim wheel from 0 to -10 degrees and back to 0. Verify that stabilizer and control columns follow trim wheel inputs (use surface position indicator to follow stabilizer movement). Verify that trim system operates without binding (a ratchet-type oscillation in force is normal).

(e) Move control column full forward and aft several times. Verify that stabilizer control system operates smoothly without binding.

NOTE: Steps (f) through (h) check feel/trim input pushrod adjustment.

(f) Position pitch trim wheel to -4 degrees.

(g) On the aft side of the aft pressure bulkhead, install rig pin R4 in Captains pressure bulkhead bellcrank and -4 degree hole (lower hole) in bracket (Reg. Fig. 401, Sheet 2). If necessary, manually position bellcrank to install rig pin.

(h) With rig pin installed in pressure bulkhead bellcrank, rig pin R6 must fit freely through electrical feel/trim housing and output arm (Ref. Fig. 401, Sheet 1). If not, remove all rig pins, turn off hydraulic power, readjust input pushrod, turn on hydraulic power, and recheck input pushrod by performing Steps (g) and (h).

(i) Remove all rig pins.

(j) Perform Pitch Trim Operational Test (Ref. 22-18-00, Adjustment and Test).

(k) Perform Mach Trim and Feel Operational Test (Ref. 22-21-00, Adjustment and Test).

(23) Close access doors opened in Step A(1).

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR
R (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH
R FULL STABILIZER THROWS TO CHECK FOR ANY
R INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE
R STABILIZER SERVO OPERATING LINKAGE. CORRECT
R INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR
R ASSOCIATED STIFFENER (REF. SB53-188).

(24) Turn off electrical power if no longer required (Ref. 24-41-00).

(25) Turn off hydraulic power if no longer required (Ref. 29-11-00).

C. MACH Sync and Trim Sync Coupler Shaft Repair (Ref. SB 27-A134)

(1) If groove in shaft is more than 0.015 inch deep, replace shaft.

(2) If groove in shaft is less than 0.015 inch, repair as follows:

(a) Polish grooved area to provide a minimum radius of 0.250 inch at bottom of groove. Maximum allowable depth of groove is 0.015 inch after polish.

(b) Apply Alodine corrosion prevention (Ref. 51-21-02).

(c) Apply primer (Ref. 20-51-09).

(d) Apply topcoat (Ref. 20-51-10).

MECHANICAL PITCH FEEL/TRIM ASSEMBLY REMOVAL AND INSTALLATION

1. Equipment and Materials

Control Column and Trim Wheel Lock, PN BA80-101, or equivalent

Rig Pins: 5/16-inch diameter; 4 inches long (R4, 2 each), 5 inches long (R5, 2 each), 6 inches long (R6, 1 each), 12.5 inches long (R12, 1 each)

R Rig Pin, Bertea (P/N 216135-101)

2. Referenced Procedures

6-40-00	External Access Doors and Panels
12-23-00	Flight Controls Lubrication
20-51-09	Application of Phosphate Ester Resistant Primer - LCP78-1131C
20-51-10	Application of Weather Resistant Polyurethane Enamel - LCP78-1133C
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
51-21-02	Structural Repair Manual - Corrosion Prevention and Treatment

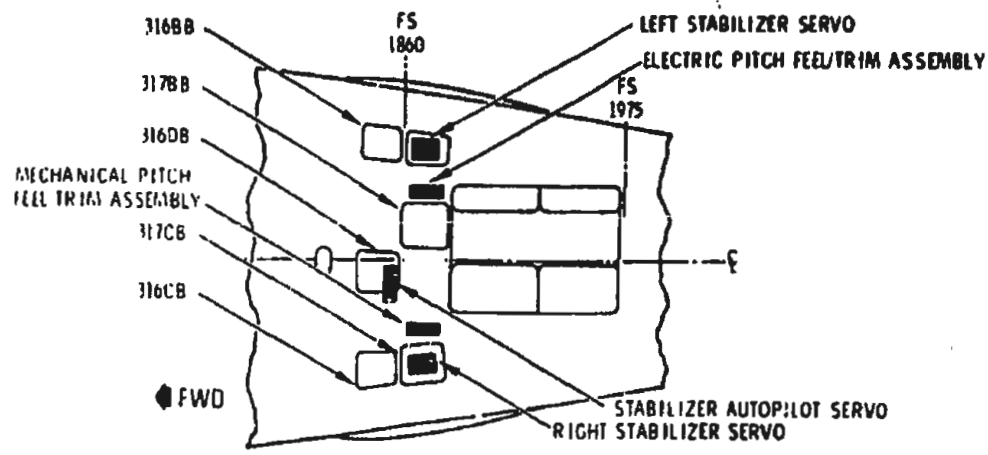
3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

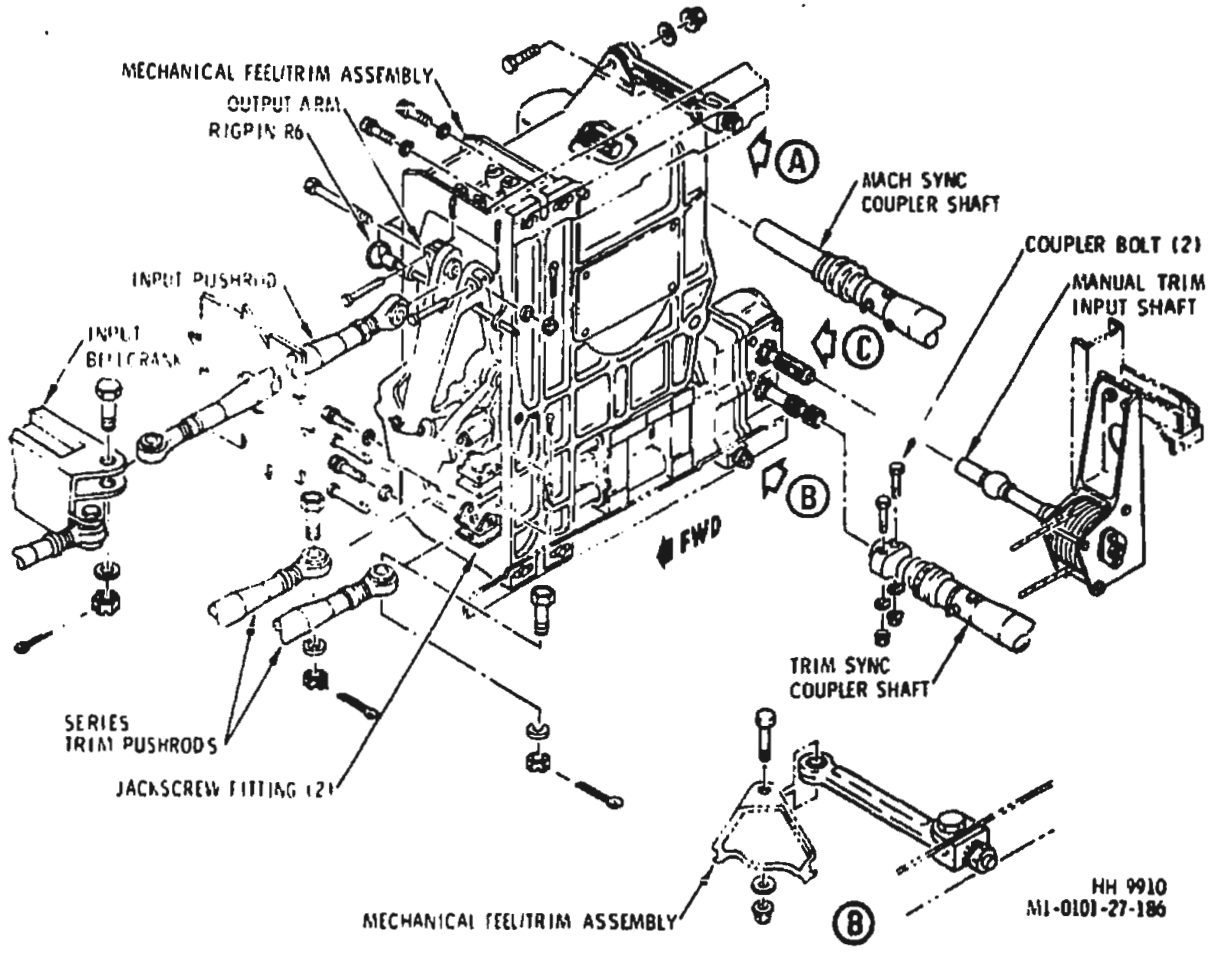
A. Removal (Ref. Fig. 401)

(1) Open access panels 316CB, 316DB, 317BB, and 317CB (Ref. 6-40-00) to lower afterbody area, (Ref. Fig. 401).

(2) Tag control columns against movement.

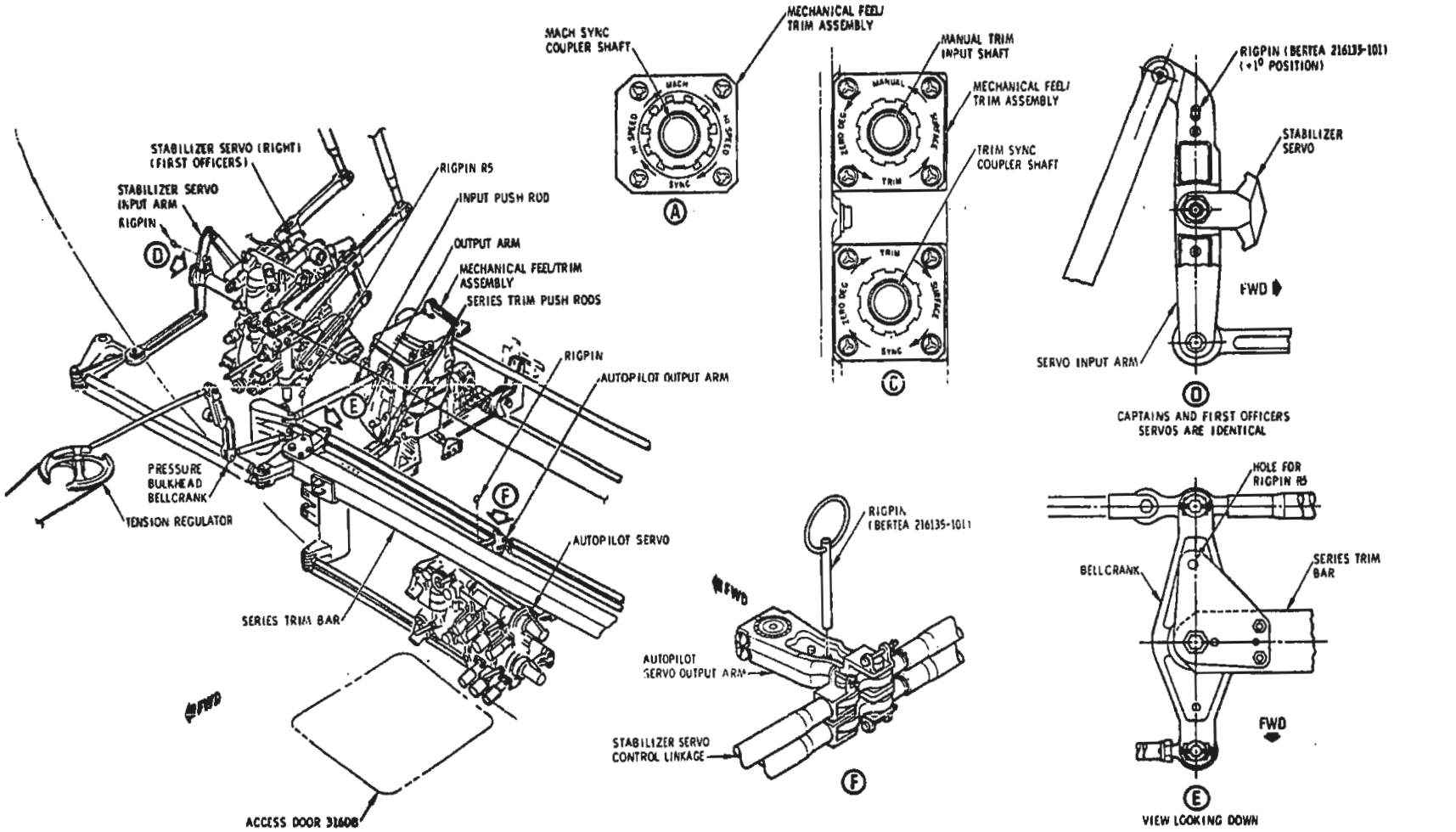


VIEW LOOKING UP AT AFTERBODY



R Mechanical Pitch Feel/Trim Assembly - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL

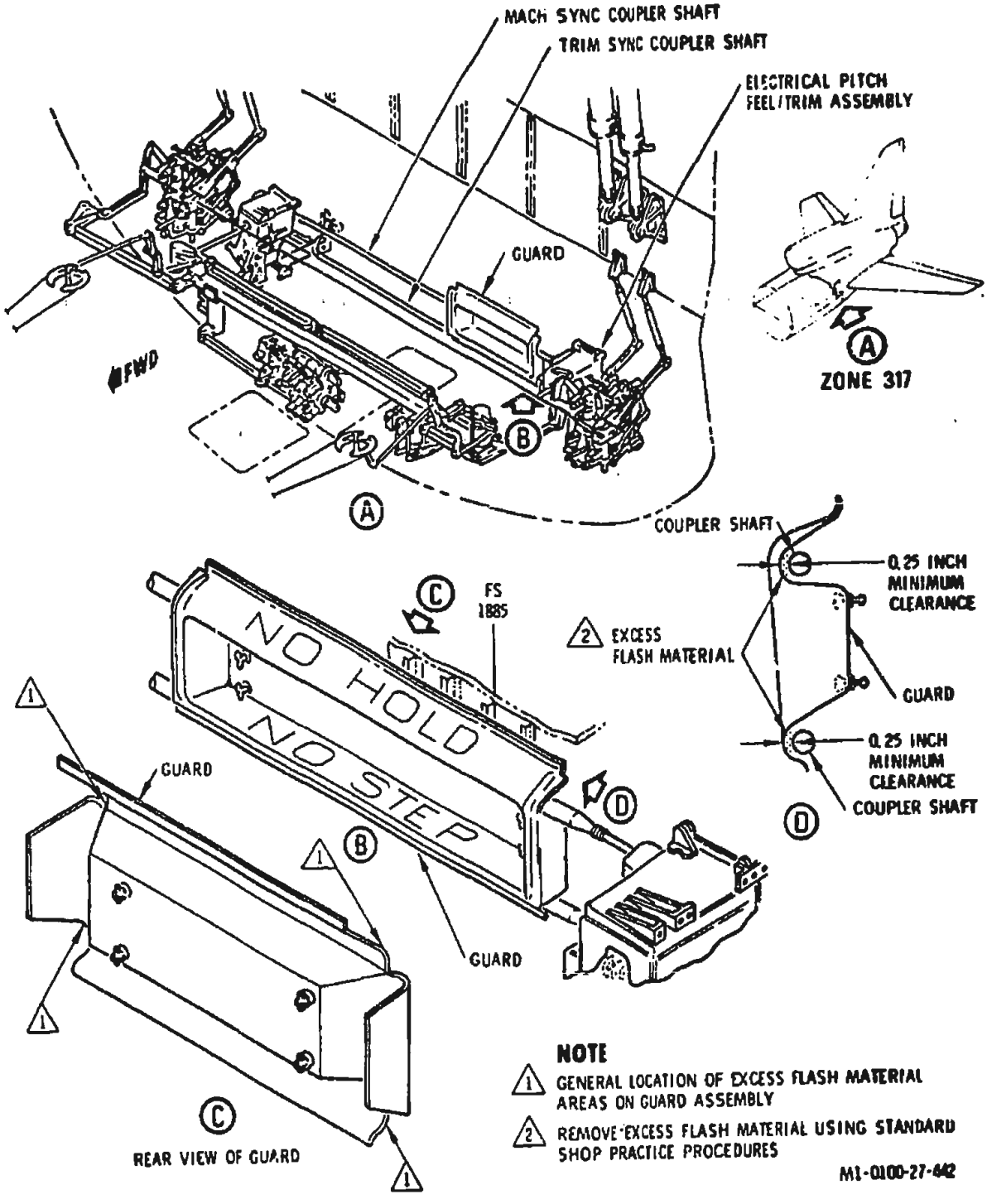


M1-0002-27-187

R Mechanical Pitch Feel/Trim Assembly - Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: ALL

001B



R Coupler Shaft Guard Rework
R Figure 402

(3) Disconnect forward end of mechanical feel/trim input pushrod at input bellcrank on forward side of FS 1860 bulkhead.

(4) Install the control column lock.

(5) Remove guard covering trim and Mach sync coupler shafts.

CAUTION: INSPECT BOTH COUPLER SHAFTS ADJACENT TO BOTH ENDS OF GUARD (REF. FIG. 402). IF EITHER COUPLER SHAFT IS GROOVED OR SCORED, SEE PARAGRAPH C FOR REPAIR INSTRUCTIONS.

(6) Disconnect lower (trim sync) coupler shaft at mechanical feel/trim assembly by removing coupler bolts.

(7) Slide coupler shaft from mechanical feel/trim assembly, then from the electrical feel/trim assembly.

(8) Disconnect upper (Mach sync) coupler shaft at electrical feel/trim assembly by removing coupler bolts.

(9) Slide coupler shaft from electrical feel/trim assembly, then from mechanical feel/trim assembly.

(10) Disconnect the two series trim pushrods from mechanical feel/trim assembly.

(11) Install Rig pins in stabilizer servo input arms (Ref. Fig. 401).

(12) Rotate pitch trim wheel to the -10 degree position to extend mechanical feel/trim output arm for accessibility to input pushrod attach bolt.

(13) Remove input pushrod from mechanical feel/trim assembly output arm.

(14) Remove electrical connector on outboard side of assembly.

(15) Remove mounting bolts.

NOTE: Mechanical feel/trim assembly weighs 56 pounds. Assembly can be removed by hand however, a portable hoist hard point is located above stabilizer actuators and a lifting lug is mounted to the top of the feel/trim assembly.

(16) Move assembly outboard to clear manual trim input shaft and remove from aircraft.

B. Installation (Ref. Fig. 401)

(1) Verify that control column lock is installed.

(2) Verify that all hydraulic power is turned off.

(3) Before installation, lubricate one fitting on mechanical feel/trim assembly (Ref. 12-23-15).

(4) Rotate pitch trim wheel in flight station to 4 degree position and install rig pin R4 in pitch trim aft cable drum.

(5) Remove two rig pins (shipping pins on common strap) from mechanical feel/trim assembly. Reinstall rig pin R12 in MACH FEEL SCHEDULER RIG HOLE.

(6) Manually rotate MANUAL TRIM spline shaft (center spline shaft) on mechanical feel/trim assembly clockwise until rig pin R6 can be inserted through -4 DEG RIG HOLE on front of feel/trim assembly and output arm.

(7) Raise mechanical feel/trim assembly to installation position. Mate assembly with manual trim input shaft and align dowl with bulkhead receptacle. Slide assembly inboard against bulkhead.

(8) Install mounting bolts.

(9) Verify proper coupling of manual trim input shaft: With rig pin in aft cable drum, rig pin R6 must be easily removable from -4 DEGREE RIG HOLE and output arm, of mechanical feel/trim assembly.

(10) Rotate MACH SYNC spline shaft (top spline shaft) on electrical feel/trim assembly assembly to HIGH SPEED position as shown on spline shaft instruction plate (Ref. 27-41-16, Fig. 401, Sheet 1). Install rig pin R12 in hole marked MACH FEEL SCHEDULER RIG HOLE. Rotate MACH SYNC spline shaft in both directions to verify that rig pin has locked linkage against rotation in either direction.

(11) If mechanical feel/trim assembly does not already contain rig pin in MACH FEEL SCHEDULER RIG HOLE, rotate MACH SYNC spline shaft on mechanical feel/trim assembly to HIGH SPEED position as shown on spline shaft instruction plate (Ref. Fig. 401, Sheet 2). Install rig pin R12 in MACH FEEL SCHEDULER RIG HOLE. Rotate

MACH SYNC spline shaft in both directions to verify that rig pin has locked linkage against rotation in either direction.

CAUTION: IF MACH SYNC SPLINE SHAFT ON EITHER THE ELECTRICAL OR MECHANICAL FEEL/TRIM ASSEMBLY CAN BE ROTATED IN ONE DIRECTION, THE RIG PIN INSERTED IN THE MACH FEEL SCHEDULER RIG HOLE HAS NOT ENGAGED THE INTERNAL MACH FEEL ARM AND THE ARM IS OUT OF RIG. RECHECK RIGGING AS OUTLINED IN STEP (10) OR (11).

(12) Install Mach sync coupler shaft (longest shaft) on top spline shaft of mechanical feel/trim assembly, then mate with top spline shaft of electrical feel/trim assembly. Install coupler bolts.

(13) Remove all rig pins from electrical and mechanical feel/trim assemblies and trim aft cable drum.

(14) IN flight station, rotate pitch trim wheel to -10 degree (Nose Up) position to extend mechanical feel/trim assembly output arm for accessibility.

(15) Connect input pushrod to mechanical feel/trim assembly output arm.

(16) IN flight station, rotate pitch trim wheel to zero degree position.

R R R R (17) Rotate mechanical feel/trim assembly TRIM SYNC spline shaft clockwise against its internal stop. Rotate electrical feel/trim assembly TRIM SYNC spline shaft counterclockwise against its internal stops.

(18) Mate trim sync coupler shaft (shorter shaft) with lower spline shaft on electrical assembly, then mechanical assembly. Install coupler bolts.

(19) Verify that there are no rig pins in any part of stabilizer control system.

(20) Connect both series trim pushrods to mechanical feel/trim assembly jackscrew fittings. Rotate manual trim input shaft to align pushrod connecting bolts.

NOTE: Verify that bolts that connect series pushrods to jackscrew fittings can be inserted freely (there should be no load between pushrods).

(21) Remove control column lock. Connect forward end of input pushrod to input bellcrank (Forward of FS 1860 bulkhead). Reinstall control column lock.

(22) Install coupler shaft guard assembly as follows (Ref. Fig. 402):

(a) Position guard assembly to the extreme lowest position.

(b) Secure the guard assembly with four camloc fasteners.

(c) Verify that clearance between each coupler shaft and both ends of guard assembly is 0.250 inch minimum. If not, remove excess flash material from guard assembly (Ref. Fig. 402).

CAUTION: VERIFY THAT BOTH INBOARD AND OUTBOARD EDGES OF GUARD CLEAR COUPLER SHAFTS BY A MINIMUM OF 0.250 INCH.

(23) Install electrical connector on outboard side of assembly.

(24) Remove hydraulic panel placards installed in Step 3.

(25) Remove control column locks and tags.

(26) Check mechanical feel/trim assembly as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on electrical power (Ref. 24-41-00).

(b) Turn on hydraulic system B and C (Ref. 29-11-00).

(c) Cycle control column a minimum of three times to normalize pitch control system.

(d) Operate pitch trim wheel in flight station from zero to -10 degrees and back to zero degrees. Verify that stabilizer and control columns follow

trim wheel inputs (use surface position indicator to follow stabilizer movement). Verify that trim system operates with no binding (a ratchet-type oscillation in force is normal).

(e) Operate electric trim wheel on control wheel to move stabilizer to full nose down trim and then to full nose up trim. Check for smooth operation of electric trim system.

(f) Slowly move control column full forward and full aft several times. Verify that stabilizer control system operates smoothly without binding.

NOTE: Steps (g) through (j) check feel/trim input pushrod and series trim pushrods adjustment.

(g) Position pitch trim wheel to 4 degrees. Install rig pin R4 in pitch trim aft cable drum.

(h) Install Bertea rig pin (P/N 216135-101) in stabilizer autopilot servo output arm (top arm) and autopilot servo.

(i) Rig pin R5 must fit freely through the series trim bar and bellcrank (right end of series trim bar)(Ref. Fig. 401, Sheet 2). If not, remove all rig pins, turn off hydraulic power, adjust series trim pushrods, turn on hydraulic pressure and recheck per Steps (g) thru (i).

(j) With rig pin R5 in series trim bar and bellcrank, rig pin R6 must fit freely through mechanical feel/trim -4 DEG RIG HOLE and feel/trim output arm. If not, remove all rig pins, turn off hydraulic power, adjust input pushrod, turn on hydraulic pressure, and recheck.

(k) Remove all rig pins.

(27) Close access panels opened in Step A(1).

CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH FULL STABILIZER THROWS TO CHECK FOR ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE STABILIZER SERVO OPERATING LINKAGE. CORRECT INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR ASSOCIATED STIFFENER (REF. SB53-188).

(28) Turn off hydraulic power if no longer required (29-11-00).

(29) Turn off electrical power if no longer required (24-41-00).

C. MACH Sync and Trim Sync Coupler Shaft Repair (Ref. SB 27-A134)

(1) If groove in shaft is more than 0.015 inch deep, replace shaft.

(2) If groove in shaft is less than 0.015 inch deep, repair as follows:

(a) Polish grooved area to provide a minimum radius of 0.250 inch at bottom of groove. Maximum depth of groove is 0.015 inch after polish.

(b) Apply Alodine corrosion preventive (Ref. 51-21-02).

(c) Apply primer (Ref. 20-51-09).

(d) Apply topcoat (Ref. 20-51-10).

HORIZONTAL STABILIZER POWER SERVO - REMOVAL AND INSTALLATION

1. General

Following is a listing of the stabilizer power servo module line replaceable units (LRU's) and the ATA number under which the LRU removal and installation is covered.

Servo filter element, 27-41-21

Servo solenoid shutoff valve, 27-41-22

Servo bypass and shutoff valve, 27-41-39

Servo static cavity relief valve, 27-41-42

2. Equipment and Materials

Container - one gallon

Hydraulic line plugs

Hydraulic fitting caps

Portable Hoist, Wadell Equipment Co. Inc., PN WE 3981, or equivalent

Stabilizer servo feedback arm shipping fixture, Bertea PN 216140, or equivalent

Control Column and Trim Wheel Lock PN BA80-101, or equivalent

Lock-wire, Fed. Spec. QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
20-29-01	Fluid Lines and Fittings Assembly - Maintenance Practices
24-41-00	External Power/Ground Service Systems - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

CAUTION: THE SERVO MUST NOT BE HANDLED OR LIFTED BY THE FEEDBACK ARM IF A RIG PIN IS INSTALLED IN THE SERVO INPUT ARM. PERMANENT DAMAGE TO SERVO WILL RESULT.

A. Removal (Ref. Fig. 401)

(1) Position pitch trim wheel to full NOSE DOWN.

(2) Install control column and trim wheel lock.

(3) Open and tag the following circuit breakers:

(a) On pilots overhead panel CB1, zone 210:

AVIONICS FLIGHT CONTROL SYSTEM

FCES - COMPUTERS - DC and AC & L AOA (B4, B5)

(b) On Flight Engineer/Second Officers overhead panel CB2, zone 215:

STABILIZER SERVO

LB (H16)

RC (H17)

LA (H18)

RD (H19)

(4) Open associated access doors (Ref. 6-40-00) to gain access to the stabilizer servo (Ref. Fig. 401).

(a) Left servo: 316BB, 317AB.

(b) Right servo: 316CB, 317CB.

CR CR (5) Disconnect electrical connectors from the servo module and disconnect wire harness clamps and clip on top of

C servo. Install protective caps on electrical
C connectors and plugs.

C (6) Remove shroud installed over the stabilizer servo
C module by releasing four (4) quick disconnects.

(7) Disconnect input rod at the servo input arm.

WARNING: DISCONNECT INPUT ROD BEFORE DISCONNECTING FEEDBACK PUSHRODS. IF FEEDBACK PUSHRODS ARE DISCONNECTED FIRST, THE FEEDBACK ARMS WILL DROP QUICKLY WHEN THE INPUT PURHROD IS SUBSEQUENTLY DISCONNECTED, AND MAY CAUSE INJURY.

C (8) Disconnect two feedback pushrods at the servo feedback
C arms. Attach feedback arm shipping fixture to hold the
C feedback arms in alignment. DO NOT REMOVE SHIPPING
C FIXTURE FROM REPLACEMENT SERVO.

C (9) Disconnecthydraulic lines from the servo. Install
C protective caps on servo fittings and pressure plugs on
C hydraulic lines.

C (10) On front of servo, disconnect comparator arm from
C crosstie system: on left servo, disconnect arm from
C cable fitting; on right servo, disconnect arm from
C pushrod.

C (11) Connect portable hoist to fuselage hard point fitting
C located between and above the stabilizer actuators.

C (12) Attach cable fitting to lug on top of servo.

C (13) Operate hoist to take up all slack until cable supports
C servo.

R (14) Remove two nuts on servo lower attaching studs.

R (15) Remove two bolts attaching top of servo to gate link.

R (16) Using the hoist, carefully lower the servo to cart.
Servo weighs approximately 130 pounds.

B. Installation (Ref. Fig. 401)

(1) Verify that all hydraulic power is turned off.

(2) Verify that circuit breakers opened in Step 3A(3) are open and tagged.

R CAUTION: REPLACEMENT SERVO COMES WITH THE FEEDBACK ARM
R SHIPPING FIXTURE INSTALLED. DO NOT REMOVE
R SHIPPING FIXTURE UNTIL DIRECTED.

(3) With hoist attached to fuselage fitting, connect hoist cable to servo hoist lug.

(4) Using the portable hoist, raise the servo into the mounting position.

(5) Position the servo until the servo lower stud pins engage lower mounting holes. Install nuts on studs.

(6) Align gate link and servo upper mounting lugs. Verify that bushings are installed in lugs. Install connecting bolts, tighten, and install cotter pin.

NOTE: On early aircraft, the servo upper left mounting lug incorporated a threaded bushing pressed into the mounting lug to accept the connecting bolt. To improve the reliability of this joint, the threaded bushing can be replaced with a straight bushing; castellated nut and cotter pin are used to lock and safety the connecting bolt. (Ref. Bertea Corporation SB 27-37, dated June 20, 1974.)Later aircraft and stabilizer servos will be delivered with the straight bushing.

(7) Disconnect the hoist cable fitting from the servo lug. Remove hoist from aircraft.

(8) Remove caps from servo hydraulic fittings and plugs from hydraulic lines. Connect hydraulic lines to the servo. Torque hydraulic fittings (Ref. 20-29-01).

(9) With feedback arm shipping fixture in place, connect the two feedback pushrods to the servo feedback arms. Connecting bolts must slide through arm and pushrod bearings freely. Install washers, nuts, and cotter pins. Lock-wire bolts. If bolts do not slide in freely, check feedback arms, feedback pushrods, and pushrod-to-stabilizer bracket for distortion or misalignment.

(10) Remove shipping fixture attached to the servo feedback arms.

(11) Verify that the slip-fit bushing is installed in the servo input arm. Connect the servo input rod to the servo input arm by installing the hollow bolt, inner bolt, washer, and nut. Install cotter pin and lock-wire bolt to servo input arm.

(12) Verify that the slip-fit bushing is installed in the servo comparator arm. Connect comparator arm on front of servo to crosstie cable system.

CAUTION: TWO CLAMPS MUST BE BUTTERFLIED BETWEEN UPPER CONNECTOR AND WIRE HARNESS AND POSITION AS SHOWN IN FIGURE 401, SHEET 3, VIEW G AND CLAMP DOES NOT ROTATE.

THE LOWER CONNECTOR ON SERVO MUST HAVE THE 90 DEGREE BACKSHELL ROUTING THE WIRES AS SHOWN IN FIGURE 401, SHEET 3, VIEW H.

VISUALLY INSPECT WIRE HARNESS ROUTING ON TOP OF SERVO FOR SUPPORT AND CONDITION. VERIFY THAT WIRE HARNESS WILL NOT BE CONTACTED BY SERVO INPUT OR FEEDBACK ARM MOVEMENT.

R R R (13) Remove protective caps from electrical connectors and plugs. Install electrical connectors and lock-wire. Connect wire harness clamps and clip to top of servo.

CR CR (14) Reinstall shroud over the stabilizer servo module and secure the quick disconnect.

R (15) Remove tags and close circuit breakers opened in Step 4A(3).

CAUTION: VERIFY THAT THERE ARE NO RIG PINS IN STABILIZER CONTROL SYSTEM OR STABILIZER SERVO. TURNING ON HYDRAULIC POWER WITH RIG PIN IN SERVO CAN DAMAGE SERVO INTERNALLY.

R (16) Remove tags from hydraulic panels.

R (17) Remove control column lock.

CAUTION: REPAIR OR REPLACEMENT OF THE SERVO HYDRAULIC LINES MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL OF THE STABILIZER USING INDIVIDUAL HYDRAULIC SYSTEMS. THIS IS REQUIRED TO ASSURE THAT HYDRAULIC LINES TO THE SERVO HAVE NOT BEEN CROSSED DURING INSTALLATION. THIS IS CHECKED BY PERFORMING A STABILIZER SERVO HYDRAULIC INTEGRITY TEST.

R (18) If hydraulic lines were repaired or replaced, perform stabilizer Servo Hydraulic Integrity Test (Ref. 27-41-00, Adjustment and Test, Paragraph 4B). Accomplish only steps necessary to check replaced R servo, then continue with Step (19) below. (Left servo

is supplied by hydraulic systems A and B; right servo is supplied by hydraulic systems C and D.)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (19) Turn on hydraulic systems supplying replaced servo: system A and B, left servo; system C and D, right servo (Ref. 29-11-00).

NOTE: Allow servo to be pressurized for at least five minutes before operating controls to ensure complete filling of servo which will reduce control oscillations.

R (20) Slowly bleed servo by operating flight station control column full forward and aft through ten full cycles until controls operate smoothly throughout control range.

NOTE: After bleeding any servo, bleed hydraulic reservoir (See Reservoir Servicing Instruction Placard, Ref. 12-13-00).

R (21) Check for leaks at the servo hydraulic fittings.

R (22) If left stabilizer servo was replaced, check that the A hydraulic system rudder fusing shutoff valve has not actuated closed due to air in system as follows:

(a) Gain access to forward electronic service center (FESC).

(b) Locate flight control auxiliary unit (FCAU) below bottom shelf of center rack.

(c) On FCAU, verify that RUDDER HYDRAULIC LIMITER A light is off with hydraulic system A pressurized. If A light is on, reset fusing system (Ref.

29-11-74, Adjustment/Test). After resetting fusing system, verify that A light is off.

R (23) Check rigging of functional comparator crosstie control system (Ref. 27-41-00, Adjustment and Test, Paragraph 5E).

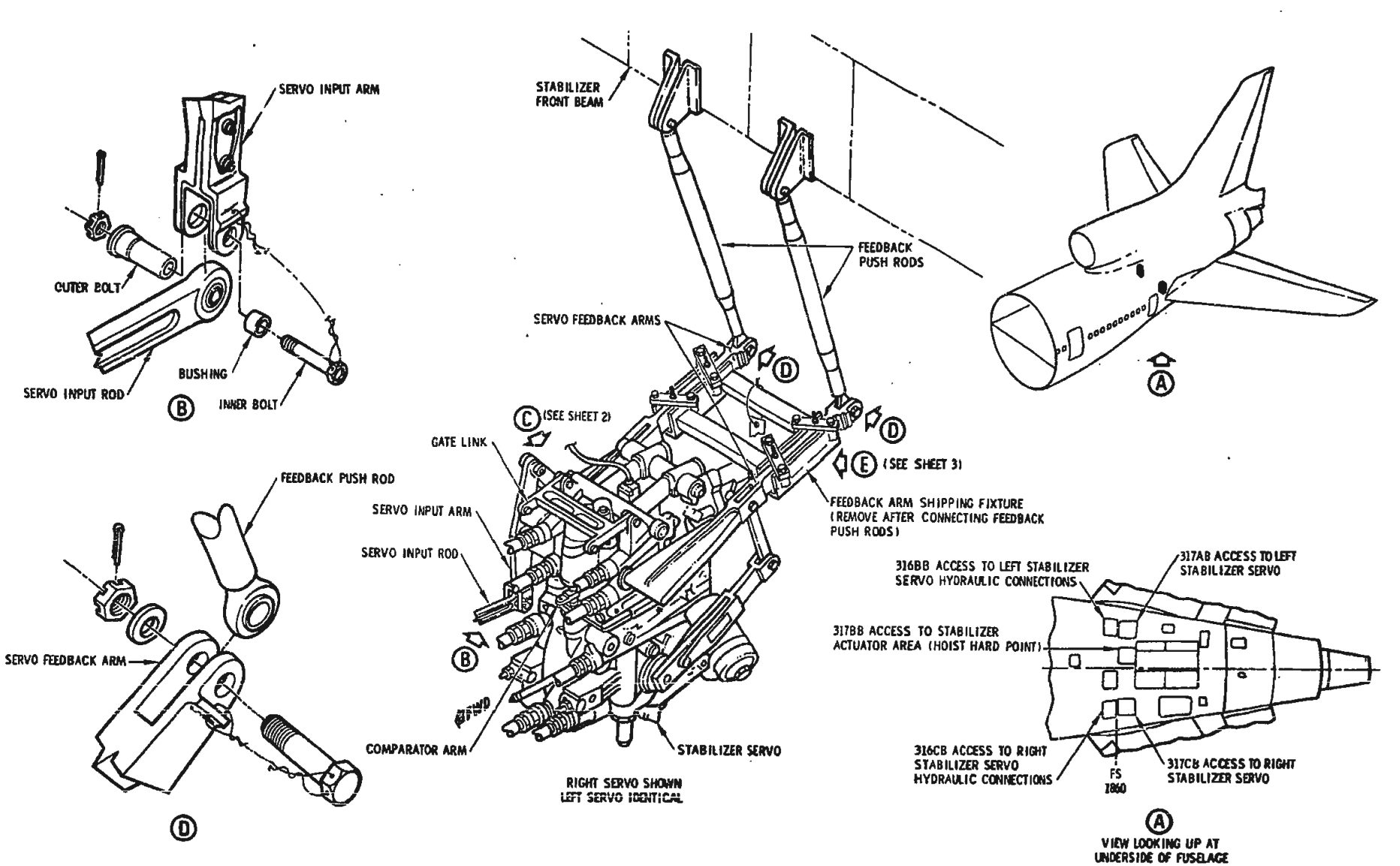
R (24) Perform a stabilizer servo pressure phasing check (Ref. 27-41-00, Adjustment and Test, Paragraph 5F).

R (25) Close access doors opened in Step 4A(4).

CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH FULL STABILIZER THROWS TO CHECK FOR ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE STABILIZER SERVO OPERATING LINKAGE. CORRECT INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR ASSOCIATED STIFFENER (Ref. SB53-188).

R (26) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

R (27) Turn off electrical power if no longer required (Ref. 24-41-00).

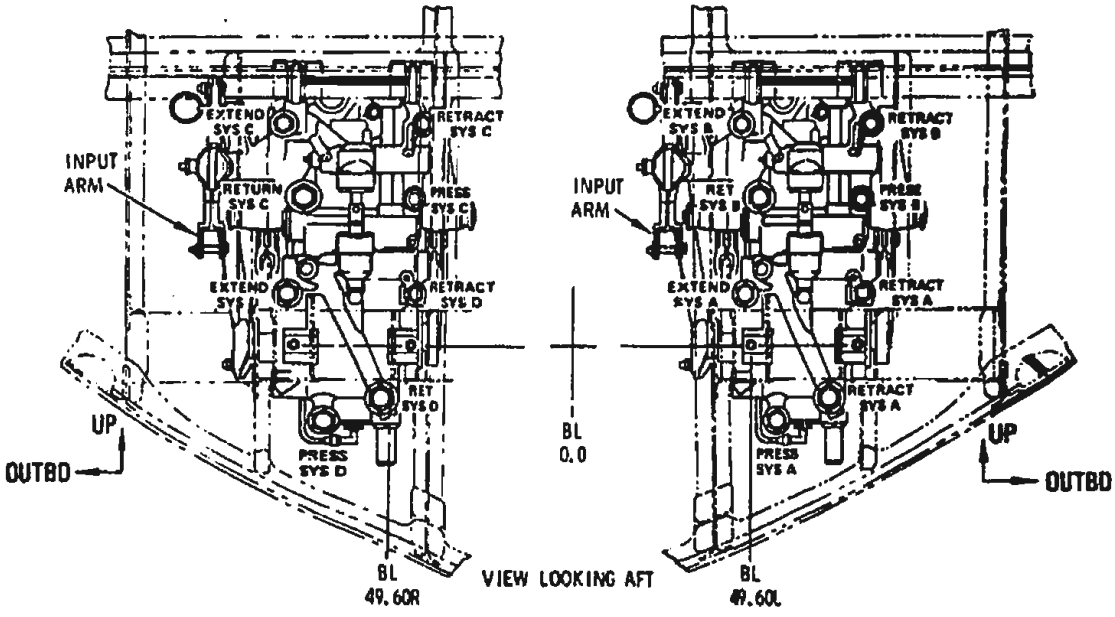


M1-0104-27-162

R Horizontal Stabilizer Power Servo - Removal and Installation
R Figure 401 (Sheet 1)

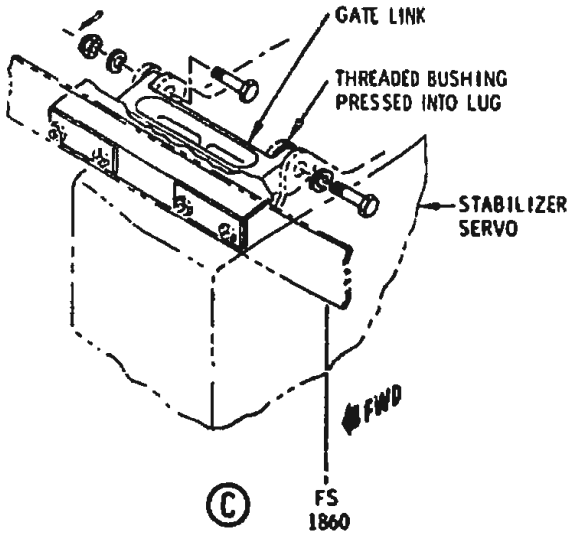
EFFECTIVITY: ALL

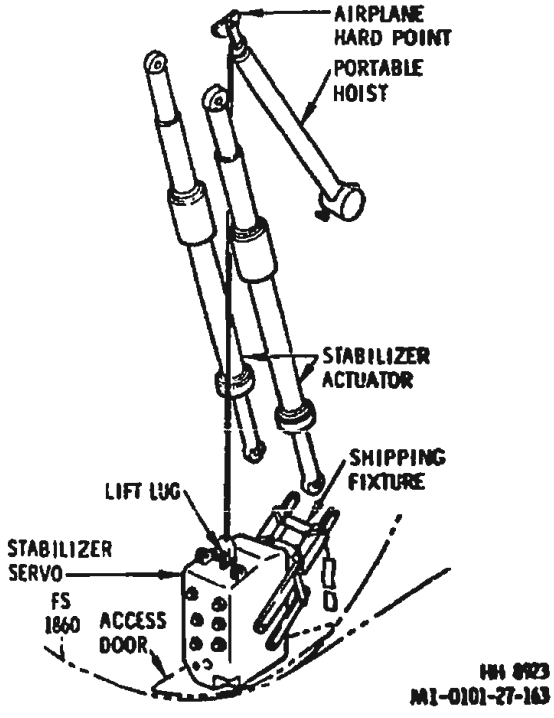
001B



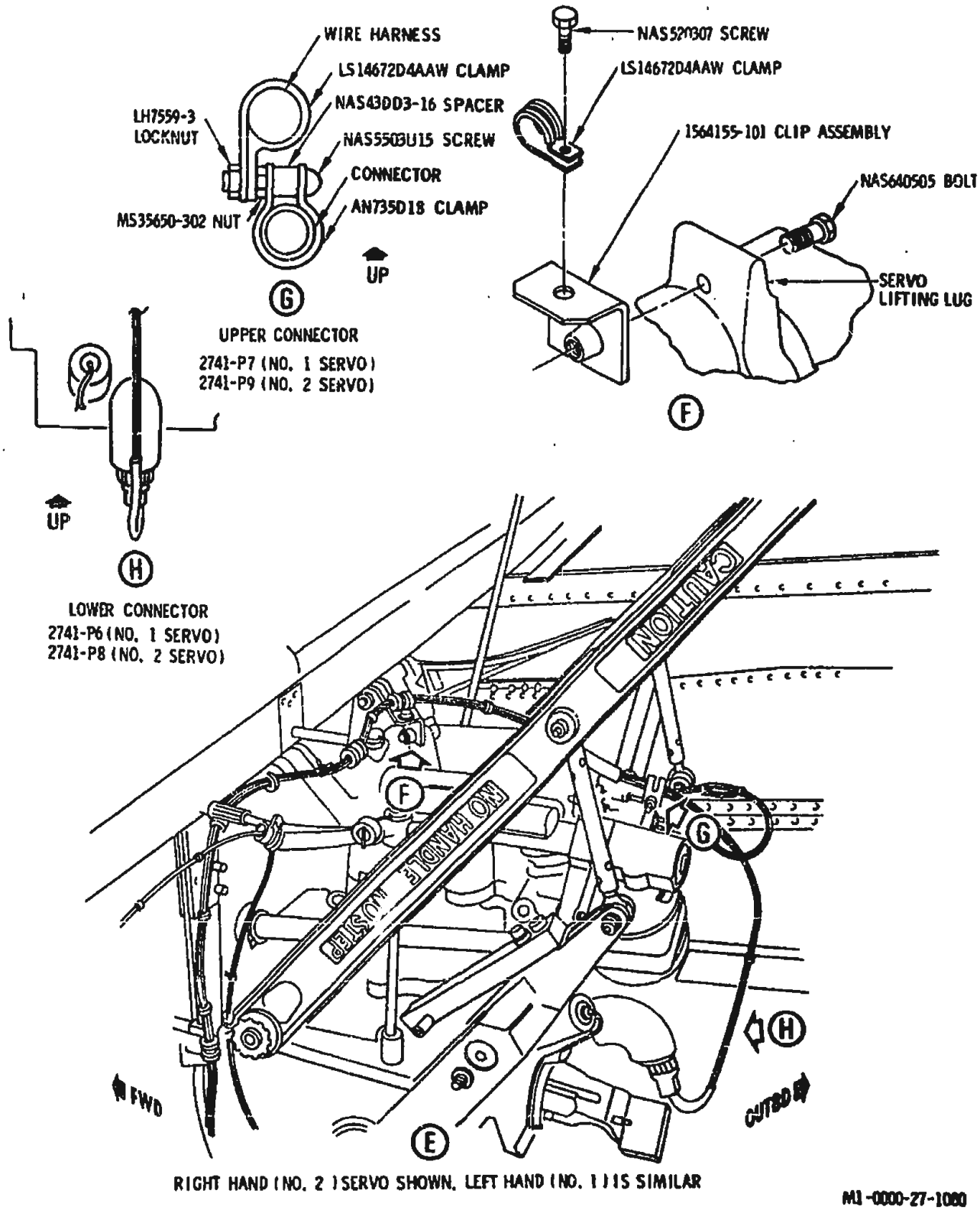
RIGHT SERVO HYDRAULIC CONNECTIONS

LEFT SERVO HYDRAULIC CONNECTIONS





Horizontal Stabilizer Power Servo - Removal and Installation
Figure 401 (Sheet 2)



RIGHT HAND (NO. 2) SERVO SHOWN. LEFT HAND (NO. 1) IS SIMILAR

M1-0000-27-1000

R Horizontal Stabilizer Power Servo - Removal and Installation
R Figure 401 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

HORIZONTAL STABILIZER SERVO MODULE - APPROVED REPAIRS

1. General

Following is a listing of the stabilizer servo module line replaceable units (LRU's) and the ATA number under which the LRU removal and installation is covered.

Servo filter element, 27-41-21

Servo solenoid shutoff valve, 27-41-22

Servo bypass and shutoff valve, 27-41-39

Servo static cavity relief valve, 27-41-42

The following procedure is to be used to correct hydraulic fluid leakage at the stabilizer servo control valve travel limiter (Ref. Fig. 801).

2. Equipment and Materials

O-ring NAS 1611-006 (2 each)

Backup Ring, LS 10862-006 (4 each)

Container, one gallon (to catch oil spillage)

Lock-wire, 0.032-inch diameter, Fed Spec QQ-W-390, Cond A, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power System - Maintenance Practices

R 4. Approved Repairs (Ref. Fig. 801)

A. Correcting For Hydraulic Leakage at the Control Valve Travel Limiter.

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open associated access door to gain access to stabilizer servo (Ref. 6-40-00).

(a) Left servo: 317AB

(b) Right servo: 317CB

(2) Disconnect hydraulic line nut (1) from fitting (2) (Ref. Fig. 801).

(3) Remove lock-wire and remove two screws (3) retaining hydraulic fitting (2) to limiter valve.

(4) Carefully remove fitting (2) from limiter valve. (Piston (5) should be in fitting.) Carefully remove piston (5) from fitting. Check fitting bore for signs of nicks, scratches, or roughness. If damaged, replace fitting.

(5) Remove and replace O-ring (6) and back-up rings (7) on piston (5).

(6) Lubricate piston seals with hydraulic fluid. Reinstall piston in fitting and fitting on limiter valve. (Do not lock-wire screws.)

(7) Reconnect and tighten hydraulic tubing nut on fitting.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

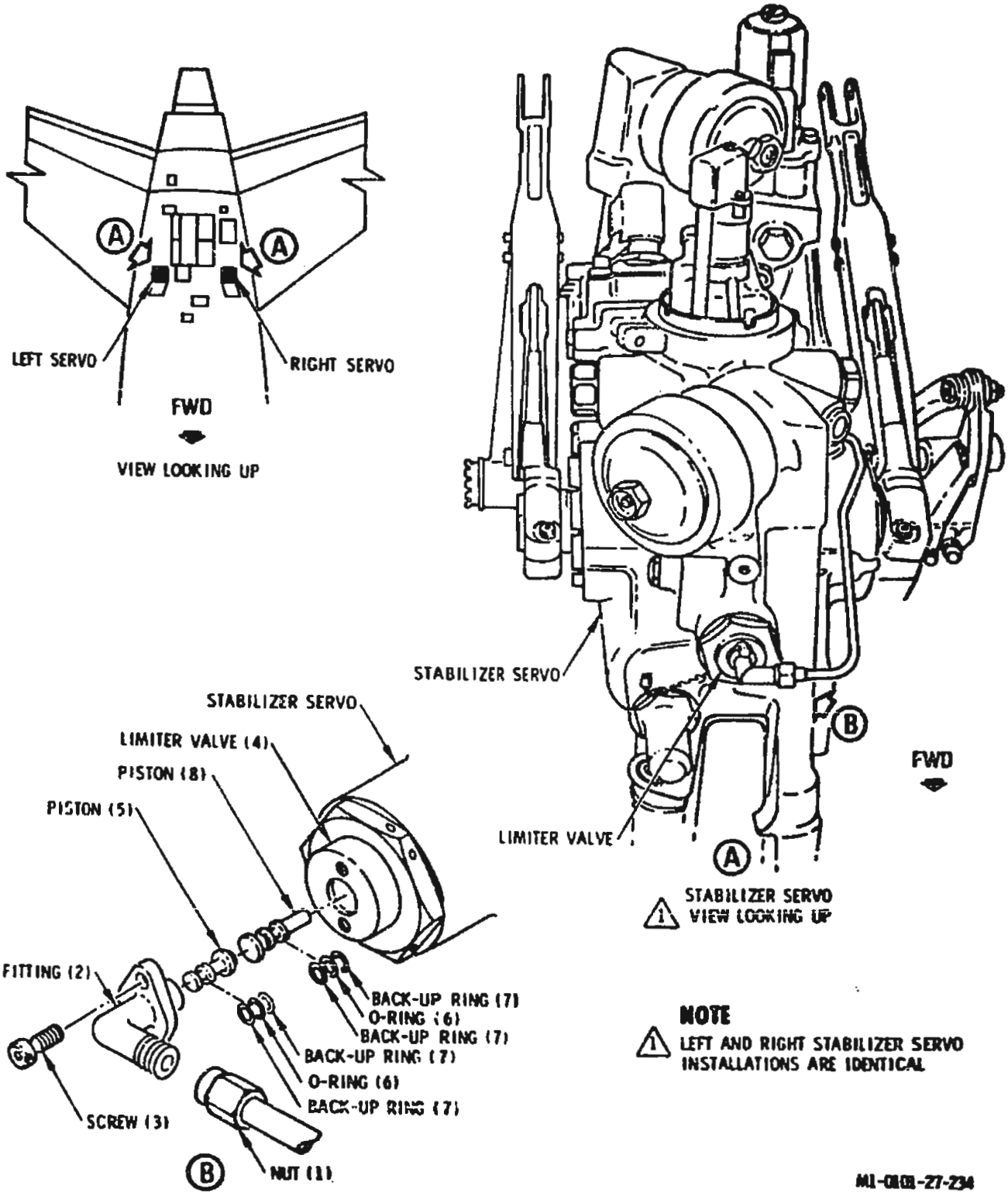
TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on both hydraulic systems supplying servo with replaced seals.

(a) System A and B for left servo.

(b) System C and D for right servo.



R Correcting Stabilizer Servo Control Valve Travel Limiter Leakage
R Figure 801

(9) Check limiter valve for signs of leakage. If leakage still exists, accomplish Steps (10) through (19). If not, proceed to Step (20).

(10) Turn off hydraulic power.

(11) Disconnect hydraulic line nut (1) from fitting (2).

(12) Remove two screws and remove fitting (2) with piston (5).

(13) Carefully remove piston (8) from limiter valve (4) bore. Use care not to damage bore.

(14) Remove and replace O-ring (6) and back-up rings (7) from piston (8).

(15) Lubricate piston seals with hydraulic fluid and carefully reinstall piston (8) in limiter valve.

(16) Reinstall fitting (2), with piston (5), on limiter valve. Install attaching screws. (Do not lock-wire screws.)

(17) Reconnect and tighten hydraulic tubing nut on fitting.

R (18) Lock-wire two screws.

R (19) Turn on affected hydraulic systems.

R (20) Check limiter valve for signs of leakage. If leakage continues, replace stabilizer servo (Ref. 27-41-20).
R If no leakage, proceed to Step (20).

R (21) Close access door below stabilizer servo.

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS
R DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER
R THROUGH FULL STABILIZER THROWS TO CHECK FOR
R ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND
R THE STABILIZER SERVO OPERATING LINKAGE.
R CORRECT INTERFERENCE AS REQUIRED BY TRIMMING
R BAFFLE AND/OR ASSOCIATED STIFFENER (REF.
R SB53-160).

R (22) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

STABILIZER POWER SERVO FILTER ELEMENT REMOVAL AND INSTALLATION

1. Equipment and Materials

Drip pan, 1-gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

2. Referenced Procedure

R 6-40-00 External Access Doors and Panels

29-11-00 Hydraulic Power - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

(1) Open applicable access door, left power servo door 317AB or right power servo door 317CB, for access to
R stabilizer power servo (Ref. 6-40-00).

(2) Place drip pan under stabilizer power servo to catch hydraulic fluid.

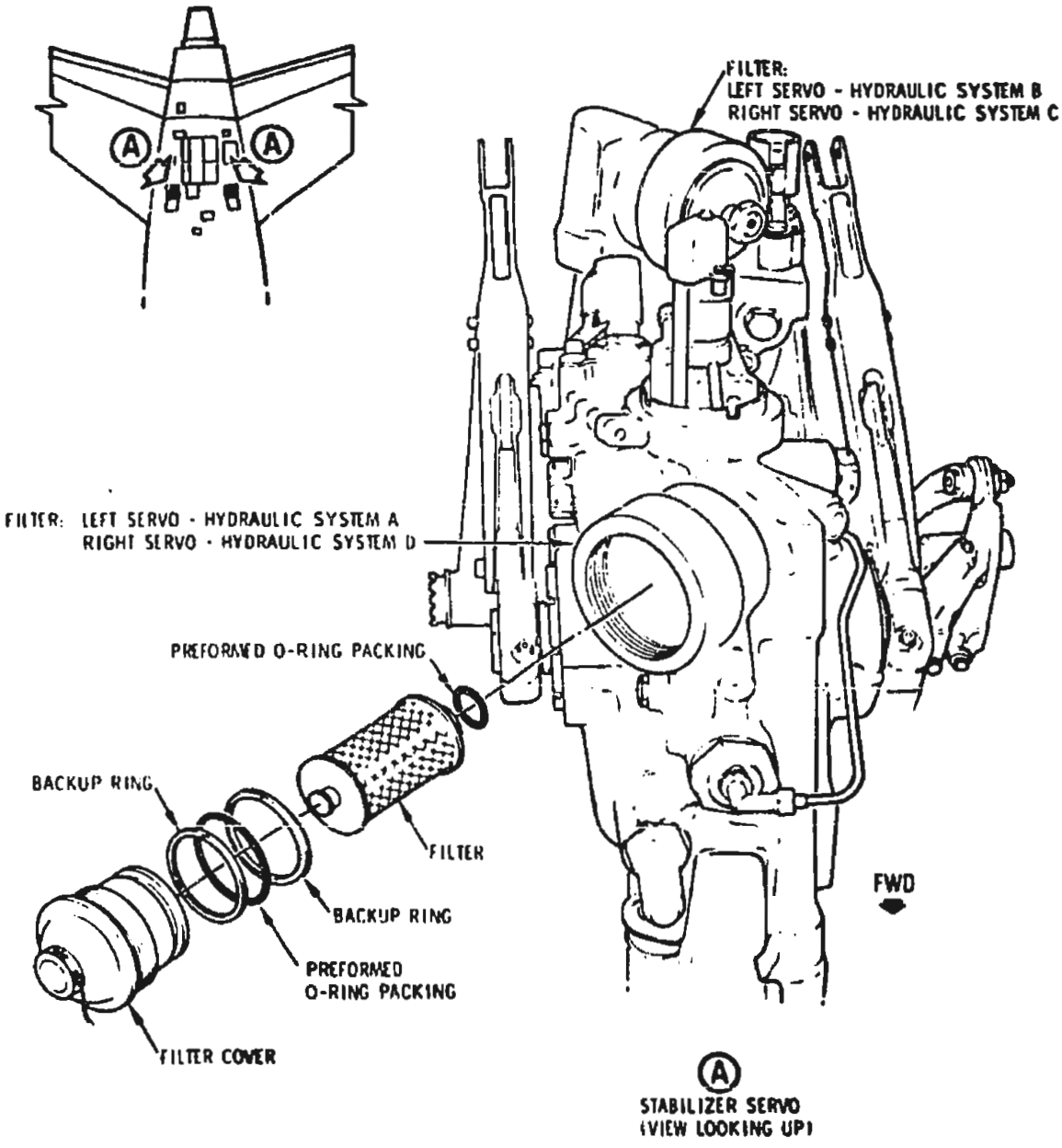
(3) Remove filter cap from power servo (Ref. Fig. 401).

(4) Remove and discard backup ring, preformed packing, and backup ring from filter cap.

(5) Pull filter element from power servo. Remove and discard preformed packing from filter element.

R B. Installation

(1) Wet preformed packings and backup rings with hydraulic fluid before installation.



NOTE
LEFT AND RIGHT STABILIZER
SERVO INSTALLATION IDENTICAL

HH 9035
M1-0100-27-459

Filter Element, Stabilizer Power Servo - Removal and Installation
Figure 401

R (2) Install preformed packing on filter element (Ref. Fig.
R 401).

(3) Install filter element in stabilizer power servo.

(4) Install backup ring, preformed packing, and backup ring in groove on filter cap.

R CAUTION: DO NOT EXCEED 450 LB IN. WHEN TIGHTENING FILTER
R CAP.

(5) Install filter cap over filter element and torque 400 to 450 lb in. Attach lock-wire to filter cap and manifold.

(6) Remove placards from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic system (Ref. 29-11-00) associated with filter element being installed (Ref. Fig. 401).

(8) Bleed stabilizer power servo by slowly cycling pilots control column in flight station, zone 210, from full forward to full aft position five times. Visually determine that filter cap is not leaking.

(9) Close and secure access door under stabilizer servo.

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR
R (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH
R FULL STABILIZER THROWS TO CHECK FOR ANY
R INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE
R STABILIZER SERVO OPERATING LINKAGE. CORRECT
R INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR
R ASSOCIATED STIFFENER (REF. SB53-188).

(10) Turn off hydraulic power if no longer required (Ref. 29-11-00).

STABILIZER SERVO SOLENOID SHUTOFF VALVE REMOVAL AND INSTALLATION

1. General

The solenoid shutoff valve can be replaced as an assembly, however, the solenoid coil can be replaced separately without disturbing the hydraulic portion of the shutoff valve assembly or the valve-to-servo interface. Replace the coil only if the valve malfunction appears to be an electrical problem.

R 2. Equipment and Materials

Container, 1 quart (If replacing entire valve assembly)

Control Column Lock, PN BA80, or equivalent

Gasket Plate (Ref. Fig. 401) (If replacing entire valve assembly)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Preparation

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT
R OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag applicable STABILIZER SERVO circuit breaker (LD, RC, LA, or RD) (H16, H17, H18, or H19).

(2) Install control column lock.

(3) Open applicable lower afterbody access door (Ref. 6-40-00):

317AB - left power servo (systems A and B)

317CB - right power servo(systems C and D)

B. Removal of Solenoid Coil

(1) Remove lock-wire and remove screw on top of shutoff valve assembly (Ref. Fig. 401).

(2) Disassemble coil from valve assembly as follows:

(a) Remove stepped washer and spacer.

(b) Pull coil assembly to disengage electrical connector from servo and remove coil assembly from the valve housing.

C. Installation of Solenoid Coil Assembly

(1) Verify that a spacer is installed on valve housing.

(2) Verify that O-ring is installed on electrical connector.

(3) Slide coil assembly on valve housing while positioning coil assembly electrical connector through hole in the valve flange. Verify that electrical connectors are properly engaged.

(4) Install spacer and stepped washer valve housing.

(5) Install screw through the stepped washer and into end of valve housing. Tighten screw and lock-wire.

(6) Check solenoid valve operation per Paragraph F.

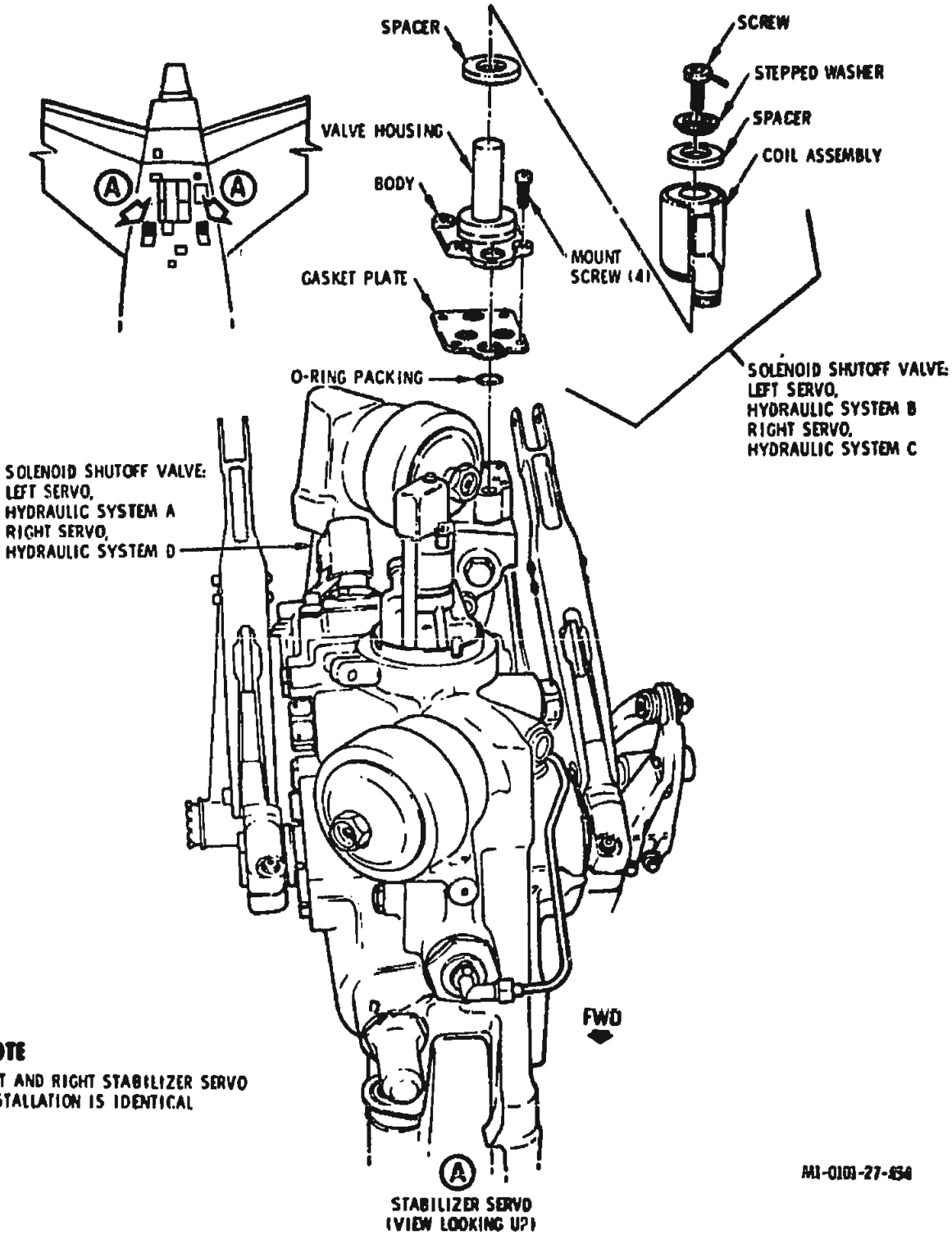
D. Removal of Solenoid Shutoff Valve

(1) Place container under servo to catch oil spillage.

(2) Remove shutoff valve mount screws and remove valve (Ref. Fig. 401).

E. Installation of Solenoid Shutoff Valve

WARNING: VERIFY THAT ALL HYDRAULIC POWER IS TURNED OFF AND CONTROL COLUMN LOCK IS INSTALLED.



R
R
R Stabilizer Servo Solenoid Shutoff Valve
Removal and Installation
Figure 401

EFFECTIVITY: ALL

0018

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

(2) Verify that O-ring is installed on valve electrical connection groove. Verify that plate gasket is installed on shutoff valve.

NOTE: If electrical plug is contaminated with hydraulic fluid, wash fluid off of electrical plug.

(3) Install shutoff valve. Secure with mount screws and lock-wire.

NOTE: Tri-wing mount screws can be replaced by NAS 1351 socket-head cap screws.

(4) Check solenoid valve operation in accordance with Para. F.

F. Checkout of Solenoid Shutoff Valve

(1) Remove tag and close circuit breaker opened in Step A(1).

(2) Remove tags from hydraulic control panels.

(3) Remove control column lock.

R R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Turn on only hydraulic system supplying replaced shutoff valve (Ref. 29-11-00). (See Fig. 401 to determine hydraulic system supplying replacement shutoff valve.)

(6) On the overhead PFCS panel, verify that STABILIZER switchlight corresponding to system supplying replaced shutoff valve is depressed (in). The switchlight INOP and PUSH lights must be off.

(7) On the PFCS panel, release (out) the STABILIZER switchlight of system supplying replaced shutoff valve. Verify that the switchlight INOP light comes on.

(8) On the PFCS panel, depress (in) the same STABILIZER switchlight. Verify that the switchlight INOP light goes out.

(9) If solenoid shutoff valve was replaced, check shutoff valve installation for hydraulic leakage.

(10) Close the stabilizer servo access door.

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR
R (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH
R FULL STABILIZER THROWS TO CHECK FOR ANY
R INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE
R STABILIZER SERVO OPERATING LINKAGE. CORRECT
R INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR
R ASSOCIATED STIFFENER (REF. SB53-188).

(11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(12) Turn off electrical power if no longer required (Ref. 24-41-00).

STABILIZER SERVO CROSS-TIE INTERLOCK BUNGEE REMOVAL AND INSTALLATION

1. General

The stabilizer cross-tie bungee is mounted on forward side of F.S. 1860 bulkhead. The left stabilizer servo is mounted on the
R aft side of the same bulkhead near the same location.

2. Equipment and Materials

Cotter pin MS 24665-151

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	24-00-00	Electrical Power - Maintenance Practices
	27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
R	29-11-00	Hydraulic Power - Maintenance Practices

4. Removal/Installation

A. Removal

R WARNING: VERIFY HYDRAULIC AND ELECTRICAL POWER IS OFF PRIOR
R TO REPLACEMENT OF STABILIZER SERVO CROSS-TIE
R INTERLOCK BUNGEE.

R (1) Turn off all four hydraulic systems (Ref. 29-11-00).
R Tag Flight Engineer/Second Officers hydraulic system
R panel, zone 215, and the hydraulic service panel, zone
R 147.

R (2) Turn off electrical power (Ref. 24-00-00). Tag Flight
R Engineer/Second Officers electrical system panel, zone
R 215.

R (3) Install control column and trim wheel locks. Tag
R control column and trim wheel against operation

R (4) Open access panel 316BB (Ref. 6-40-00).

R (5) Remove bolt connecting bungee with cross-tie cable
R fitting (Ref. Fig. 401).

R NOTE: Save bolt, nut and bushing for reinstallation.

R (6) Remove bolt connecting bungee with bracket and remove bungee.

B. Installation

R WARNING: VERIFY HYDRAULIC AND ELECTRICAL POWER IS OFF PRIOR
R TO REPLACEMENT OF STABILIZER SERVO CROSS-TIE
R INTERLOCK BUNGEE.

R (1) Turn off all four hydraulic systems (Ref. 29-11-00).
R Tag Flight Engineer/Second Officers hydraulic system
R panel, zone 215, and the hydraulic service panel, zone
R 147.

R (2) Turn off electrical power (Ref. 24-00-00). Tag Flight
R Engineer/Second Officers electrical system panel, zone
R 215.

R (3) Install control column and trim wheel locks. Tag
R control column and trim wheel against operation

R (4) Attach bungee to bracket with bushing, bolt, washer and
R nut.

R (5) Attach bungee to cross-tie cable fitting with bushing,
R bolt, washer, nut and cotter pin.

R (6) Remove control column and trim wheel locks.

R (7) Turn on electrical power (Ref. 24-00-00).

R (8) Remove tags from hydraulic system panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC
R PRESSURE.

R (9) Turn on hydraulic systems A, B, C and D (Ref.
R 29-11-00).

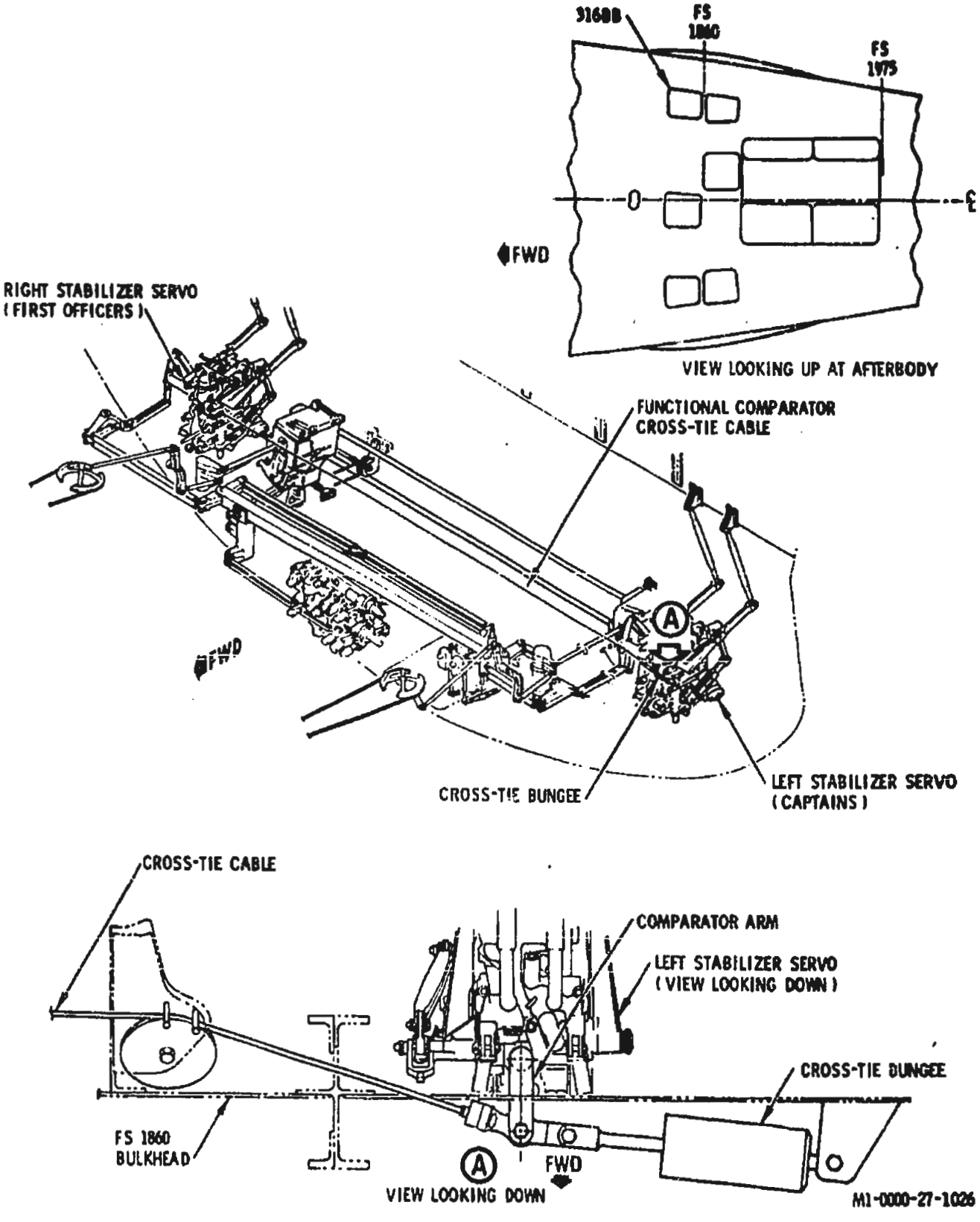
R (10) Perform Stabilizer Servo Functional Comparator and
R Cross-tie Control System Rigging Procedure (Ref.
R 27-41-00).

R NOTE: When performing the Stabilizer Servo Functional
R Comparator Cross-tie Interlock System Test as
R required in Step 5E(5)(h) in the rigging
R procedure, Steps 4C(1) through (33) may be
R omitted.

R (11) Verify hydraulic power is turned off (Ref. 29-11-00).

R (12) Verify electrical power is turned off (Ref. 24-00-00).

R (13) Close access panels opened during procedure.



Stabilizer Servo Cross-tie Interlock Bungee
Removal and Installation
Figure 401

R HORIZONTAL STABILIZER HYDRAULIC ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Container - one gallon

Hydraulic line protective plugs

Hydraulic fitting protective caps

Control Column and Trim Wheel Lock, PN BA80-101, or equivalent

Portable Hoist, Wadell Equipment Co. Inc. PN WE3981, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-15	Horizontal Stabilizer and Elevator Lubrication
20-29-01	Fluid Lines and Fittings Assembly - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

NOTE: The stabilizer actuator attach fittings on the stabilizer and 1860 bulkhead are held to very close tolerances. The fatigue life of these fittings depend on maintaining these tolerances. If any of these eight fittings must be replaced, the new fitting must be accurately located so that with the actuator bottomed in the retracted position, the dimension between fitting centers must be 71.500 (±0.010) inches.

A. Removal (Ref. Fig. 401)

(1) Install control column lock.

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

(2) Open following access doors on bottom of afterbody (Ref. 6-40-00):

(a) 317BB, 317CB for right actuators

(b) 317BB, 317AB for left actuators

(3) Remove shield over stabilizer servo.

(4) Remove hydraulic line clamp from actuator (Ref. Fig. 401).

(5) Disconnect hydraulic tubing from the load modulator and from the return port on cylinder. Use container to catch oil. Install protective caps and plugs on load modulator fittings and hydraulic lines. Install protective plate on drain line port.

(6) Remove bolt from fail-safe lugs between actuators.

(7) Remove piston rod bolt by drifting out bolt with brass rod.

CR NOTE: AD 92-16-19 applies.

(8) Attach portable hoist to hard point in structure above actuators.

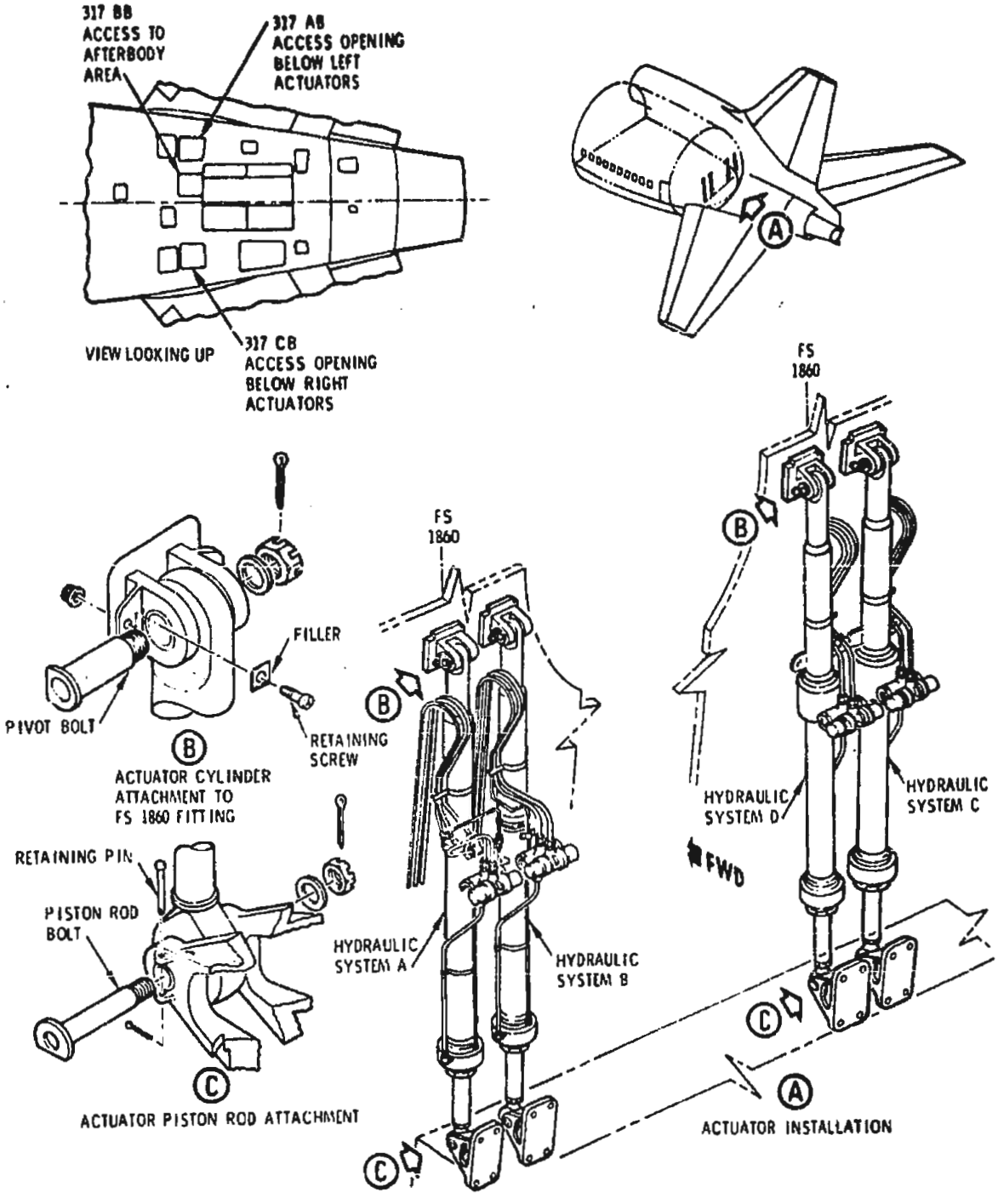
NOTE: Stabilizer actuator weighs 84 pounds. If hoist is not available, actuator can be manually removed and installed by two men using rope.

(9) Install clevis fittings on actuator hoist lugs. Tie loop of rope through clevis fittings. Connect hoist cable to rope and take up slack on hoist cable to support actuator.

(10) On actuator cylinder attachment to FS 1860 fitting, remove pivot bolt by drifting out bolt with brass rod.

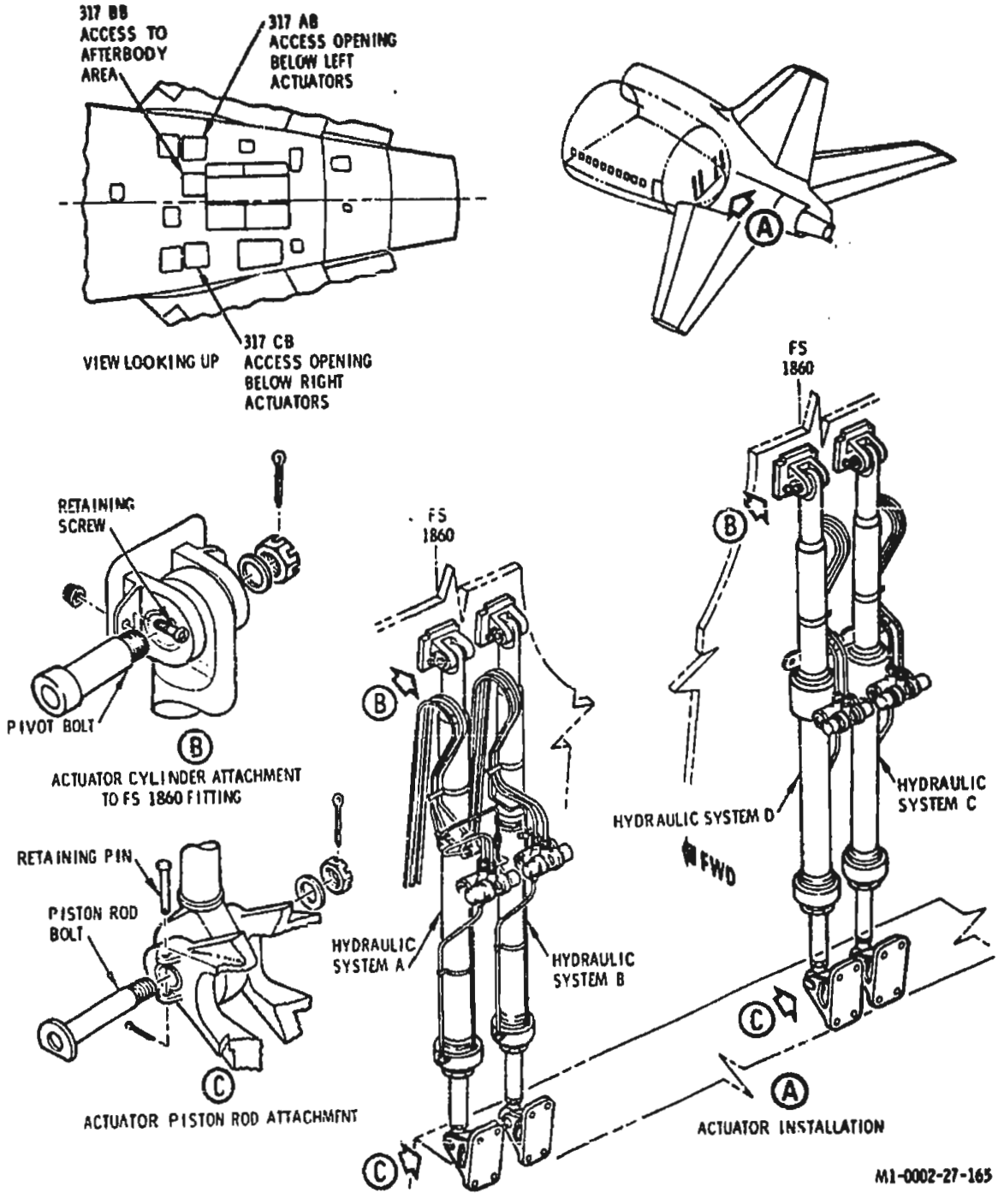
(11) Carefully lower actuator and guide through access opening.

B. Installation (Ref. Fig. 401)



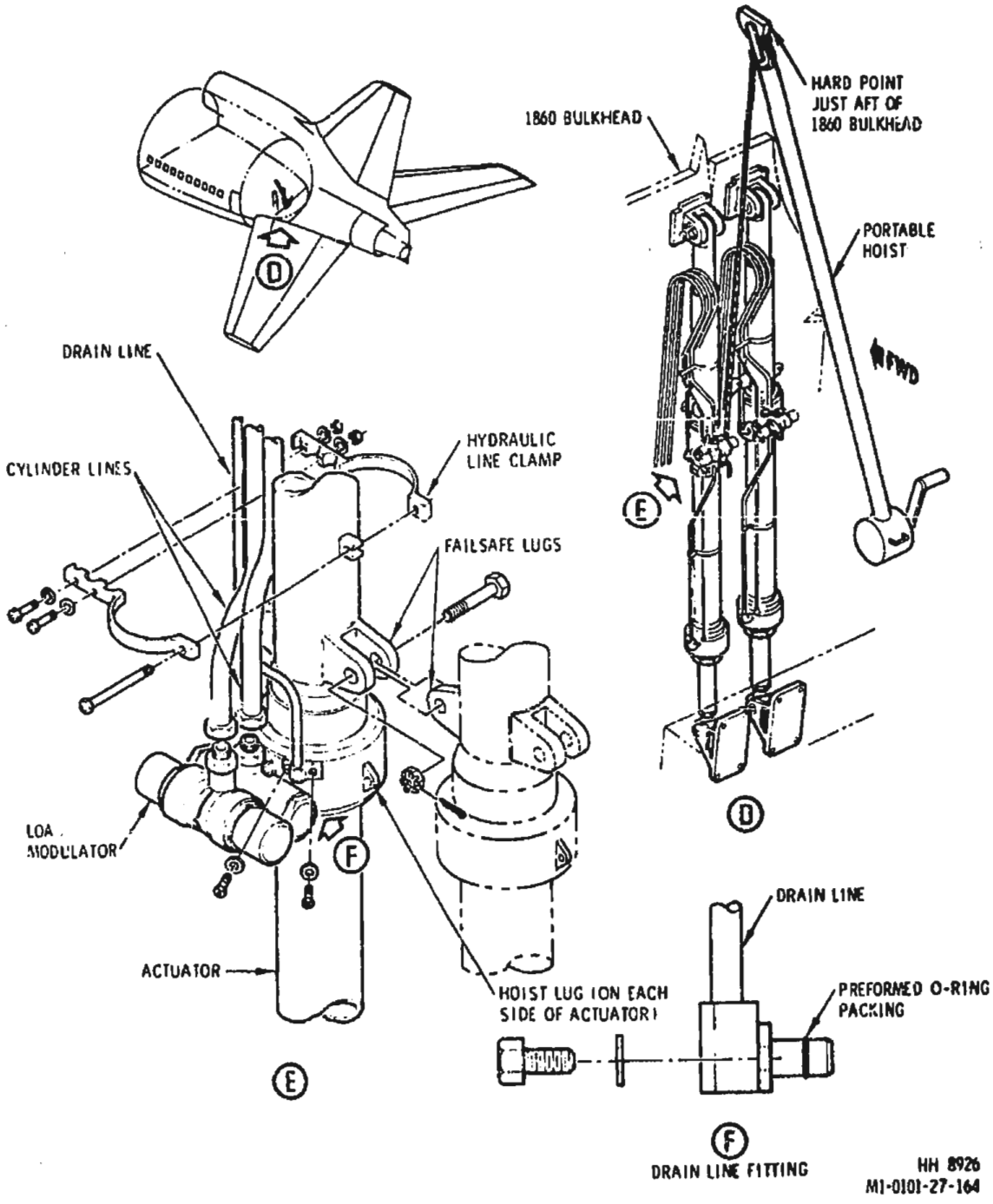
M1-0000-27-1236

R Horizontal Stabilizer Hydraulic Actuator - Removal and Installation
R Figure 401 (Sheet 1)



R Horizontal Stabilizer Hydraulic Actuator - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: 020-999



Horizontal Stabilizer Hydraulic Actuator - Removal and Installation
Figure 401 (Sheet 2)

(1) Verify that all hydraulic power is turned off and that hydraulic control panels are tagged (Ref. 29-11-00).

(2) Verify that control column lock is installed.

(3) Coat piston rod bolt and cylinder pivot bolt with MIL-G-23827A lubricant.

(4) Install clevis fittings and rope loop on replacement actuator. Connect hoist cable to rope.

(5) Carefully guide actuator (with piston rod pointing down, and load modulator facing aft) through access opening and into mounting position.

(6) On aircraft 001-019, connect the actuator cylinder to the FS 1860 fitting by installing the pivot bolt, filler, washer and nut.

(6) On aircraft 020-999, connect the actuator cylinder to the FS1860 fitting by installing the pivot bolt, washer, and nut.

NOTE: Early aircraft were delivered with FS 1860 stabilizer actuator pivot bolts with straight heads. Fillers are installed with these bolts to prevent bolt rotation. The redesigned pivot bolts which were delivered on later aircraft and which may be used on any aircraft have angled heads. Fillers are not used with angle head pivot bolts.

(7) Connect the actuator piston rod end to the stabilizer fitting by installing the piston rod bolt, washer, and nut.

CR NOTE: AD 92-16-19 applies.

(8) Determine running torque of nut and pin. Torque nut to running torque plus 250 to 400 lb-in. and install cotter pin. If cotter pin cannot be installed, change components until torque range will allow cotter pin installation.

(9) Install piston rod bolt retaining pin and cotter pin.

(10) Install pivot bolt retaining screw and nut.

(11) Remove rope and clevis fittings from actuator.

(12) Remove portable hoist from aircraft structure attach hard point.

(13) Remove protective caps from load modulator fittings and from cylinder lines. Connect cylinder lines to the load modulator. Torque hydraulic fittings (Ref. 20-29-01).

(14) Remove protective plate from drain line port.

(15) Install new preformed O-ring packing on drain line fitting. Install drain line with washers and bolts.

(16) Install hydraulic line clamp.

C (17) Install bolt in actuator fail-safe lugs. The maximum
C gap between lugs of the actuator fittings is to be
C 0.120 inch.

(18) Lubricate stabilizer actuator (Ref. 12-23-15).

(19) Install shield over stabilizer servo.

(20) Remove placards from hydraulic control panels.

(21) Remove control column lock.

(22) Check that no tools or equipment are left on top or below stabilizer.

(23) Check horizontal stabilizer actuator as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: REPLACEMENT OF STABILIZER ACTUATOR MUST BE FOLLOWED BY A CHECK FOR CORRECT DIRECTION OF TRAVEL USING INDIVIDUAL HYDRAULIC SYSTEMS. THIS IS REQUIRED TO ASSURE THE HYDRAULIC LINES TO THE STABILIZER ACTUATORS HAVE NOT BEEN CROSSED DURING INSTALLATION. THIS IS CHECKED BY PERFORMING A STABILIZER SERVO HYDRAULIC INTEGRITY TEST.

(a) Turn on hydraulic system supplying replaced actuator (Ref. Fig. 401).

(b) Perform Stabilizer Servo Hydraulic Integrity Test (Ref. 27-41-00 Adjustment and Test, Para. 4B). Accomplish only steps necessary to check replaced servo. (Left servo is supplied by hydraulic systems A and B; right servo is supplied by hydraulic systems C and D.)

(c) Bleed actuator by slowly operating flight station control column forward and aft through ten full cycles, or until control feels smooth.

NOTE: After bleeding any component, bleed affected hydraulic reservoir (See Reservoir Servicing Instruction Placard, Ref. 12-13-00).

(d) After bleeding system, check that stabilizer operates smoothly without binding or hesitation throughout control range.

(e) While cycling control column, visually verify stabilizer actuator operation. Check that actuator clears all structure and equipment.

(f) Check the actuator assembly for leaks at the hydraulic fittings.

(g) Close all access doors.

CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH FULL STABILIZER THROWS TO CHECK FOR ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE STABILIZER SERVO OPERATING LINKAGE. CORRECT INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR ASSOCIATED STIFFENER (REF. SB53-188).

C (h) Close stabilizer actuator access doors and perform
C the following check:

C C WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

C C LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

C C C PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

C C THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

C 1) Turn on electrical power, (Ref. 24-41-00).

C C 2) Turn on hydraulic system B and C, (Ref. 29-11-00).

C C C C 3) With the horizontal stabilizer trimmed between four and 10 degrees, slowly pull the control column full aft and check that servo arms clear door baffles over full range of travel.

C C C NOTE: Clearance with servo arms on both sides of aircraft must be 0.44 minimum at installation.

C 4) Position trim wheel to 0 degrees.

(i) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(j) Turn off electrical power if no longer required (Ref. 24-41-00).

R CONTROL COLUMN ROTARY DAMPER - REMOVAL AND INSTALLATION

R 1. General

R The control column rotary damper is located under the flight
R station floor, above the center electronic rack in the forward
R electronic service center, zone 112.

R 2. Equipment and Materials

R Control Column Lock, PN BA80-101, or equivalent

R Lock-wire, Fed. Spec QQ-W-390, Cond A, 0.032-inch diameter

R 3. Referenced Procedure

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Removal/Installation

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
R (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

R (1) Install control column lock.

R (2) Open access door 112AB to forward electronic service
R center.

R (3) Remove four screws holding drip pan on top of center
R electronic rack. Remove drip pan (Ref. Fig. 401).

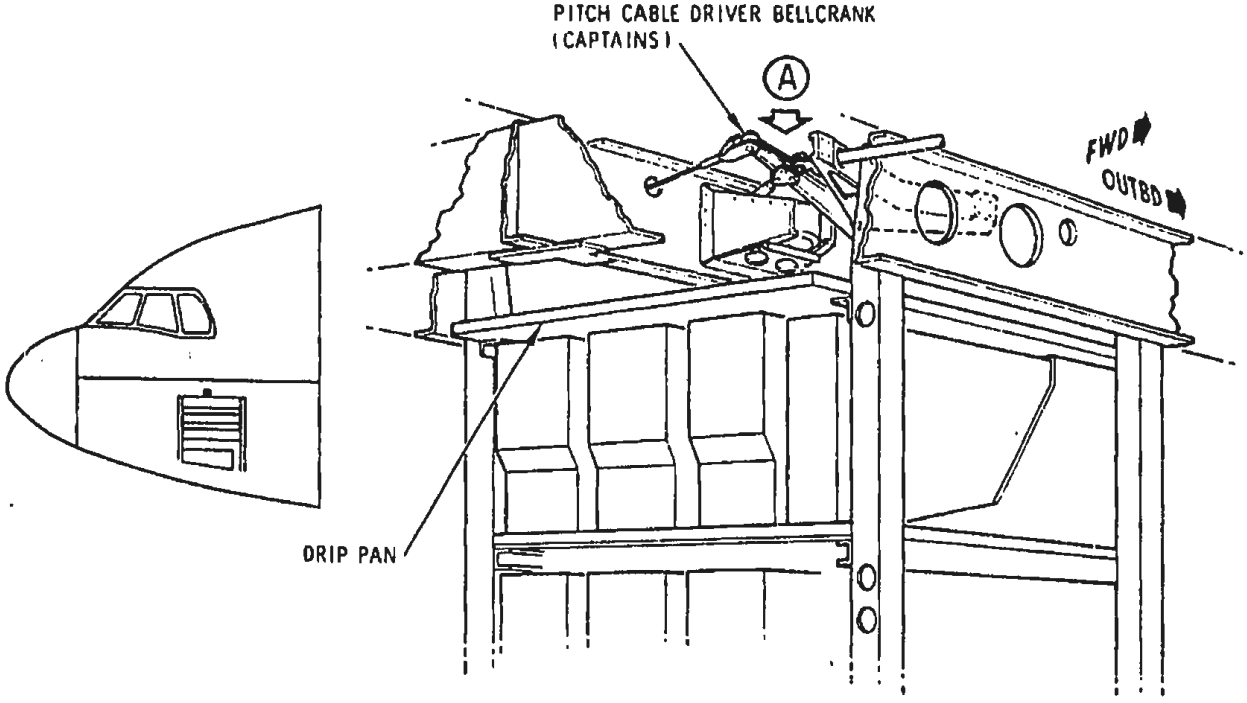
R (4) Unscrew and remove damper arm clamp screw.

R NOTE: Clamp screw engages notch in damper splined
R shaft and must be removed to remove arm.

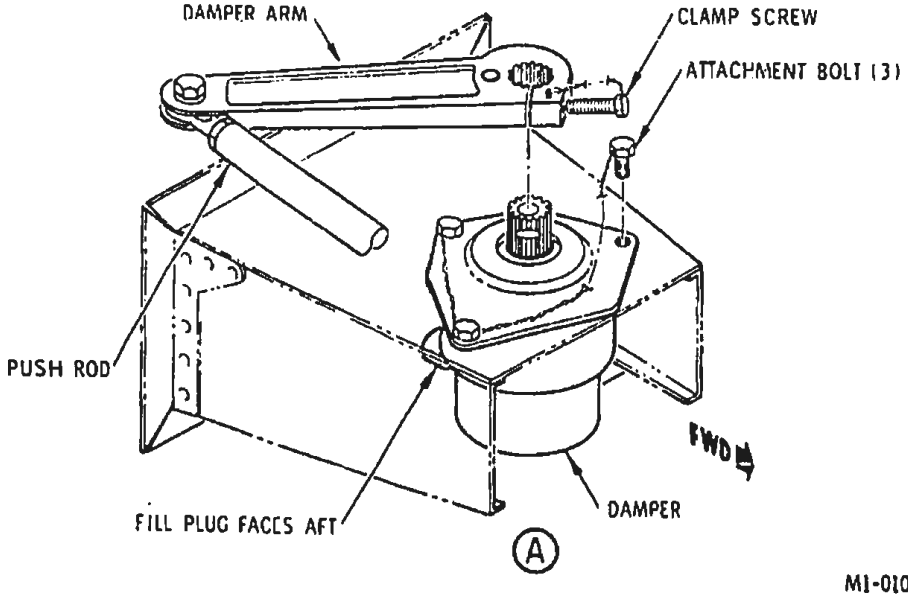
R (5) Remove the three damper attach bolts and remove damper.

R B. Installation

R (1) Verify that all hydraulic systems are shut off.



CENTER ELECTRONIC RACK



HA 1078
M1-0100-27-147

R R Control Column Rotary Damper - Removal and Installation
Figure 401

R NOTE: Check replacement damper for proper fluid
R supply. With damper at 70°F, pin on bottom of
R damper should be flush with cover (±1/8 inch).
R If pin is more than 1/8 inch inside cover,
R return to shop for refilling.

(2) Position the damper with the fill plug on the side facing aft.

(3) Install the three damper attach bolts, tighten and lock-wire.

(4) Position damper arm on damper spline. Engage spline so that clamp screw can be installed.

(5) Install clamp screw, tighten, and lock-wire.

(6) Install the center electronic rack drip pan.

(7) Remove control column lock.

R (8) Remove tags from hydraulic panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

R (9) Turn on any one of the four hydraulic systems (Ref.
R 29-11-00).

R (10) Operate control column through a minimum of three full
R pitch-up and pitch-down cycles. Controls must operate
R smoothly without binding.

R (11) During control column cycling, visually verify that
R damper input pushrod and arm operates freely and clears
R all structure.

R (12) Shut off hydraulic power (Ref. 29-11-00).

PITCH CONTROL CABLE BREAKAGE DETECTOR REMOVAL AND INSTALLATION

1. General

A cable breakage detector is installed in both the Captains and First Officers pitch cable runs to detect a slack or broken cable. The cable breakage detectors are located in the ceiling in the forward end of the forward cargo compartment.

2. Referenced Procedures

6-50-00	Interior Access Doors and Panels
27-41-32	Pitch Control Cable Breakage Detector - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Gain access to forward cargo compartment and remove ceiling access panel 125NR for First Officers break detector, or 125NL for Captains break detector (Ref. 6-50-00).

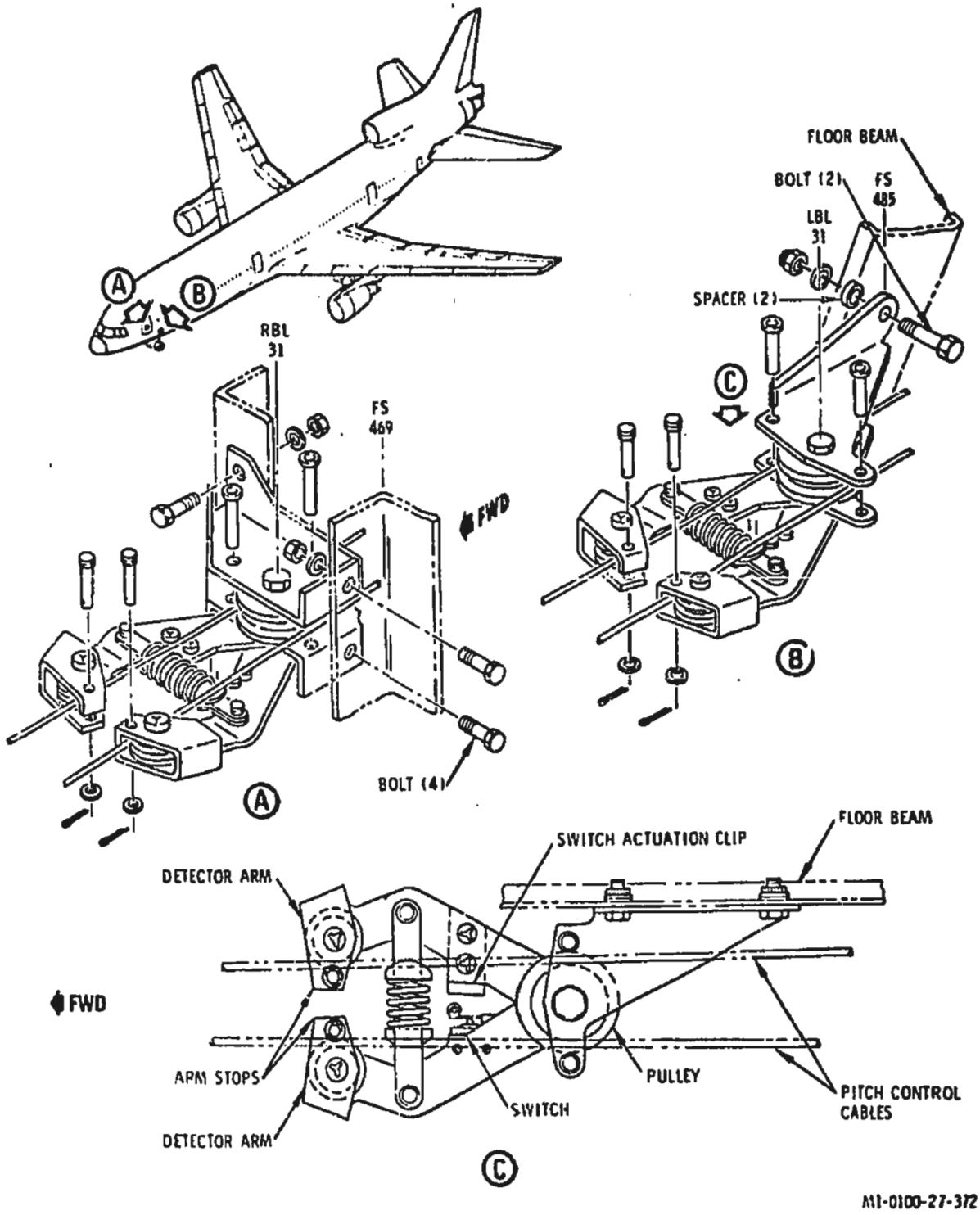
(2) Remove the cable guard pin from each detector arm (Ref. Fig. 401).

(3) Remove the cable guard pin from each side of the pulley.

R (4) Tag and disconnect the electrical wires to the
R switches.

R NOTE: Switches are wired to poke-home terminal boards
R located close to break detectors.

(5) Remove the detector assembly bracket attach bolts; disengage cables from arms and remove detector assembly.



R Pitch Cable Breakage Detector - Removal and Installation
R Figure 401

B. Installation

(1) Verify that all hydraulic power is turned off (Ref. 29-11-00).

(2) If installed, remove the four cable guard pins on replacement detector assembly.

(3) Place detector assembly in mounting position with arms pointing forward.

(4) Engage cables in detector arms. Position detector assembly pulley between cables. Install mounting bolts, washers and nuts (Ref. Fig. 401). Note spacers between Captains detector bracket and floor beam.

(5) Install cable guard pin on each side of pulley.

(6) Install cable guard pin, washer and cotter pin in each arm.

R (7) Connect switch wires to terminal boards. Remove wire tags.

(8) Check detector switch adjustment as follows:

(a) Position a 0.060-inch shim between the detector arms and squeeze the cables together so that the detector arm stops contact the shim.

(b) At this point, the switches must first actuate. If not, loosen screws holding switch actuation clip to arm and adjust clip as required. Tighten clip screws.

(9) Perform Operational Test (Ref. 27-41-32, Adjustment and Test).

(10) Before installing ceiling panels; inspect ceiling area to verify that no tools or equipment are left in area.

PITCH CONTROL CABLE BREAKAGE DETECTOR - ADJUSTMENT AND TEST

1. General

Procedures are provided to perform an operational test of the cable breakage detectors.

2. Referenced Procedures

6-50-00	Interior Access Doors and Panels
22-03-00	Flight Control Electronic System - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices
27-41-00	Horizontal Stabilizer Control System - Fault Isolation

3. Adjustment/Test

A. Operational Test

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breakers AVIONICS FLIGHT CONTROL SYSTEM FCES COMPUTERS - DC and AC & L AOA (B4 and B5) are closed.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breaker FLIGHT STATION MISC - R AOA (F1) is closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breakers IND LT - PFCS ADS/DH (G8) is closed.

(2) Turn on electrical power (Ref. 24-41-00).

(3) Perform quick check of the PFCS monitoring circuits as follows:

NOTE: If light indications in following steps are not as specified, a fault in pitch monitor wiring or FCES computer is indicated (Ref. 27-41-00 Fault Isolation, Fig. 102, and 22-17-00 Adjustment/Test, PFCS monitoring).

R

(a) Open circuit breaker FCES L AOA (CB1-B5). On PFCS MONITOR panel, verify that PITCH 1 FAIL light comes on and PITCH 2 FAIL light remains off.

(b) Close FCES L AOA circuit breaker. PITCH 1 FAIL light must go off.

(c) Open circuit breaker R AOA (CB2-F1). On PFCS MONITOR panel, verify that PITCH 2 FAIL light comes on and PITCH 1 FAIL light remains off.

(d) Close R AOA circuit breaker. PITCH 2 FAIL light must go off.

(4) On PFCS MONITOR panel, release (out) PITCH 1 switchlight. Switchlight OFF legend must come on. Verify that PITCH 2 switchlight is depressed (latched in).

(5) Enter forward cargo compartment and remove ceiling access panels 125NR and 125 NL (Ref. 6-50-00).

NOTE: If light indications in the following steps are not as specified, a faulty breakage detector switch or wiring is indicated (Ref. 27-41-00 Fault Isolation, Fig. 102, and 22-17-00 Adjustment/Test).

The FLT CONT PANELS light on the pilots caution and warning panel will flash for 10 seconds and then go steady anytime a fault light illuminates on the overhead flight control panels.

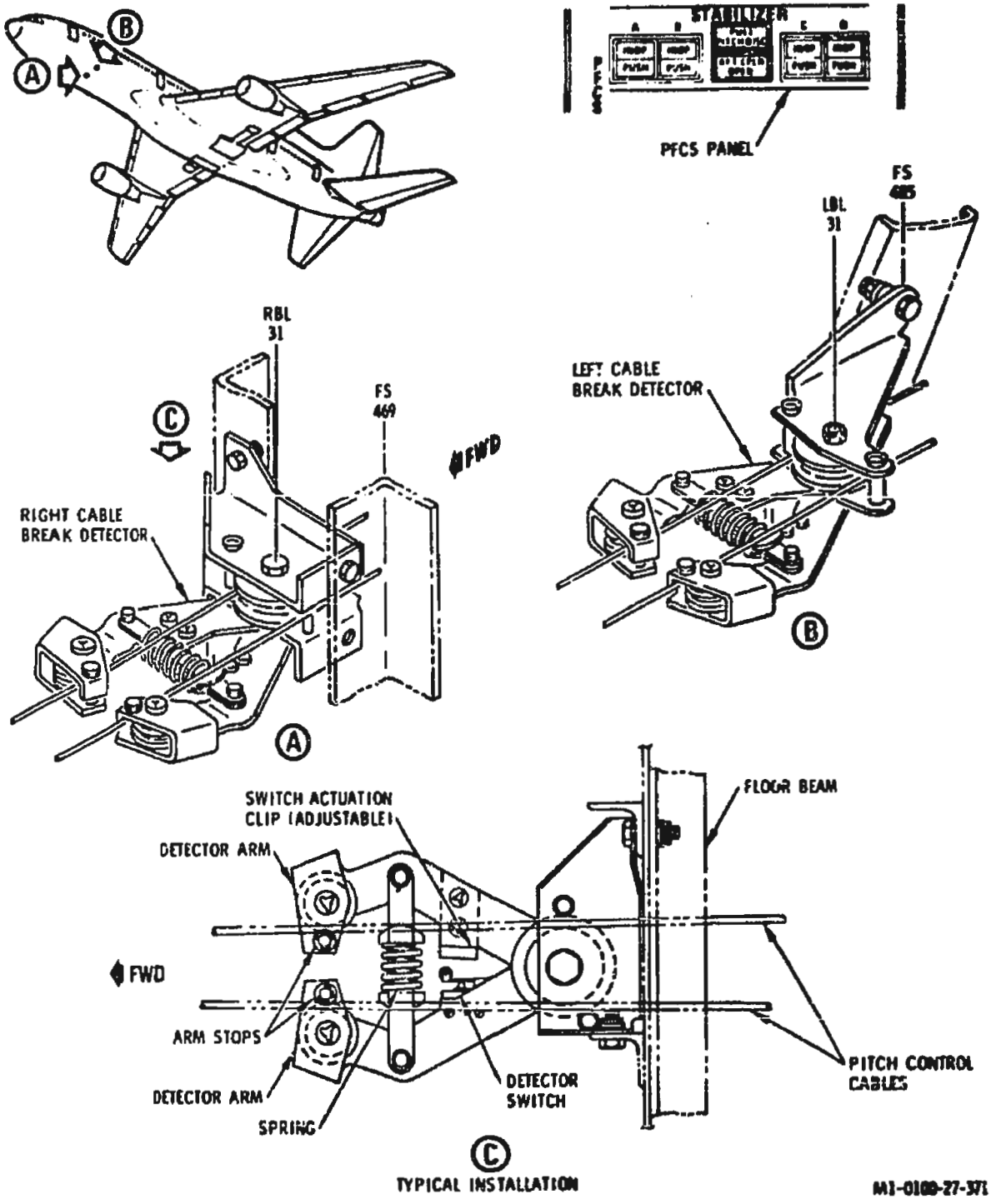
(6) Squeeze left cables (Captains) together to actuate detector switches (Ref. Fig. 501). On PFCS panel, verify that STABILIZER A and B switchlight PUSH legends come on.

(7) Release cables; STABILIZER A and B switchlight PUSH legends must go off.

(8) On PFCS MONITOR panel, depress PITCH 1 switchlight and release PITCH 2 switchlight. PITCH 1 switchlight OFF legend must go out; PITCH 2 switchlight OFF legend must come on.

(9) Squeeze left cables together to actuate detector switches. Verify that STABILIZER A and B switchlight PUSH legends come on.

(10) Release cables; STABILIZER A and B switchlight PUSH legends must go off.



Pitch Cable Break Detector - Adjustment and Test
Figure 501

R (11) Squeeze right cables (First Officers) together to actuate detector switches. Verify that STABILIZER C and D switchlight PUSH legends come on.

R (12) Release cables; STABILIZER C and D switchlight PUSH legends must go off.

R (13) On PFCS MONITOR panel, depress PITCH 2 switchlight and release PITCH 1 switchlight. PITCH 2 switchlight OFF legend must go out; PITCH 1 switchlight OFF legend must come on.

R (14) Squeeze right cables together to actuate detector switches. Verify that STABILIZER C and D switchlight PUSH legends come on.

R (15) Release cables; STABILIZER C and D switchlight PUSH legends must go off.

R (16) On PFCS MONITOR panel, depress PITCH 1 switchlight. PITCH 1 switchlight OFF legend must go out.

R (17) Install forward cargo compartment ceiling access
R panels.

R (18) Turn off electrical power (Ref. 24-41-00).

CONTROL COLUMN POSITION DFDR POTENTIOMETER REMOVAL AND INSTALLATION

1. General

R A potentiometer is mounted on the bottom of both the Captains
R and First Officers pitch cable drive assembly. Removal and
R installation procedures are identical for either potentiometer
R unless noted.

2. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Cotter Pin, MS24665-149, or equivalent

PR 1422AZ Sealant

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
21-61-02	Zone Trim Control Temperature Controller - Removal and Installation
22-10-11	AFCS/MLG Accessory Unit (LG LOGIC RELAY UNIT) - Removal and Installation
22-31-07	Speed Control Computer - Removal and Installation
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
31-31-00	Digital Flight Data Recorder (DFDR) System - Adjustment and Test

4. Removal/Installation

A. Removal

(1) Verify four hydraulic systems are shut off and hydraulic control panels tagged.

(2) Verify following circuit breakers are open and tagged:

R (a) On Pilots overhead circuit breaker panel CB1, zone
R 210: No. 1 SYSTEMS - PITCH ROLL (A6) and No. 2
R SYSTEMS - PITCH ROLL (A24). (b) On Flight
R Engineer/Second Officers aft circuit breaker panel
R CB3, zone 215:

R AIDS/FLT RCDR DC(H10), A(H11), B(H12), C(H13).

(3) Open access door 112AB to gain access to forward electronic service center (Ref. 6-40-00).

(4) Remove following equipment to gain access to DFDR potentiometer:

(a) For Captains potentiometer, remove AFCS/MLG Accessory unit (LG LOGIC RELAY UNIT) (Ref. 22-10-11) and speed control computer (Ref. 22-31-07) from center rack.

(b) For First Officers potentiometer, remove zone trim control temperature controllers (two forward ones) from top shelf of electrical rack (Ref. 21-61-02).

(c) Remove drip shield above equipment rack.

(5) Locate potentiometer on bottom of Captains or First
R Officers cable drive arm and disconnect potentiometer
R wires from terminal boards (Ref. Fig. 401).

R (6) On aircraft 001-031 without SB27-173,
R remove potentiometer as follows:

R (a) Remove rivet attaching alignment plate to bracket
R assembly (Ref. Fig. 401).

R (b) Support potentiometer arm from rotating, remove
R arm attaching nut and washer, and remove arm (Ref.
R Fig. 401).

R (c) Remove nut and lockwasher attaching potentiometer
R to bracket (Ref. Fig. 401).

R (d) Remove potentiometer with alignment plate.

R (6) On aircraft 001-031 with SB27-173 and 032-036,
R remove potentiometer as follows:

R (a) At potentiometer arm, remove cotter pin, nut and
R washer and disconnect link from potentiometer arm.

R (b) Remove nut and washer and remove arm from
R potentiometer shaft.

NOTE: Save all linkage components for reinstallation.

(c) Loosen clamp screws and rotate clamps from flange and remove flange with potentiometer attached.

(d) Remove nut and lockwasher and remove potentiometer.

B. Installation

(1) Verify all hydraulic power is turned off.

(2) Verify circuit breakers opened in Step 4A(2) are opened and tagged.

(3) On aircraft 001-031 without SB27-173, install potentiometer as follows:

(a) Apply sealant inside both mounting hole and index pin hole of alignment plate.

(b) Place alignment plate over potentiometer shaft and seat firmly, engaging index pin of potentiometer to index hole on alignment plate (Ref. Fig. 401).

(c) Insert potentiometer shaft through bracket mounting hole and install lockwasher and nut on potentiometer shaft and tighten.

(d) Clamp alignment plate to bracket and install rivet (Ref. Fig. 401).

(e) Position flat on potentiometer so "D" slot in arm engages.

NOTE: Verify flat on potentiometer shaft faces aft.

(f) Install washer and nut to secure arm to potentiometer shaft.

R R (g) Connect potentiometer wires to terminal board (Ref. Fig. 401).

(3) On aircraft 001-031 with SB27-173 and 032-036 install potentiometer as follows:

(a) Brushcoat inside surface of index hole and mounting hole of flange with sealant.

(b) Install flange on ring platform so index hole on Captains (left) cable drive arm is located at 3 O'clock position and on First Officers (right) cable drive arm is located at 9 o'clock position and tighten all three clamps.

(c) Insert potentiometer shaft through mounting hole of flange, and verify index pin of potentiometer engages index hole of flange (Ref. Fig. 401).

(d) Install lockwasher and nut on potentiometer shaft and tighten.

(e) Position flat on potentiometer so "D" slot in arm engages.

NOTE: Verify flat faces outboard on Pilots and First Officers side.

(f) Install arm on potentiometer shaft so shaft engages "D" slot in arm and install washer and nut and tighten (Ref. Fig. 401).

(g) Install link to potentiometer arm with washer, nut and cotter pin.

CAUTION: FREE OPERATION OF LINKAGE DEPENDS ON CORRECT ASSEMBLY AND INSTALLATION OF LINKAGE COMPONENTS.

R R (h) Connect potentiometer wires to terminal board (Ref. Fig. 401).

WARNING: VERIFY FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Remove tags and close circuit breakers opened in Step 4A(2).

(5) Remove tags from hydraulic control panels.

(6) Turn on electrical power (Ref. 24-41-00).

(7) Turn on one hydraulic system for each stabilizer servo: A or B and C or D (Ref. 29-11-00).

CAUTION: TO PREVENT FUSELAGE OSCILLATIONS AT EXTREMES OF CONTROL COLUMN TRAVEL, REVERSE CONTROL COLUMN TRAVEL SLOWLY.

(8) Slowly cycle control column from full forward to full aft and visually verify normal operation of potentiometer arm linkage.

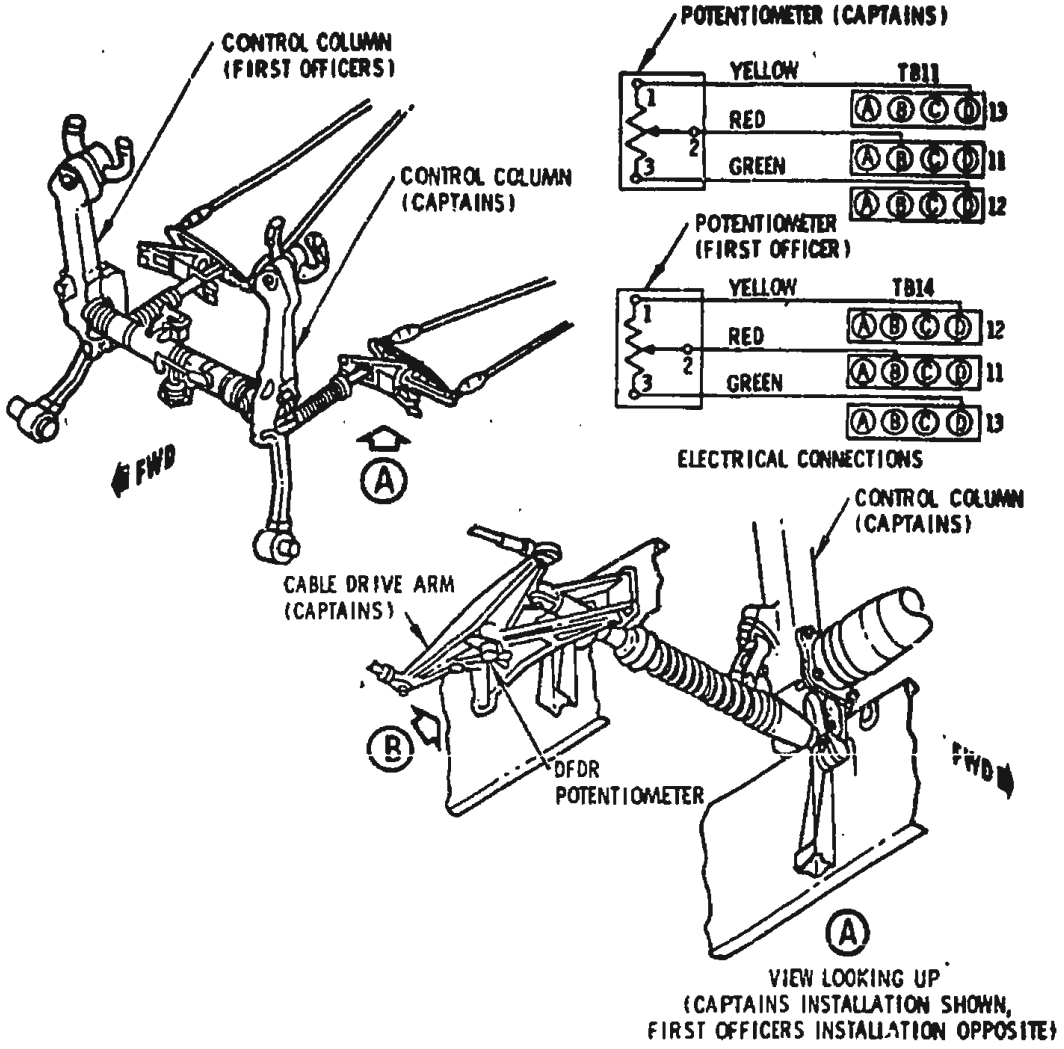
(9) Check control column position potentiometer for proper voltage and phase output (Ref. 31-31-00, Adjustment and Test, Table 501, signal code 111-1 for Captains potentiometer or 111-2 for First Officers potentiometer).

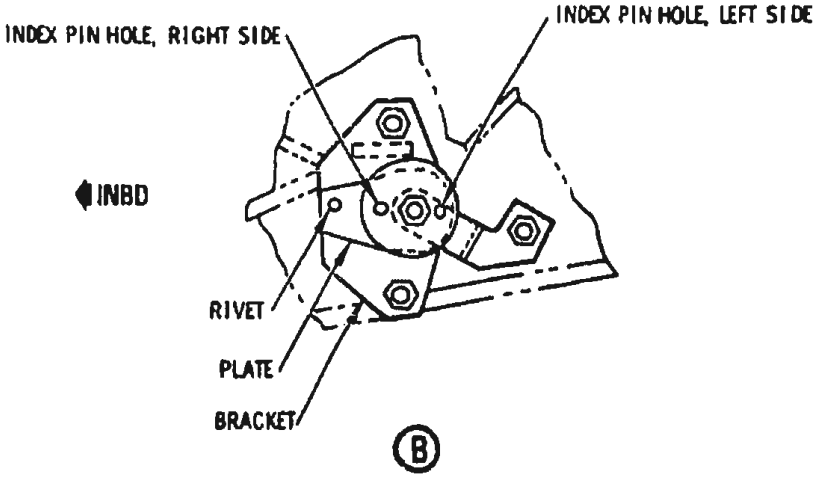
(10) Install equipment removed in Step 4A(4).

(11) Turn off hydraulic power (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 24-41-00).

(13) Close access door opened in Step 4A(3)(Ref. 6-40-00).



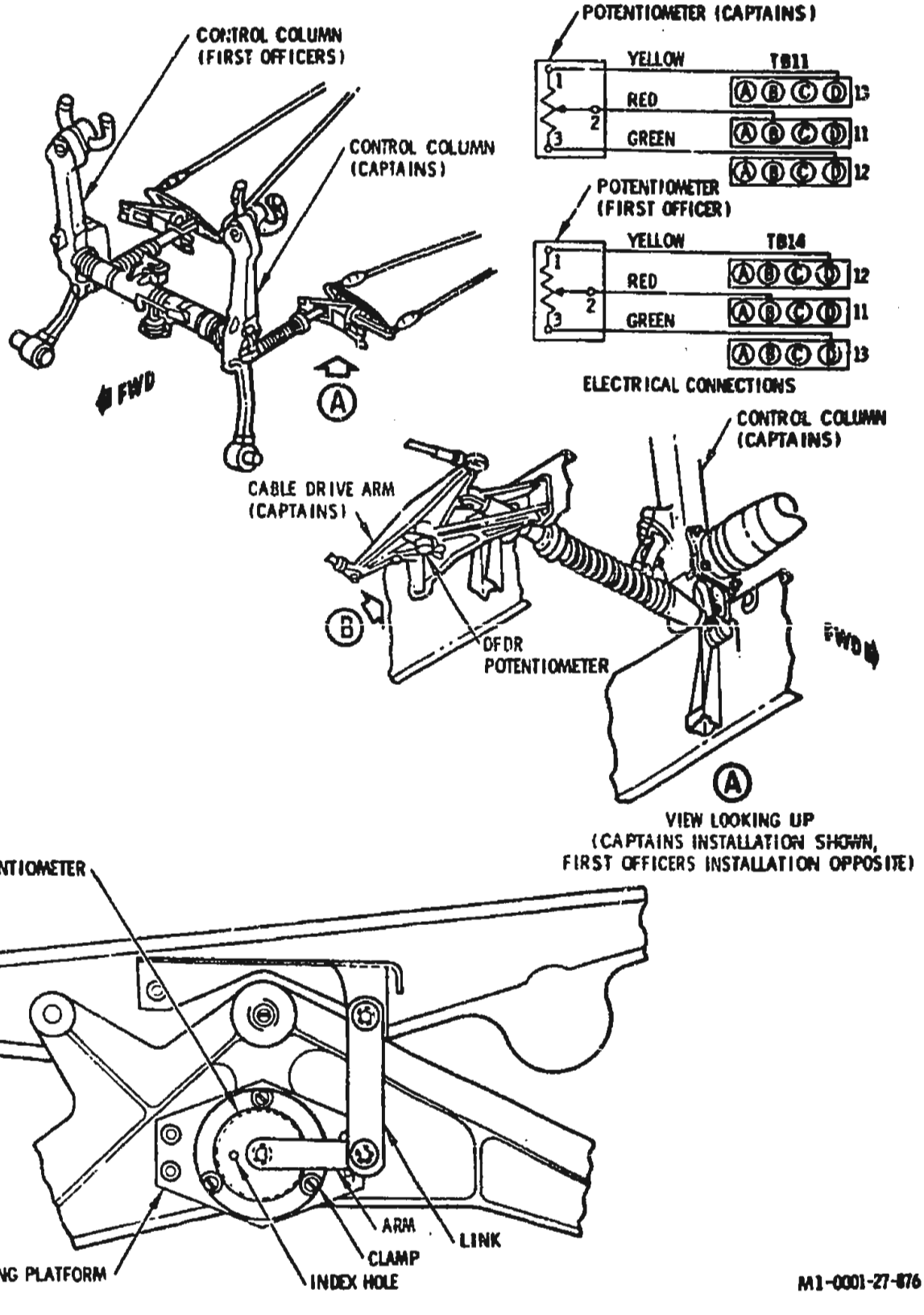


M1-0000-27-935

R Control Column Position DFDR Potentiometer - Removal and
R Installation
R Figure 401

EFFECTIVITY: 001-031 WITHOUT SB27-173

001B



R Control Column Position DFDR Potentiometer - Removal and
R Installation
R Figure 401

R EFFECTIVITY: 001-031 WITH SB27-173 AND 032-036
R
0018

R PITCH DISCONNECT HANDLE
R - MAINTENANCE PRACTICES

R 1. General

R This pageblock contains instructions for the relamping of the
R pitch disconnect handle.

R 2. Referenced Procedures

R 24-41-00 External Power/Ground Service System - Maintenance
R Practices

R 3. Maintenance Practices

R A. Relamping Pitch Disconnect Handle

R (1) Insert small diameter tool (lockwire, ballpoint pen,
R etc.) in hole on either end of T-handle to depress lens
R clips and remove lens.

R (2) Remove reflector and lampholder assembly. Note
R orientation of assembly to T-handle for reassembly.

R (3) Invert assembly and remove metal plate at bottom of
R assembly.

R (4) Press lamps out bottom of assembly.

R (5) Install new lamps.

R (6) Reinstall metal plate. Insure hole in plate is offset
R from center lamp.

R (7) Reinstall reflector and lampholder assembly. Insure
R center lamp is offset from metal spike in T-handle.
R Hole in metal plate should align with spike.

R (8) Reinstall lens. Insure lens clips are seated in holes
R on either end of T-handle.

R (9) Perform functional test of lamps as follows:

R (a) On Flight Engineer/Second Officers overhead
R circuit breaker panel CB2, verify circuit breaker
R IND LT-PILOTS (J2) is closed.

R (b) Turn on electrical power (Ref. 24-41-00).

R (c) Pull disconnect handle. Lamps should be on with
R handle extended, and out with handle retracted.

R (d) Return handle to the retracted position.

R (e) Turn off electrical power if no longer required
R (Ref. 24-41-00).

R PITCH DISCONNECT HANDLE - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Lock-wire, Fed. Spec. QQ-W-390, Cond A, 0.020-inch diameter, or
R equivalent

R 2. Referenced Procedures

R 24-41-00 External Power/Ground Service System - Maintenance
R Practices

R 25-11-01 Captains Seat Assembly - Removal and Installation

R 3. Removal/Installation

R A. Removal (Ref. Fig. 401)

R (1) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, open and tag circuit
R breaker IND LT - PILOTS (J2).

R (2) Remove Captains seat (Ref. 25-11-01).

R (3) Remove the forward and aft trim panel on the left side
R of the center console.

R (4) Verify that the pitch disconnect handle is released and
R retracted against the console.

R (5) Remove the two cotter pins from the pitch disconnect
R handle cable anchor.

R (6) Pull on the pitch disconnect arm to provide slack to
R the cable and slip the pitch disconnect cable ball from
R the cable anchor.

R (7) Tag for identification and disconnect the two pitch
R disconnect handle wires from the throttle stand wiring
R module board. Note location of wire ties and cut wire
R ties.

R (8) Remove lock-wire between locknut and spacer. Remove
R locknut and spacer and remove the pitch disconnect
R handle assembly.

R B. Installation (Ref. Fig. 401)

R (1) Insert pitch disconnect handle assembly through console
R mounting hole. Verify that handle assembly tang
R engages the console mounting hole slot.

R (2) Install spacer and nut on handle assembly mount thread.
R Verify that spacer slot engages handle assembly tang.
R Tighten nut and lock-wire nut to spacer.

R (3) Verify that the handle is released and retracted
R against the console.

R (4) Pull on the pitch disconnect cable and engage the cable
R ball into the cable anchor. Install the two cotter
R pins in the cable anchor.

R (5) Connect the two pitch handle wires to the throttle
R stand wiring module board. Tie handle wires as noted
R during handle removal Step (7).

R NOTE: Field reports indicate that the handle-to-shaft
R clamping bolt has been found loose. Verify that
R clamping bolt is torqued 25 lbs in.

R (6) Operate pitch disconnect handle through several
R disconnect and reconnect cycles. Verify normal
R operation of the handle (handle rotates and locks in
R extended position). Verify that the disconnect cable
R is properly positioned on the pulley.

R (7) Check the pitch disconnect cable adjustment as follows:

R (a) Pull up and lock PITCH DISC handle in the extended
R position.

R (b) Verify that pitch disconnect clutch teeth are
R separated a minimum of 0.020 inch. (Ref. Fig.
R 401, View C). If not, accomplish Steps (c)
R through (g).

R CAUTION: VERIFY THAT PITCH DISCONNECT HANDLE
R CABLE ANCHOR CONTAINS TWO COTTER PINS TO
R RETAIN CABLE BALL IN ANCHOR (REF. FIG.
R 401, VIEW B).

R (c) Remove lock-wire from threaded coupling locknut on
R bottom of pitch disc handle.

R (d) Loosen locknut and disengage lock washer.

R (e) Adjust threaded coupling so that clutch teeth are
R separated a minimum of 0.020 inch.

(f) Engage lockwasher tab in slot; tighten locknut and lock-wire to tab on lockwasher.

(g) Cycle pitch disc handle through several cycles then pull up and lock handle in extended position. Recheck pitch disconnect clutch teeth separation of 0.020 inch.

R (h) With pitch disconnect handle in the stowed
R position and the control column in the -4 degree
R position, up to 1/2 inch slack in pitch disconnect
R cable is acceptable.

(8) Remove tag and close circuit breaker IND LT - PILOTS CB2-J2.

(9) Turn on electrical power (Ref. 24-41-00).

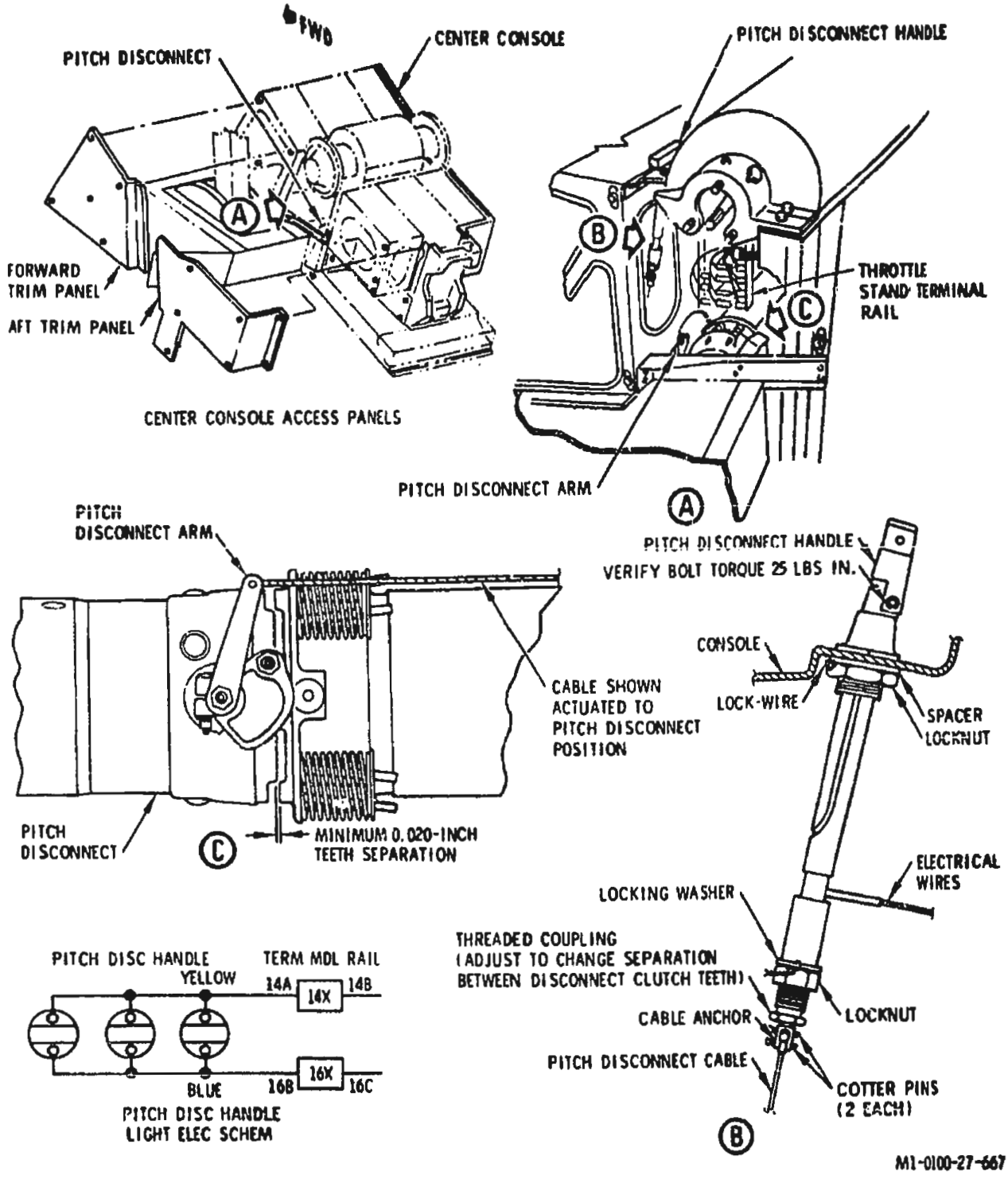
(10) Check handle light operation with handle retracted against console, handle light should be out. With handle extended (control columns disconnected), handle light should be on.

(11) Verify that console area is clear of all tools and equipment.

(12) Install the console forward and aft trim panels.

(13) Install the Captains seat (Ref. 25-11-01).

(14) Turn off electrical power if no longer required (Ref. 24-41-00).



R Pitch Disconnect Handle - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

R PITCH DISCONNECT HANDLE LIGHT SWITCH - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Lock-wire, Fed Spec QQ-W-390, TEMP A, 0.020-inch diameter, or
R equivalent

R Large mirror (approximately 10 by 12 inches)

R 2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	25-11-01	Captains Seat Assembly - Removal and Installation
R	25-11-02	First Officers Seat Assembly - Removal and Installation
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Removal/Installation

R WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC
R SERVICE PANEL, ZONE 147.

R A. Removal

R (1) On Flight Engineer/Second Officers circuit breaker
R panel CB2, zone 215, verify that circuit breaker IND LT
R PILOTS (J2) is open and tagged.

R (2) Remove Captains and First Officers Seats (Ref. 25-11-01
R and 25-11-02).

R (3) Remove the center console forward and aft trim panels
R on both sides of the console (Ref. Fig. 401).

R (4) Verify that PITCH DISC handle on console is not
R actuated (handle should be retracted against console).

R (5) Support control column.

(6) Open access door 112AB to gain access to forward electronic service center (FESC) (Ref. 6-40-00).

(7) Disconnect forward end of left and right pitch override bungees from control columns.

(8) Slowly allow control columns to move full forward. Release control column.

(9) Place a large mirror under the switch. (Switch is mounted on bottom of pitch disconnect.)

NOTE: It is recommended that the sides of the drip shield pan in the FESC be taped to catch any hardware.

Two men, one working from each side of console, are required to replace switch.

(10) Tag for identification and disconnect switch wires.

NOTE: On early aircraft, pitch disconnect switch wires run to terminal module in forward electronic service center (FESC) at FS 175, WL 180, BL 25R. On later aircraft, the pitch disconnect switch incorporates poke-home connectors.

(11) Remove lock-wire and two screws holding switch actuator and switch to bracket. Remove switch.

B. Installation

NOTE: Earlier switches had soldered connections. Later switches have poke-home connections. Replacing earlier switches with poke-home switches requires poke-home pins for wire termination and new mounting clip. (Refer to IPC for replacement part numbers.)

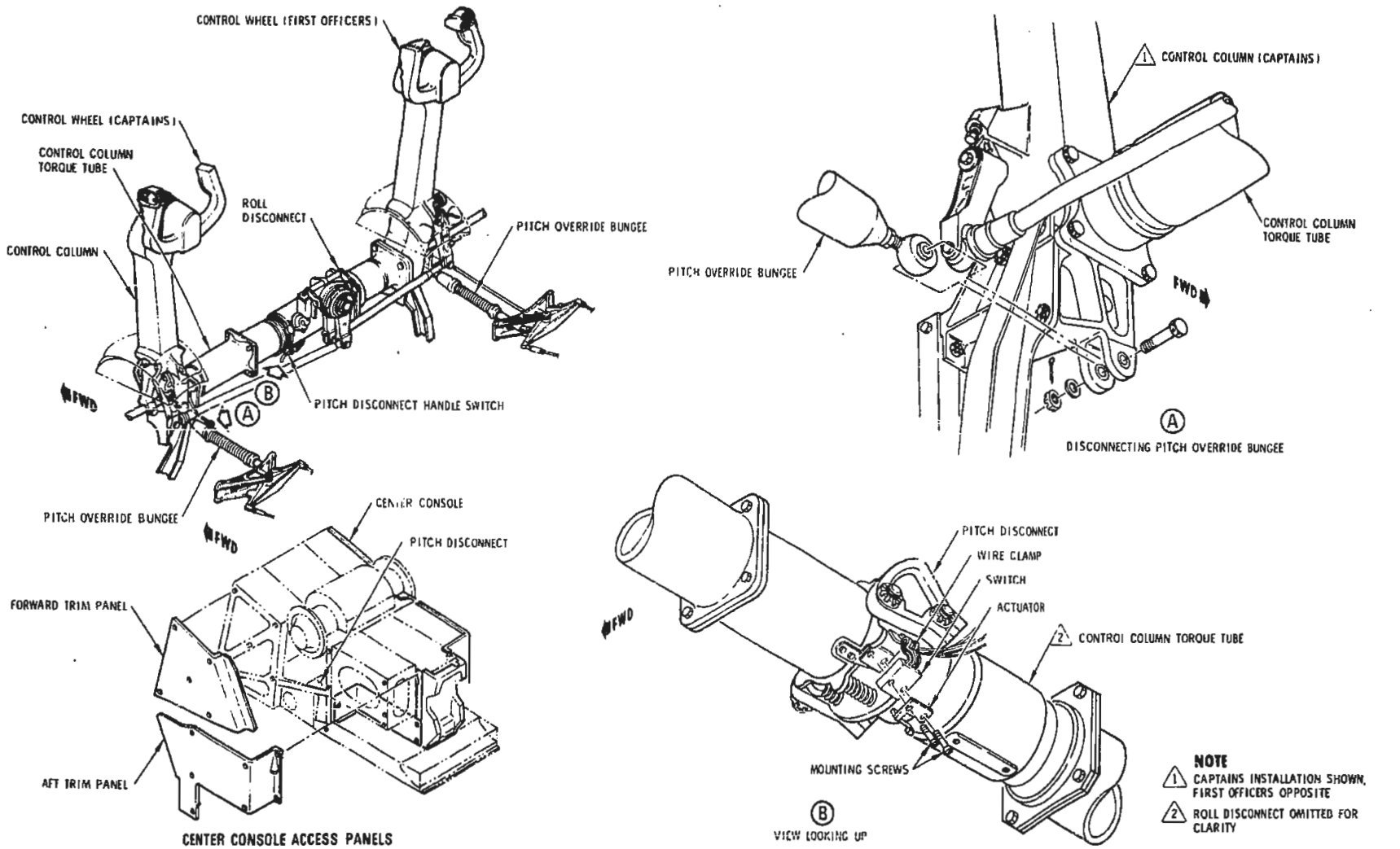
(1) Position two screws and washers through switch actuator, switch, and clip. Install switch on bracket, tighten screws and lock-wire.

(2) Reconnect switch electrical wires [Ref. Step A(10)].

(3) Check switch adjustment as follows:

(a) With pitch disconnect fully engaged, measure clearance between end of clutch tooth and bottom of opposite tooth space.

(b) Slowly pull up on PITCH DISC handle until clearance equals Step (a) plus 0.075 (±0.005)



M1-0100-27-374

R Pitch Disconnect Mechanism Handle Switch
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
R
001

inch. At this point, switch should just actuate. If not, loosen cam attach screws, adjust cam and retighten attach screws. Lock-wire screws.

(4) Close circuit breaker IND LT PILOTS (CB2-J2).

(5) Turn on electrical power (Ref. 24-41-00).

(6) Pull up and lock PITCH DISC handle. Verify that handle lights come on.

(7) Release PITCH DISC handle and allow handle to retract against console. Verify that handle lights go out.

NOTE: If the light does not operate properly, check the first disconnect after the pitch disconnect handle. When male and female connectors are pushed in too far, an open circuit can be caused. Disconnect electrical connector and reconnect taking care not to push connectors in too far. Inserting a 1/16-inch plastic spacer between two plugs will insure correct connector engagement.

(8) Remove mirror from beneath switch.

(9) Verify that console area is clear of tools and equipment.

(10) Install console side panels.

(11) Install Captains and First Officers seats (Ref. 25-11-01 and 25-11-02).

(12) Reconnect forward end of left and right pitch override bungees to control columns with bolt, washer, and nut. Install cotter pin.

(13) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(14) Turn on any one of the four hydraulic systems (Ref. 29-11-00).

(15) Cycle control column full forward and aft several times. Verify that controls operate smoothly with no roughness or interference.

(16) During control column cycling, visually monitor pitch bungee operation. Verify that pitch bungees clear all structure and equipment.

(17) Shut off hydraulic power (Ref. 29-11-00).

(18) Shut off electrical power (Ref. 24-41-00).

STABILIZER POWER SERVO BYPASS AND SHUTOFF VALVE REMOVAL AND INSTALLATION

1. General

All parts required to replace the stabilizer servo bypass and shutoff valve on the stabilizer servo upper or lower manifold is contained in the Bertea LRU installation kit PN 2341. The valve is shipped with pre-assembled backup rings and O-rings and is ready for installation. Two transfer tubes are packaged separately. These transfer tubes, with pre-assembled backup rings and O-rings, are required for installation of the valve in the lower manifold.

C TWA does not stock kit P/N 2341. The stabilizer servo bypass
C and shutoff valve is stocked under TWA Stk. Nbr. 273-6219 and
C does not have transfer tubes installed, or packaged with the
C valve. Consequently, the transfer tubes found installed when
C the valve is removed, must be reused in the new valve, using new
C seals.

C Seals and backup rings required for the small transfer tubes
C are:

C Upper Manifold - Mfr. P/N 200104-7 Tube

C Large End - 1 each TWA Stk. Nbr. 42-9408 "O" Ring

C 2 each TWA Stk. Nbr. 72-2442 Backup Rings

C Small End - 1 each TWA Stk. Nbr. 42-9665 "O" Ring

C 2 each TWA Stk. Nbr. 72-2441 Backup Rings

C Lower Manifold - Mfr. P/N 200104-1 Tube

C 2 each TWA Stk. Nbr. 42-9665 "O" Rings

CR 2 each TWA Stk. Nbr. 72-2441 Backup Rings

2. Equipment and Materials

Container, one gallon (to catch oil spillage)

C Spanner Wrench, Bertea PN AT1-200155-1, or equivalent TWA Tool
C GEN 3509

Lock-wire, 0.032 inch diameter, Fed Spec QQ-W-423, Form 1, Cond A, or equivalent

Torque Wrench, 1/2 Drive, 0 to 200 pounds feet

Control Column and Trim Wheel Lock, PN BA8D-101, or equivalent

Grease, MIL-G-23827, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) Verify that following circuit breakers are opened and tagged:

(a) On Pilots overhead circuit breaker panel CB1, zone 210: FCES COMPUTER - AC & L AOA (B5).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: FLIGHT STATION MISC - R AOA (F1).

(2) Install control column lock.

(3) Open applicable access door (Ref. 6-40-00):

(a) Left stabilizer servo, 317AB.

(b) Right stabilizer servo, 317CB.

R CAUTION: USE REASONABLE CARE DURING VALVE REMOVAL TO PREVENT HYDRAULIC FLUID FROM COMING IN CONTACT WITH SKIN OR EYES.

(4) If upper manifold bypass and shutoff valve is to be replaced, use the pre-assembled valve assembly as it is packaged in the kit. Inspect the replacement valve to verify that the two small transfer tubes (4) are in

place (Ref. Fig. 401). These transfer tubes are identified with a -7 on an identification band around the center portion. One end of the -7 transfer tubes is larger than the other, and only the -7 transfer tubes can be used in the upper manifold.

(5) If the lower manifold bypass and shutoff valve is to be replaced, remove two -7 small transfer tubes (4) from pre-assembled valve assembly. Then install the two small transfer tubes (3) supplied in a separate plastic bag without identifying bands. Before installing the two small transfer tubes (3), lubricate backup rings and O-rings with clean hydraulic fluid. These two small transfer tubes have the same diameter on each end and must be used in the lower manifold.

(6) Clean surface next to the bypass and shutoff valve to be removed to prevent introduction of foreign matter into the hydraulic passages of the manifold.

(7) Cut and remove lock-wire from retaining spanner nut. Note where lock-wire is anchored to.

(8) Use spanner wrench PN AT1-200155-1 to loosen retaining nut. Approximately 120 pounds feet will be required. Remove nut.

R CAUTION: USE PRESCRIBED SPANNER WRENCH ONLY. DO NOT USE ANY OTHER TOOL OR SPANNER NUT WILL BE DAMAGED.

(9) Position container to catch oil spillage.

(10) Carefully remove bypass and shutoff valve from servo manifold. Remove any transfer tubes which may remain in servo manifold.

B. Installation (Ref. Fig. 401)

(1) Verify that proper small transfer tubes are installed on replacement bypass and shutoff valve [Ref. Steps A(3) and (4)].

(2) Inspect replacement valve and servo manifold mating surfaces for cleanliness. Wash any residual hydraulic fluid from manifold mating surface and the electrical connector.

(3) Lubricate all backup rings and O-rings on replacement bypass and shutoff valve with clean hydraulic fluid. Install replacement valve on servo manifold.

(4) Lubricate retaining spanner nut threads with grease MIL-G-23827, then thread spanner nut into manifold. Use spanner wrench PN AT1-200155-1 to tighten nut to torque valve of 100-120 pound feet.

(5) Lock-wire spanner retaining nut.

(6) Check replacement bypass and shutoff valve as follows:

(a) Remove control column lock.

(b) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(c) Turn on electrical power (Ref. 24-41-00).

(d) Remove tags and close circuit breakers opened in Step A(1).

(e) Turn on hydraulic system supplying servo with replacement valve (system A and B, left servo; system C and D, right servo) (Ref. 29-11-00).

(f) Bleed stabilizer servo by slowly cycling control column through several pitch up and pitch down cycles.

NOTE: After bleeding any servo, bleed affected hydraulic reservoir (See Reservoir Servicing Instruction Placard, Ref. 12-13-00).

(g) On the PFCS panel (on pilots overhead panel), verify that the two STABILIZER switchlight for the servo with replacement valve are depressed (in) and that INOP lights are out.

(h) Release (out) STABILIZER switchlight on system with replaced valve. The INOP light must come on.

(i) Depress (in) STABILIZER switchlight released in Step (h). The INOP light must go out.

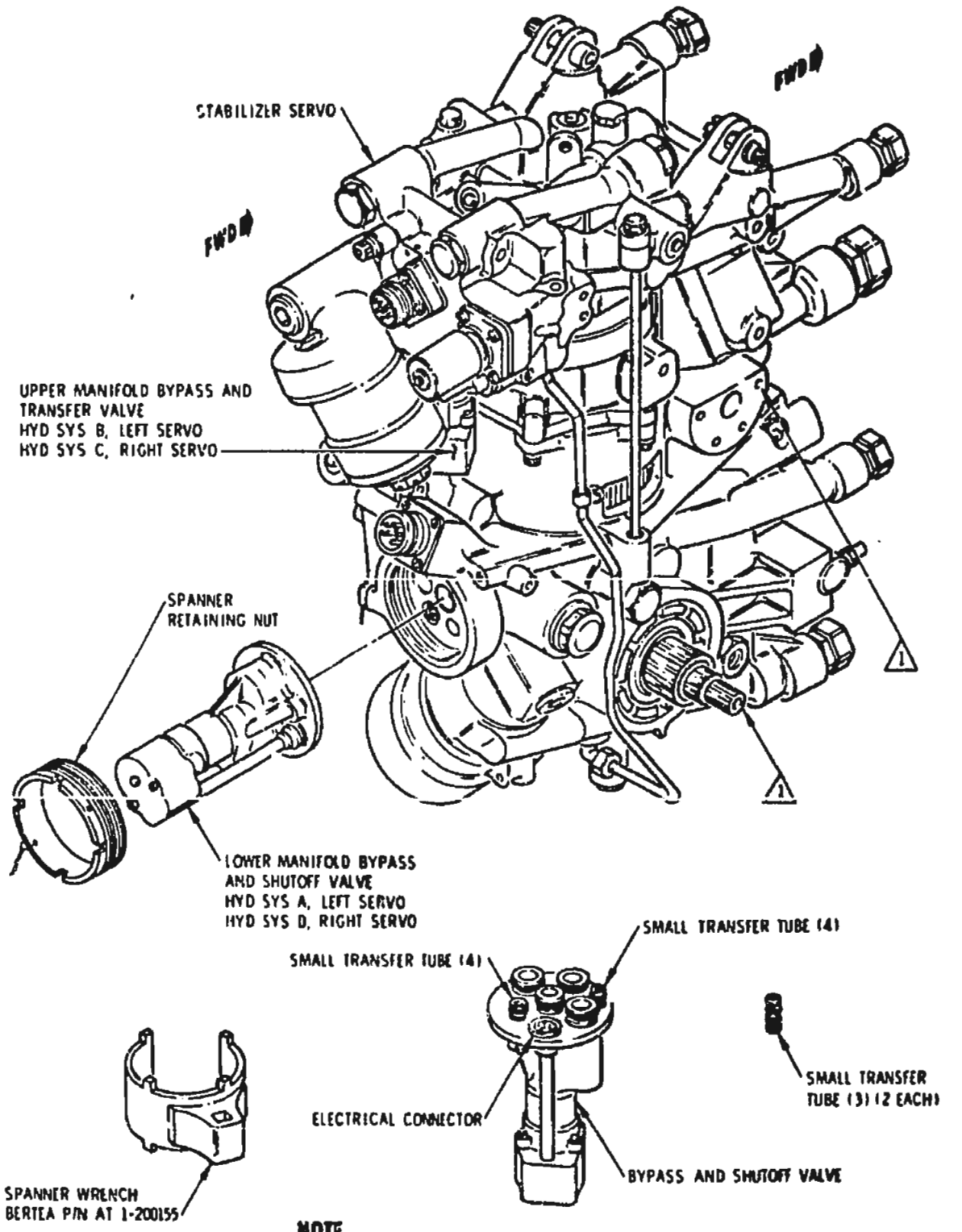
(j) Visually check bypass and shutoff valve for hydraulic leakage.

(k) Close access door.

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER THROUGH FULL STABILIZER THROWS TO CHECK FOR ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE STABILIZER SERVO OPERATING LINKAGE. CORRECT INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR
R ASSOCIATED STIFFENER.

(l) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(m) Shut off electrical power if no longer required (Ref. 24-41-00).



R Stabilizer power Servo Bypass and Shutoff Valve - Removal and
R Installation
R Figure 401

R EFFECTIVITY: ALL

PITCH AFT COUPLER JAM SENSING SWITCH ASSEMBLY REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, TEMP A, 0.020-inch dia, or equivalent

Multimeter, Simpson Model 260, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service Systems - Maintenance Practices
27-41-06	Pitch Control Override Bungee and Aft Pitch Coupler - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) Verify that following circuit breakers are open and tagged:

On pilots overhead circuit breaker panel CB1, zone 210: FCES - COMPUTERS - AC & L AOA (B5).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: FLIGHT STATION MISC - R AOA (F1).

(2) Remove access panels 316BB and 316DB on afterbody to gain access to pitch aft coupler.

(3) Remove cable clamps holding switch cable to logic arm and to lower frame (Ref. Fig. 401).

(4) Disconnect switch wires from the terminal strips on the right side.

(5) On the logic arm assembly, loosen the locknut and back off the switch actuation screws (two on each side).

(6) Remove two screws attaching the switch assembly to the logic arm assembly. Remove the switch assembly.

B. Installation

(1) Verify that hydraulic power is turned off and the hydraulic control panels are tagged.

(2) Install the switch assembly on the logic arm assembly with the two attaching screws.

(3) Secure the switch wire bundle to the two cable clamps.

(4) Connect the switch wires to the terminal strips (Ref. Fig. 401 electrical schematic).

(5) Adjust the switch actuation screws as follows:

(a) Insert a 0.040-inch feeler gage between the right logic arm and spacer (Ref. Fig. 401).

(b) Push right logic arm against spacer.

(c) Turn two switch actuating screws on the right side until switches open (circuits between pins 5 and 8 and between 6 and 7 are open). (Use a multimeter to check switch opening and closing.)

(d) Tighten locknuts on right adjusting screws.

(e) Recheck that circuits specified in Step (c) are still open. Release right logic arm. Remove feeler gage. Lock-wire locknuts.

(f) Insert 0.040-inch feeler gage between the left logic arm and spacer.

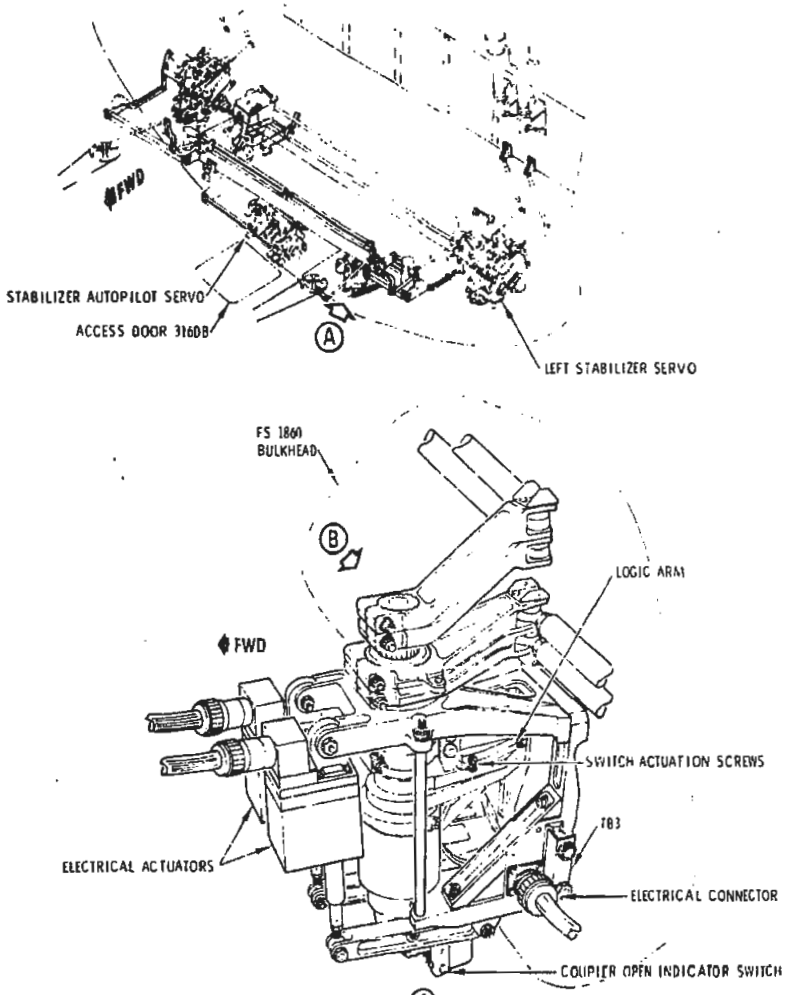
(g) Push left logic arm against spacer.

(h) Turn two switch adjusting screws on the left side until switches open (circuits between pins 1 and 4 and between 2 and 3 are open).

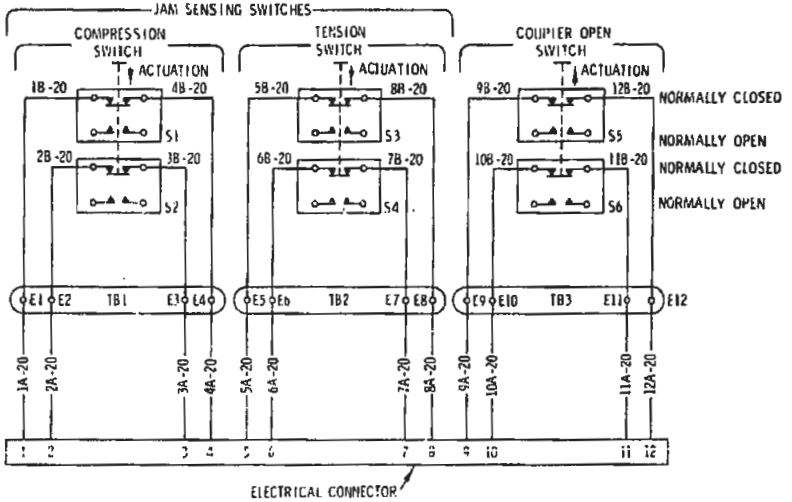
(i) Tighten locknuts on left adjusting screws.

(j) Recheck that circuits specified in Step (h) are still open. Release left logic arm. Remove feeler gage. Lock-wire locknuts.

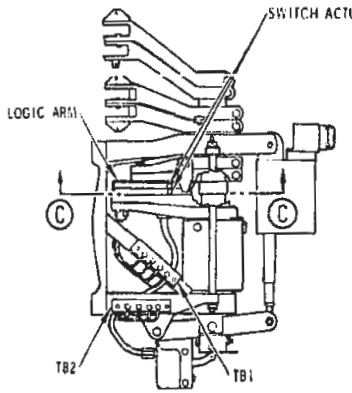
(6) Remove tags from hydraulic control panels and close circuit breakers.



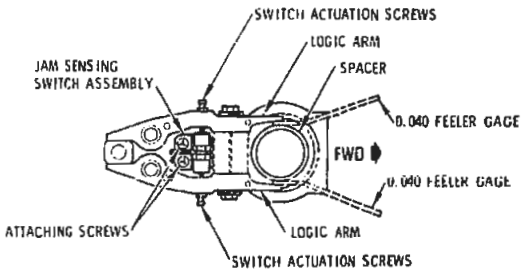
AFT COUPLER INSTALLATION



PITCH AFT COUPLER WIRING SCHEMATIC



RIGHT SIDE OF AFT COUPLER



VIEW LOOKING UP

M1-0100-27-375

R Aft Pitch Coupler Jam Sensing Switch Assembly
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

R (7) Perform Pitch Control Override Bungee and Aft Coupler
R Operational Test (Ref. 27-41-06).

R (8) Close access panels to pitch aft coupler.

PITCH CONTROL CABLE BREAKAGE DETECTOR SWITCH REMOVAL AND INSTALLATION

1. General

A cable break detector is installed in both the Captains and First Officers pitch cable runs to detect slack or broken cables. The cable breakage detectors are located in the ceiling in the forward end of the forward cargo compartment.

2. Referenced Procedures

6-50-00	Interior Access Doors and Panels
27-41-32	Pitch Control Cable Breakage Detector - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Gain access to forward cargo compartment and remove ceiling access panel 125NR for First Officers cable breakage detector, or 125NL for Captains cable breakage detector (Ref. 6-50-00).

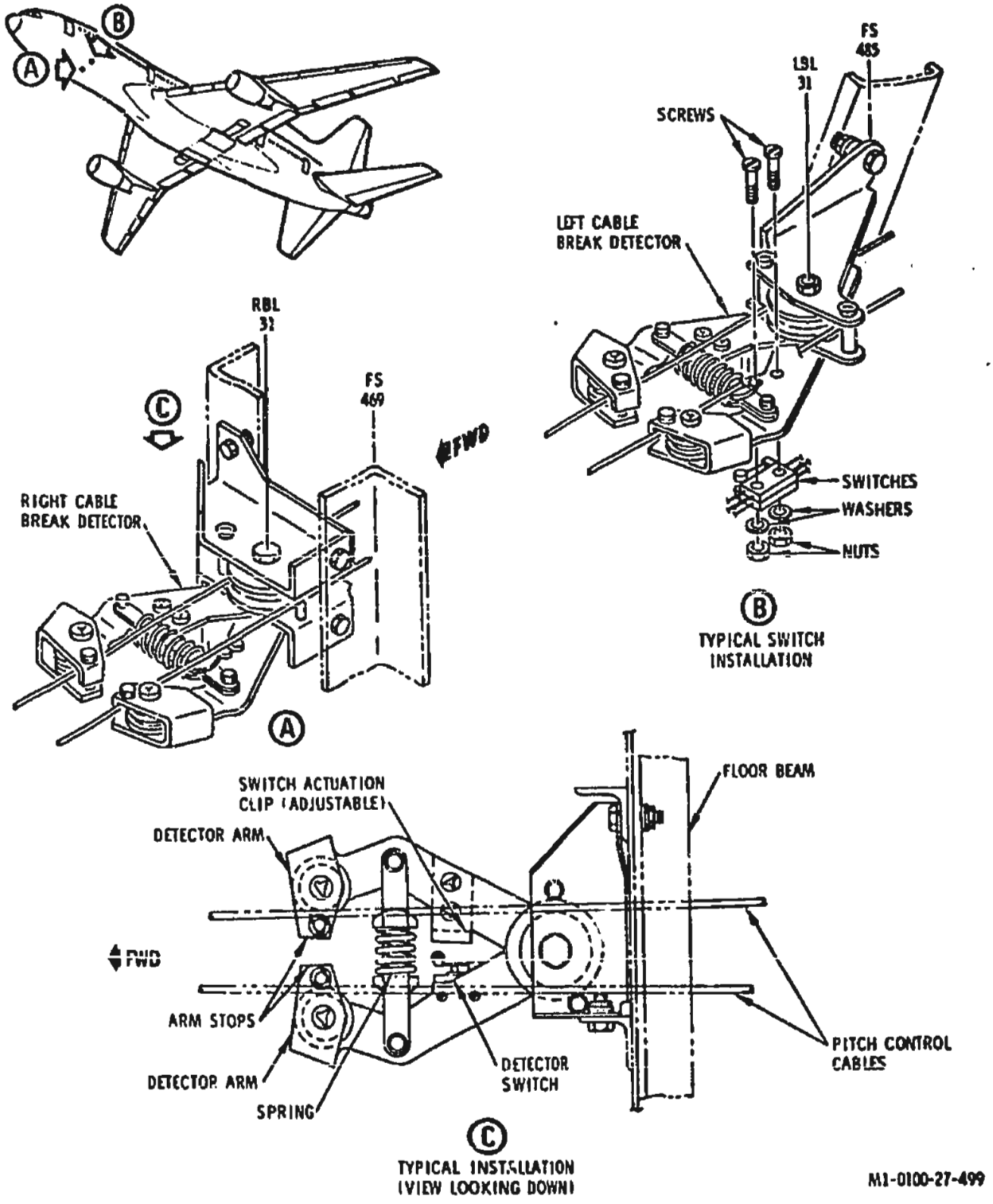
(2) Tag for identification and disconnect the switch electrical wires at terminal module near breakage detector.

(3) Remove the two screws, washers, and nuts attaching switch to detector arm; remove switch (Ref. Fig. 401).

B. Installation

(1) Position switch on bottom of detector arm and install switch mounting screws, washers and nuts.

(2) Connect switch wires to terminal module. (Check tags on removed switch for wire connection.)



R Pitch Control Cable Breakage Detector Switch - Removal and
R Installation
R Figure 401

R EFFECTIVITY: ALL
R
D018

R (3) Check switch adjustment as follows:

R (a) Position a 0.060-inch shim between the detector
R arms and squeeze the cables together so that the
R detector arm stops contact the shim.

R (b) With detector arm stops contacting the shim, the
R switch should just actuate. If not, loosen screws
R holding switch actuation clip to arm and adjust
R clip as required. Tighten clip screws.

R (4) Perform Operational Test (Ref. 27-41-32, Adjustment and
R Test). [Perform only steps necessary to check either
R left (Captains) cable breakage detector or right (First
R Officers) cable breakage detector.]

R (5) Inspect ceiling area for tools and equipment. Install
R ceiling access panel.

STABILIZER SERVO STATIC CAVITY RELIEF VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

   Container - 1 gallon

2. Referenced Procedures

   6-40-00 Exterior Access Doors and Panels

   29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

   WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal (Ref. Fig. 401)

   (1) Open associated access door (Ref. 6-40-00).

      (a) 317AB for left stabilizer servo.

      (b) 317CB for right stabilizer servo.

   (2) Locate relief valve at the lower right side of servo (for both left or right servo)(Ref. Fig. 401).

   (3) Remove lock-wire from relief valve.

   (4) Remove relief valve from servo threaded boss by unscrewing relief valve. Use container to catch any fluid.

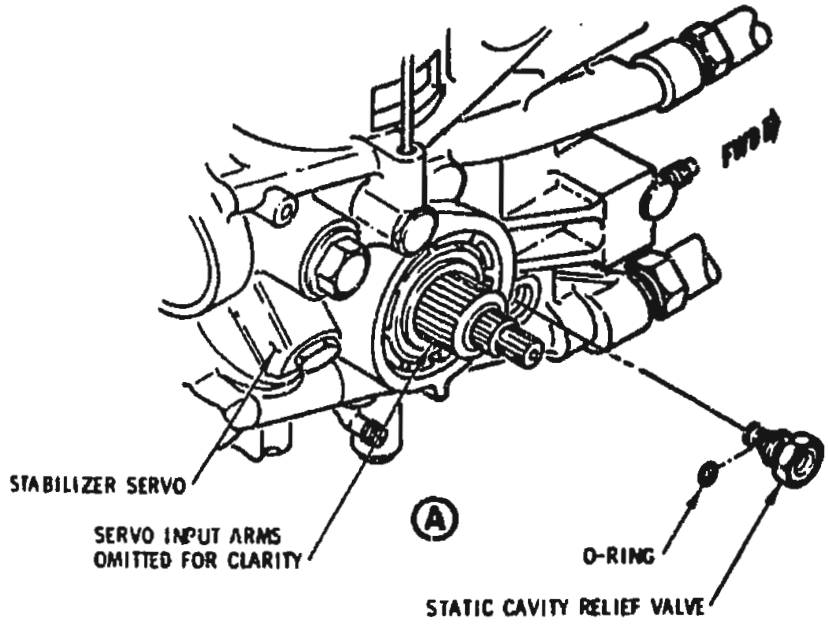
R B. Installation (Ref. Fig. 401)

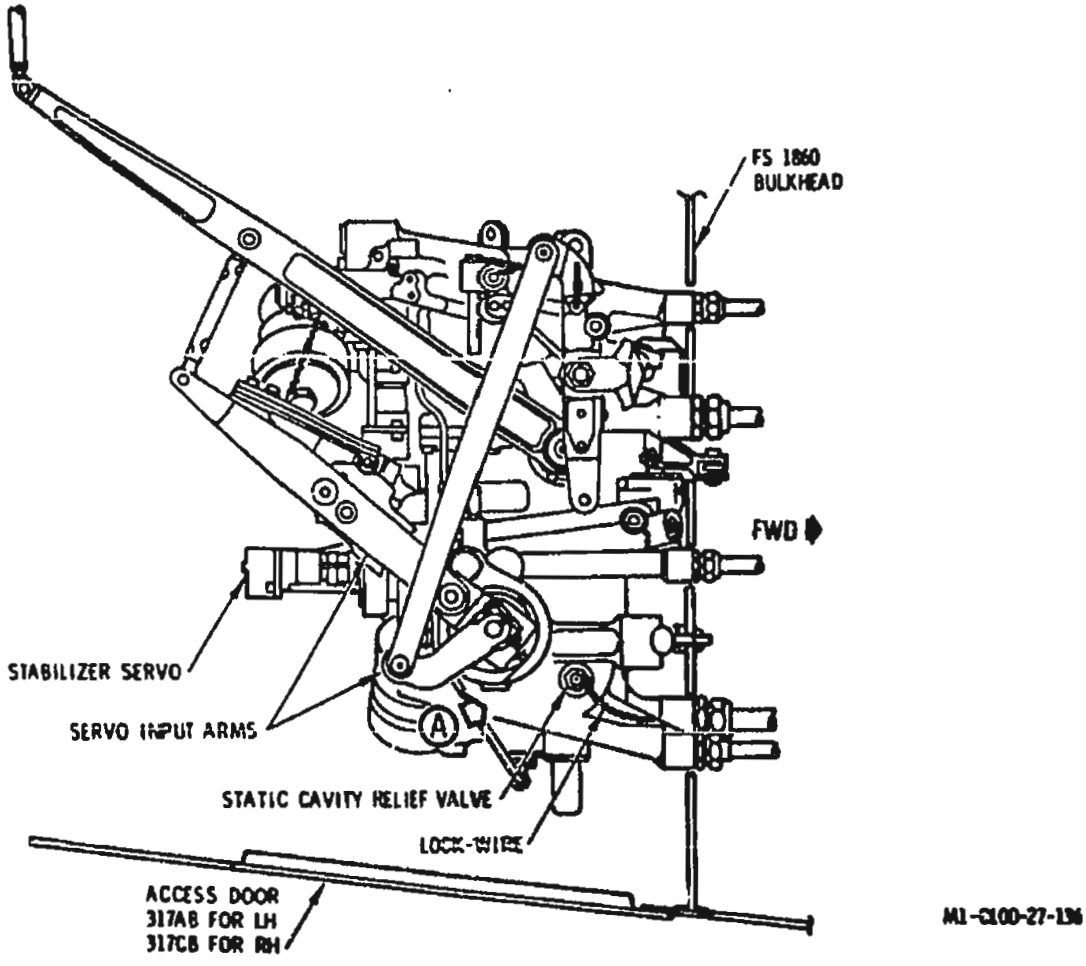
   (1) Verify that replacement relief valve has O-ring seal in place (Ref. Fig. 401).

   (2) Lubricate O-ring seal with hydraulic fluid and install relief valve in threaded boss.

   (3) Tighten relief valve 25 to 50 lb in. and lock-wire.

   (4) Remove placards from hydraulic control panels.





R R Stabilizer Servo Static Relief Valve - Removal and Installation
Figure 401

R R 001B EFFECTIVITY: ALL

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on hydraulic system (Ref. 29-11-00):

(a) System A for left servo.

(b) System D for right servo.

(6) Allow servo to be pressurized for a minimum of five minutes, then check relief valve for signs of leakage.

NOTE: Static cavity relief valve is set to relieve at 250 psi. Normal servo static cavity pressure is 75 to 100 psi. Static cavity pressure is due to internal valves lap leakage at the return ports. There should be no leakage from the relief valve under any condition. If replacement relief valve does not stop leakage from relief valve port, replace stabilizer servo as leakage is probably due to an internal high pressure seal failure.

R (7) Close access door under stabilizer servo.

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS
R DOOR (317AB, 317CB), SLOWLY CYCLE STABILIZER
R THROUGH FULL STABILIZER THROWS TO CHECK FOR
R ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND
R THE STABILIZER SERVO OPERATING LINKAGE.
R CORRECT INTERFERENCE AS REQUIRED BY TRIMMING
R BAFFLE AND/OR ASSOCIATED STIFFENER (REF.
R SB53-160).

R (8) Turn off hydraulic power (Ref. 29-11-00).

R PITCH AFT COUPLER OPEN SWITCH ASSEMBLY - REMOVAL AND INSTALLATION

R 1. General

R This procedure describes removal, installation, adjustment and
R test of the Aft Pitch Coupler Open Switch.

R 2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	24-41-00	External Power/Ground Service Systems - Maintenance Practices
R	27-41-00	Horizontal Stabilizer Control System - Fault Isolation
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Removal/Installation

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC
R SERVICE PANEL, ZONE 147.

R A. Removal (Ref. Fig. 401)

R (1) On Pilots overhead circuit breaker panel CB1, zone 210,
R open and tag circuit breaker FLIGHT CONTROL SYSTEM -
R FCES - AC & AOA (B5).

R (2) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, open and tag circuit
R breaker FLIGHT STATION MISC - R AOA (F1).

R (3) Remove access panels 316 BB and 316 DB (Ref. 6-40-00).

R (4) Disconnect four wires from terminal strip TB3 located
R on left side of coupler assembly.

R (5) Remove two screws and two bolts holding switch assembly
R and remove switch assembly.

R B. Installation (Ref. Fig. 401)

R (1) Verify hydraulic power is off and hydraulic panels are
R tagged.

R (2) Verify circuit breakers opened in Step A(1) are open
R and tagged.

R (3) Install the switch assembly with two bolts and two
R screws.

R (4) Connect the four wires to terminal strip TB3 located on
R left side of coupler assembly. Refer to wiring
R schematic in Figure 401.

R C. Adjustment and Operational Test

R NOTE: Recheck Adjustment of switch, then refer to
R Horizontal Stabilizer Control System - Fault
R Isolation (27-41-00) Figure 110.

R (1) With coupler actuators in the retracted position,
R adjust gap between roller on arms of each switch
R assembly and bottom of coupler to 0.040 ± 0.030 inch
R (Ref. Fig. 401).

R (2) On Pilots overhead circuit breaker panel CB1, zone 210,
R verify the following circuit breakers are closed:

R FLIGHT CONTROL SYSTEM - NO. 2 AFT COUPLER (B27)

R FLIGHT CONTROL SYSTEM - FCES - DC (B4)

R FLIGHT CONTROL SYSTEM - FCES - AC & AOA (B5)

R (3) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, verify the following
R circuit breakers are closed:

R FLIGHT STATION MISC - R AOA (F1)

R STABILIZER SERVO LB (H16)

R STABILIZER SERVO RC (H17)

R STABILIZER SERVO LA (H18)

R STABILIZER SERVO RD (H19)

R (4) On Flight Engineer/Second Officers aft circuit breaker
R panel CB3, zone 215, verify the following circuit
R breaker is closed:

R IND LT - PFCS/DH (G8)

R (5) Turn on electrical power (Ref. 24-41-00).

R (6) On Pilots overhead circuit breaker panel CB1, open circuit breaker FLIGHT CONTROL SYSTEM - NO. 1 AFT COUPLER (B9).

R (7) Release (out) STABILIZER A and B switchlights on the PFCS overhead panel. Verify the AFT CPLR OPEN light on the PFCS panel comes on.

R (8) Depress (in) STABILIZER A and B switchlights on the PFCS overhead panel. Verify the AFT CPLR OPEN light on the PFCS panel goes out.

R (9) On Pilots overhead circuit breaker panel CB1, close circuit breaker FLIGHT CONTROL SYSTEM - NO. 1 AFT COUPLER (B9). Open circuit breaker FLIGHT CONTROL SYSTEM - NO. 2 AFT COUPLER (B27).

R (10) Release (out) STABILIZER A and B switchlights on the PFCS overhead panel. Verify the AFT CPLR OPEN light on the PFCS panel comes on.

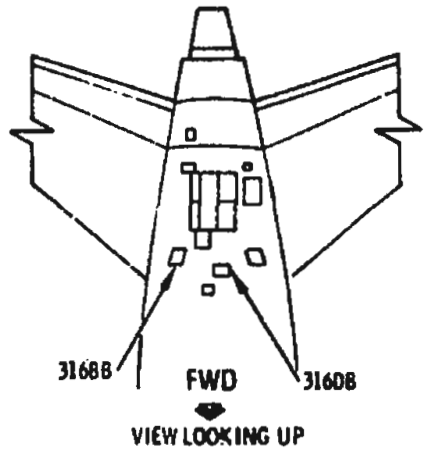
R (11) Depress (in) STABILIZER A and B switchlights on the PFCS overhead panel. Verify the AFT CPLR OPEN light on the PFCS panel goes out.

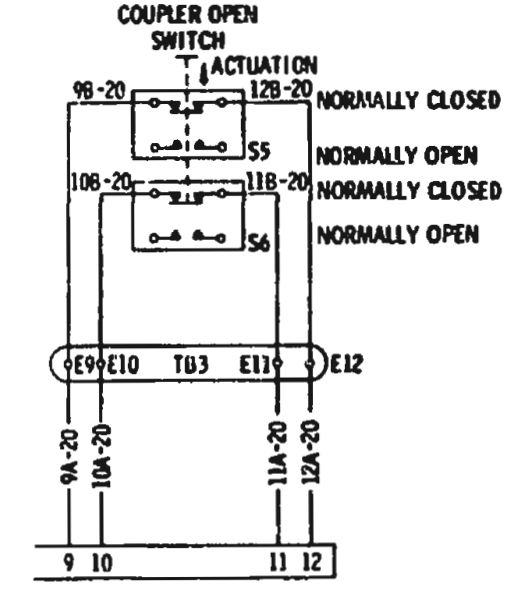
R (12) On the Pilots overhead circuit breaker panel CB1, close circuit breaker FLIGHT CONTROL SYSTEM - NO. 2 AFT COUPLER (B27).

R (13) Reinstall access panels 316BB and 316DB to aft fuselage.

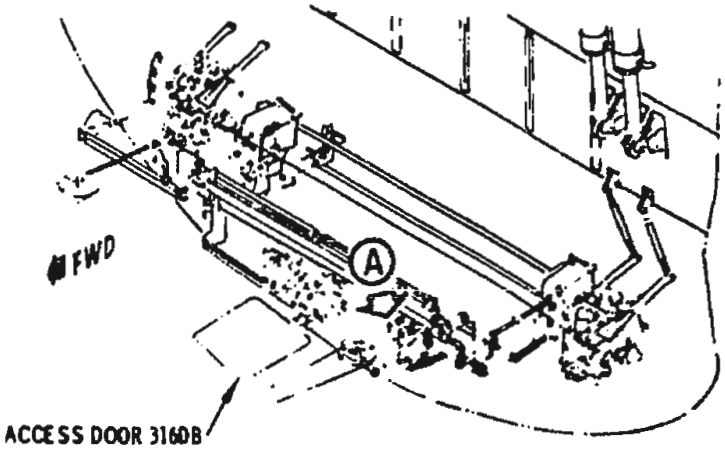
R (14) Shut off electrical power if no longer required (Ref. 24-41-00).

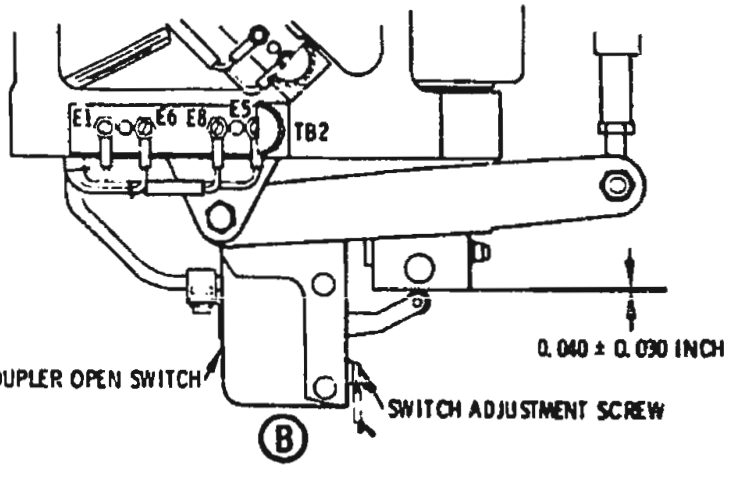
R (15) Remove tags from hydraulic control panels.

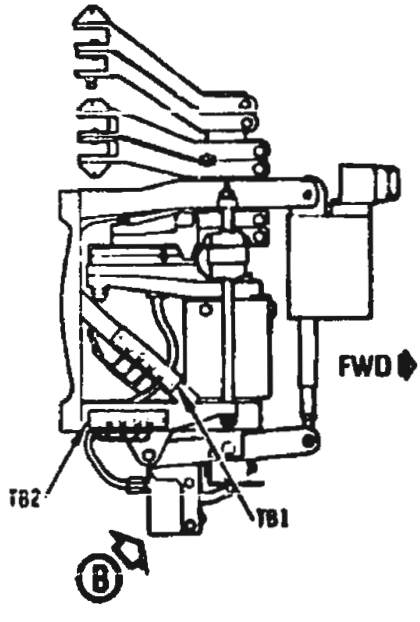




PITCH AFT COUPLER WIRING SCHEMATIC







RIGHT SIDE OF AFT COUPLER
A

M1-0000-27-000

R Pitch Aft Coupler Coupler Open Switch - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

PITCH CONTROL SERIES TRIM TORQUE TUBE ASSEMBLY REMOVAL AND INSTALLATION

1. General

This procedure contains instructions for the removal and installation of the series trim torque tube assembly and references Maintenance Manual 27-41-00 and 27-42-00 Adjustment and Test procedures for control rod adjustment and operational check.

2. Equipment and Materials

Control Column Lock, PN BA80-101,or equivalent

Cotter pin, MS24665-149

Cotter pin, MS24665-153

Cotter pin, MS24665-302

Cotter pin, MS24665-308

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
27-42-00	Horizontal Stabilizer Trim Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE OFF (REF. 29-11-00) AND FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147, ARE TAGGED AGAINST OPERATION PRIOR TO DISCONNECTING THE PITCH CONTROL SYSTEM.

R (1) Verify all four hydraulic systems are off (Ref. 29-11-00). Tag Flight Engineer/Second Officers hydraulic system panel and hydraulic service panel in hydraulic service center against operation.

R (2) Install control column and trim wheel lock.

R (3) Gain access to the afterbody through the following access panels; 316BB, 316DB and 317CB (Ref. 6-40-00).

R (4) Disconnect summing beam output rod from summing beam (Ref. Fig. 401).

R NOTE: Do not completely remove any control rod. It is necessary only to detach one end of each rod from the components as indicated.

R (5) Disconnect autopilot summing beam rod from summing beam (Ref. Fig. 401).

R (6) Disconnect the two summing beam output rods from summing beam.

R NOTE: Reposition summing beam as required for following steps.

R (7) Disconnect series trim bar from series trim torque tube assembly. Shift bar forward or aft to clear yoke of torque tube.

R (8) Disconnect the two autopilot trim rods from bottom bellcrank of series trim torque assembly.

R (9) Disconnect the two feel unit output rods from middle of series trim torque tube assembly.

R (10) Remove series trim torque tube assembly mounting bolt.

R (11) Remove bushings from upper and lower series trim torque tube assembly mounts and remove series trim torque tube assembly. Tag bushings to indicate the location (upper or lower) they were removed from.

R NOTE: Upper and lower bushings are not interchangeable.

R B. Installation

R WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE OFF (REF. 29-11-00) AND FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147, ARE TAGGED AGAINST OPERATION PRIOR TO DISCONNECTING THE PITCH CONTROL SYSTEM.

R (1) Verify all four hydraulic systems are off (Ref. 29-11-00). Verify Flight Engineer/Second Officers hydraulic system panel and hydraulic service panel in hydraulic service center is tagged against operation.

R (2) Verify control column and trim wheel lock is installed.

R (3) Gain access to the afterbody through the following access panels; 316BB, 316DB and 317CB (Ref. 6-40-00).

R (4) Verify replacement series trim torque tube assembly includes yoke on upper end.

R CAUTION: USE EXTREME CARE WHILE POSITIONING TORQUE TUBE ASSEMBLY TO AVOID DAMAGE TO THE TORQUE TUBE ASSEMBLY OR TO ADJACENT FLIGHT CONTROL COMPONENTS.

R (5) Position series trim torque tube assembly in aircraft and install bushings. Verify upper and lower bushings are in correct locations (Ref. Fig. 401).

R NOTE: Upper and lower bushings are not interchangeable.

R (6) Install series trim torque tube assembly mounting bolt. Torque nut to 95 to 110 lb-in. and install cotter pin.

R (7) Install secondary safety flathead pin below series trim torque tube assembly mounting bolt.

R (8) Connect the two feel unit output rods to middle of series trim tube assembly. Install cotter pins.

R (9) Connect the two autopilot trim rods to bottom bellcrank of series trim torque tube assembly. Install cotter pin.

R (10) Install secondary safety cotter pins above and below autopilot trim rod attach bolt.

R NOTE: Flathead pins may have been previously installed as secondary safety in these and similar locations.

R (11) Connect series trim bar to series trim torque tube assembly with bushing, spacer, bolt, washer and nut. Bolt is installed inverted. Install cotter pin.

R (12) Install secondary safety cotter pins above and below autopilot trim rod attach bolt.

R (13) Connect the two summing beam forward output rods to summing beam. Install cotter pin.

R (14) Install secondary safety cotter pins at both ends of summing beam output rod attach bolt.

R (15) Connect autopilot summing beam rod to summing beam. Install cotter pin.

R (16) Install secondary safety cotter pins at both ends of autopilot summing beam rod attach bolt.

R (17) Connect summing beam aft output rod to summing beam. Install cotter pin.

R (18) Perform control rod adjustment and operational check of system, Ref. Paragraphs 5 and 6.

R (19) Install access panels 316BB, 316DB and 317CB (Ref. 6-40-00).

R 5. Control Rod Adjustment

R A. Adjustment

R (1) Perform Steps 5D(1) through 5D(12) in Maintenance Manual 27-41-00 Adjustment and Test.

R (2) Remove all rig pins installed in Maintenance Manual 27-41-00 Adjustment and Test Steps 5D(1) through 5D(12).

R (3) Connect dual pushrods to right and left servo input bellcranks. Pushrods were disconnected in Maintenance Manual 27-41-00 Adjustment and Test Steps 5D(4) and 5D(5).

R 6. Operational Check

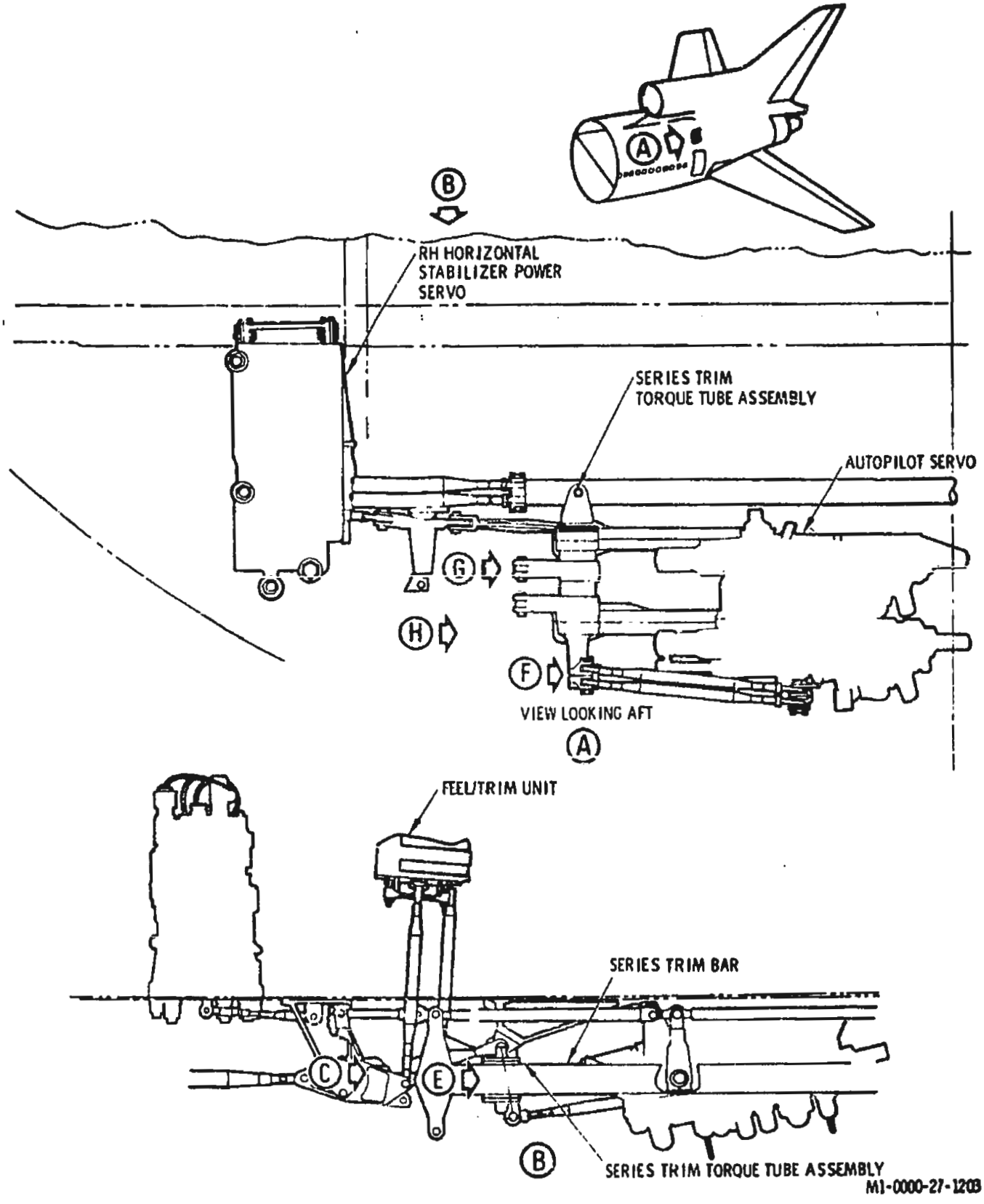
R A. Check

R (1) Remove control column and trim wheel lock.

R (2) Remove warning tags on Flight Engineer/Second Officers
R Hydraulic System Panel and Hydraulic Service Panel.

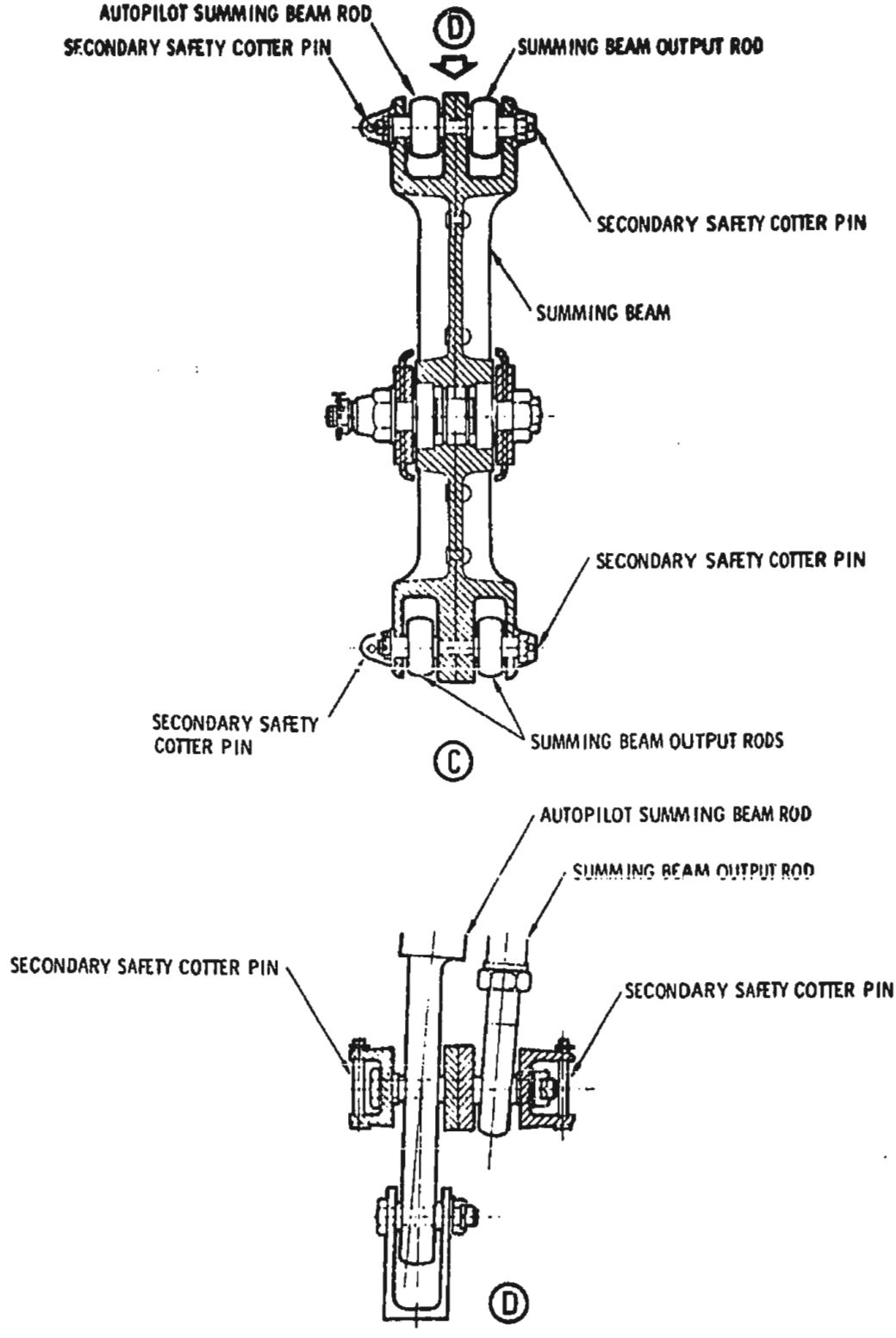
R (3) Perform Horizontal Stabilizer Trim Control System
R Oerational Test, Maintenance Manual 27-42-00 Adjustment
R and Test Paragraph 4A.

R (4) Perform Horizontal Stabilizer Control System Test,
R Maintenance Manual 27-41-00 Adjustment and Test
R Paragraph 4A.



R Pitch Control Series Trim Torque Tube Assembly - Removal and
R Installation
R Figure 401 (Sheet 1)

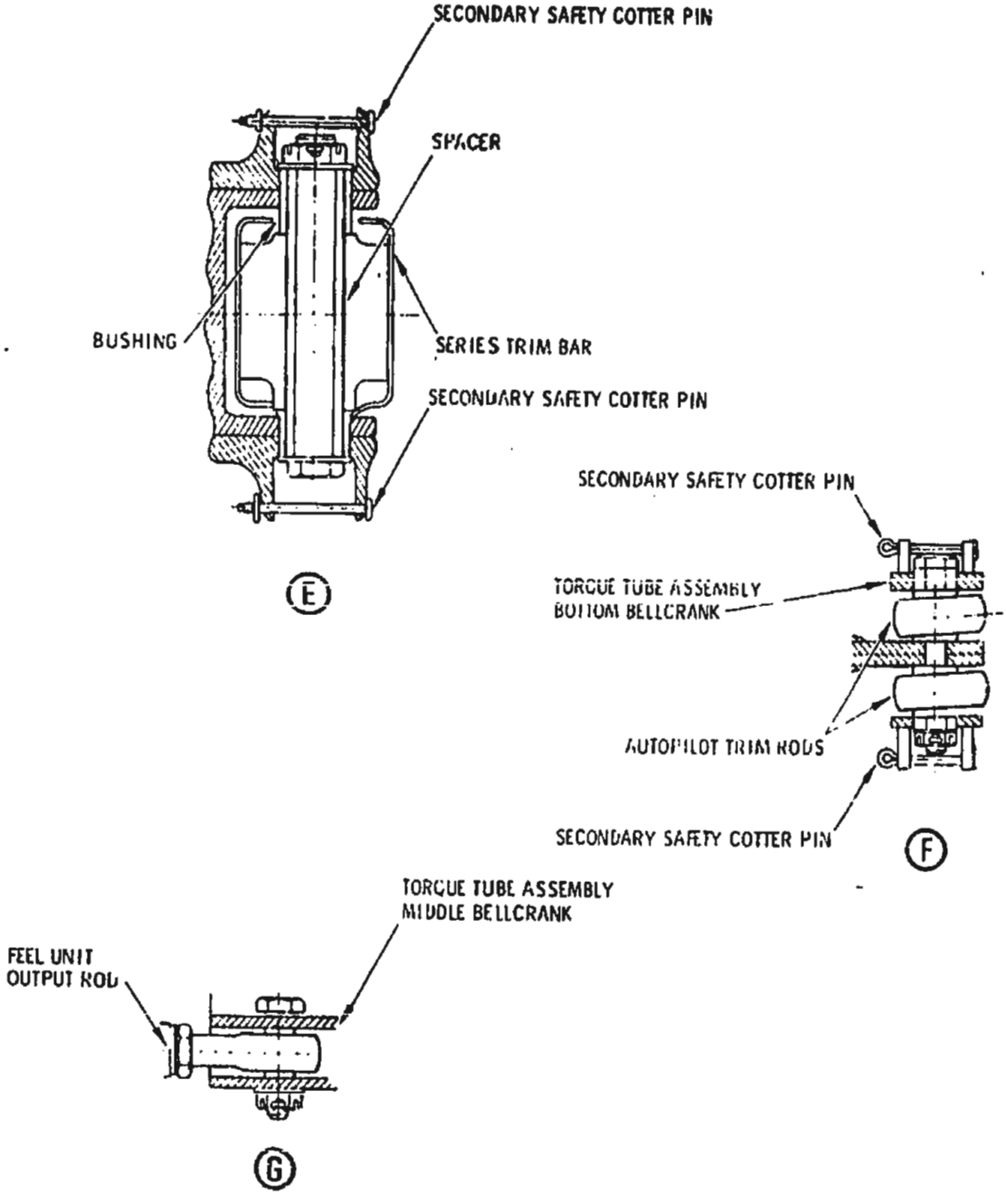
R EFFECTIVITY: ALL
R
001B



M1-0000-27-1204

R Pitch Control Series Trim Torque Tube Assembly - Removal and
R Installation
R Figure 401 (Sheet 2)

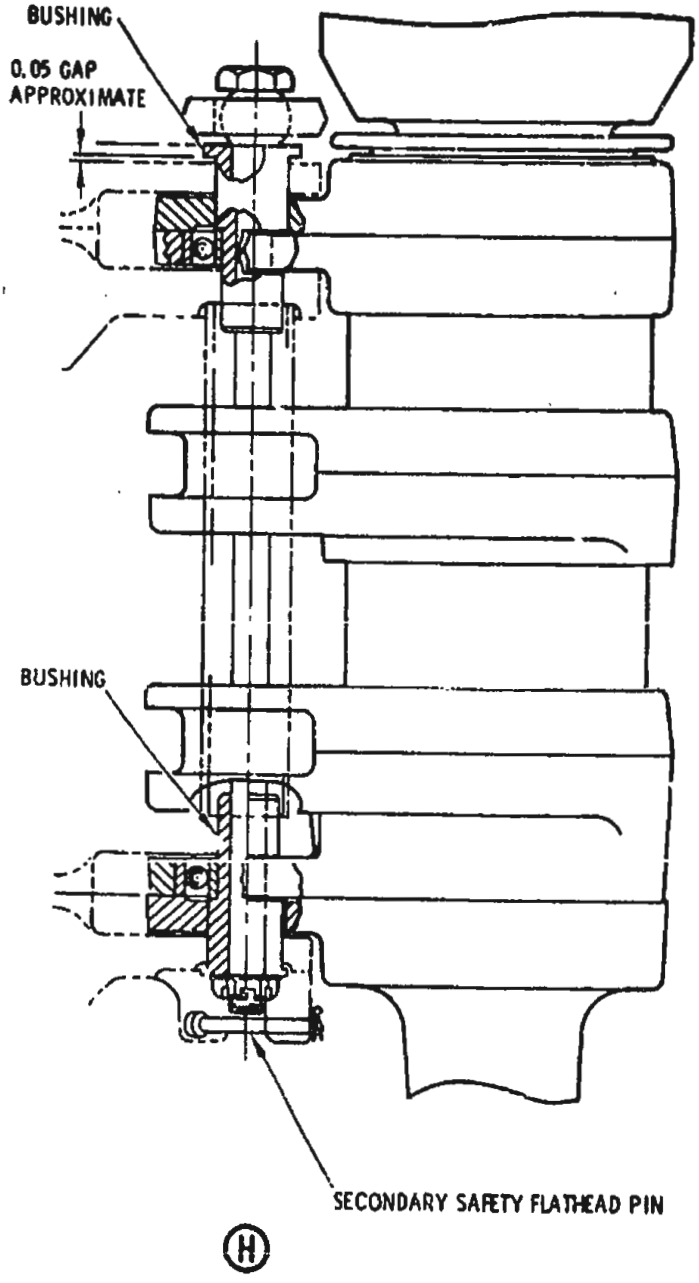
R EFFECTIVITY: ALL



MI-0000-27-1205

R Pitch Control Series Trim Torque Tube Assembly - Removal and
R Installation
R Figure 401 (Sheet 3)

R EFFECTIVITY: ALL



M1-0000-27-1206

R Pitch Control Series Trim Torque Tube Assembly - Removal and
R Installation
R Figure 401 (Sheet 4)

R EFFECTIVITY: ALL
R
001B

R CONTROL COLUMN SUPPORT BEARING
R REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Environmental sealant C-40-769 Type I or II, or equivalent

R Environmental sealant LCM40-2180 or equivalent

R Solvent - Trichloroethane MIL-T-81533 1,1,1 or equivalent

R Rawhide mallet

R Clean lint free cotton cloth

R Rubber gloves

R 2. Referenced Procedures

R	27-41-01	Control Column Assembly - Removal and Installation
R	27-41-03	Pitch Disconnect Mechanism - Removal and Installation

R 3. Removal/Installation

R A. Removal

R (1) Remove control column assembly (Ref. 27-41-01).

R (2) Remove pitch disconnect mechanism (Ref. 27-41-03).

R (3) At First Officers position, remove four bolts, nuts, washers and roll control rod clip from torque tube and adapter.

R (4) At captains position, remove four bolts, nuts, and washers from torque tube and adapter.

R (5) Gently withdraw torque tube from control column bearing retainer and adapter.

R (6) Remove six screws, nuts, and washers securing control column bearing retainer to control column support structure. Remove retainer.

(7) Push adapter inboard to separate control column support bearing from control column support.

NOTE: Tapping flange of adapter with a rawhide mallet may be required to help break sealant.

(8) Slide bearing off of adapter, remove adapter.

NOTE: Tapping around the periphery of bearing may be required to break sealant.

R B. Installation

WARNING: PROVIDE ADEQUATE VENTILATION WHEN USING SOLVENTS. DO NOT INHALE VAPORS. USE RUBBER GLOVES, AVOID CONTACT WITH SKIN, EYES, AND MUCUS MEMBRANES. KEEP AWAY FROM HEAT, SPARKS, OPEN FLAME AND OTHER IGNITION SOURCES.

(1) Clean bearing seat of control column support and adapter with solvent. Clean mating surfaces of control column support and bearing retainer with solvent. Ensure all resideual sealant is removed. Wipe dry with lint free cotton cloth.

(2) Apply environmental sealant LCM40-2180, or equivalent, to bearing recess in the control column support.

(3) Install bearing in bearing recess of the control column support.

(4) Install bearing retainer on control control column support and secure with six screws, nuts and washers.

(5) Apply environmental sealant LCM40-2180, or equivalent, to bearing surface of the adapter.

(6) Insert adapter through control column support bearing and ensure it is firmly seated.

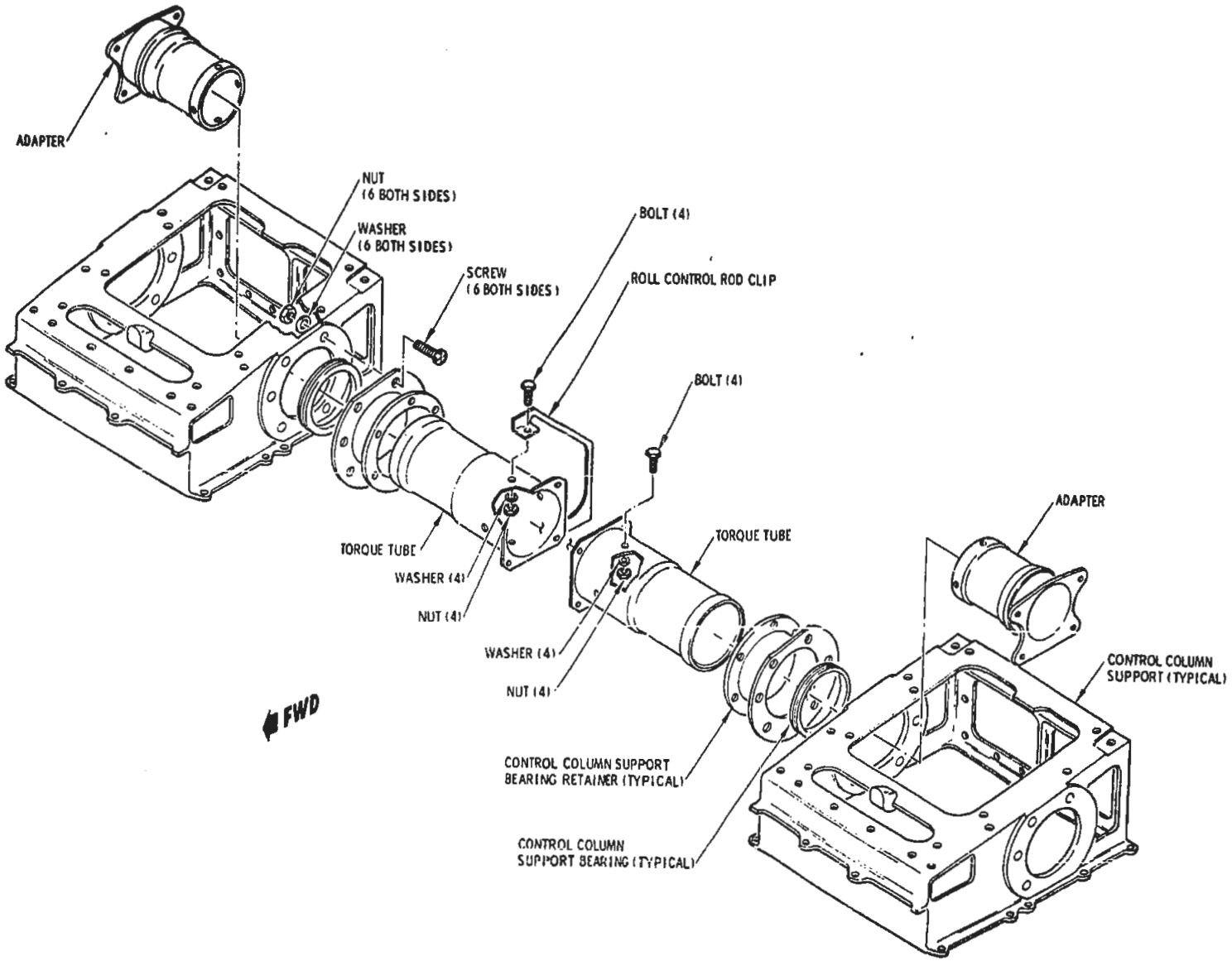
(7) Slide torque tube over adapter and into the bearing retainer.

(8) At First Officers position, properly align bolt holes in torque tube and adapter. Position roll control rod clip on torque tube. Install and tighten four bolts, nuts, and washers to a torque of 60-65 lb-in.

(9) At captains position, properly align bolt holes in torque tube and adapter. Install and tighten four bolts, nuts, and washers to a torque of 60-65 lb-in. Tighten two side bolts to a torque of 110-125 lb-in.

R (10) Install pitch disconnect mechanism (Ref. 27-41-03).

R (11) Install control column assembly (Ref. 27-41-01).



M1-0000-27-1231

R Control Column Support Bearing
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

HORIZONTAL STABILIZER TRIM CONTROL SYSTEM DESCRIPTION AND OPERATION

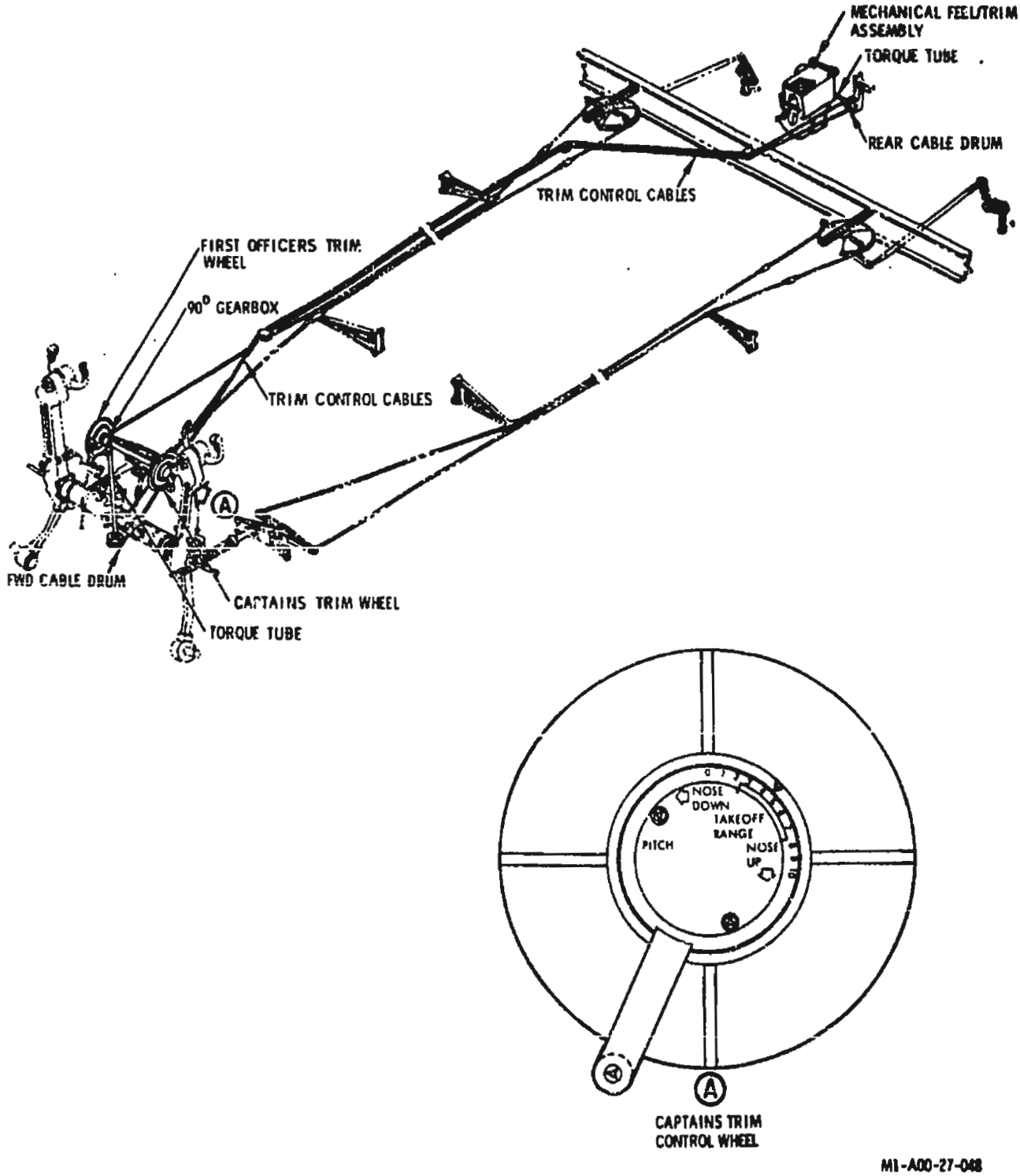
1. General

The horizontal stabilizer trim control system allows the pilot to manually or electrically trim the position of the stabilizer. Manual trim inputs are applied by conventional flight station trim wheels. Electrical trim inputs are applied by thumbwheel controls on the control wheels, and automatic signals from the Trim Augmentation Computer. In all cases, the trim forces are applied, through feel springs, into the control column to stabilizer servo linkage system (Ref. Fig. 1). These trim inputs are applied to the stabilizer servo control valves which
R results in stabilizer movement. Electrical trim input results
R in movement of manual trim control wheel. Both manual and
R electric trim input can position feel/trim assembly, trim wheel
R and move the stabilizer from zero to ten degrees nose up trim.
R Trim position is indicated by arrow on manual trim control
R wheel.

The trim system is divided into two subsystems: the mechanical trim and the electrical trim. The mechanical trim actuator is combined with a feel unit into one assembly; the electrical and autopilot trim motors are combined with a feel unit into a second assembly. Both assemblies are located in the afterbody area (Ref. Fig. 1). The mechanical feel/trim assembly (Ref. 27-41-00) is mounted just inboard of the right stabilizer servo module; the electrical feel/trim assembly (Ref. 27-41-00) is mounted just inboard of the left stabilizer servo module.

2. Operation

Manual trim is accomplished by rotating a pitch trim wheel mounted on each side of the center console (Ref. Fig. 1). The trim wheels are interconnected by a torque tube at a 90 degree gearbox integral with the First Officers control wheel assembly. A torque shaft, with a splined universal coupling on each end, couples the output of the gearbox to a cable drum located
R beneath the flight station floor. A 3/32-inch cable system extends from the forward cable drum through openings in the cabin floor beams, to a similar cable drum located just inboard of the mechanical feel/trim assembly in the afterbody. A short torque tube, with a splined universal coupling on both ends, connects the cable drum to the input shaft on the mechanical feel/trim assembly. Rotation of the input shaft operates three parallel acting jackscrew actuators in the feel/trim assembly.



Stabilizer Trim Control System
Figure 1

The pitch trim output from the mechanical feel/trim assembly is applied through two linkage systems to produce a parallel and series trim output. One jackscrew actuator output (parallel) is applied to the internal feel spring mechanism. The two other jackscrew actuator outputs (series) are applied directly to the First Officers stabilizer servo control linkage.

The parallel trim output is applied through the feel spring to shift the neutral force position of the pilots stabilizer servo control linkage, which results in stabilizer movement. The series trim output is applied directly to the stabilizer servo control linkage system. The effect of series trim is to reduce the control column travel range due to trim, and results in the control column always being in a comfortable position for the pilot even at the extreme trim position.

The left and right feel/trim assemblies are coupled by a trim synchronizing torque tube (Ref. Fig. 1). This torque tube couples the output of the mechanical trim in the right feel/trim assembly with the output of the electrical trim in the left feel/trim assembly. Thus, both feel/trim assemblies are applying identical trim forces into their respective feel springs.

The electrical feel/trim assembly contains a ball detent clutch mechanism. The clutch is installed between the jackscrew actuator and the electrical trim motors gear train. This clutch allows manual inputs from the mechanical feel/trim assembly to drive the jackscrew actuator of the electrical feel/trim assembly without backdriving the gear train.

Electrical trim of the stabilizer is accomplished by four electric motors mounted on the left feel/trim assembly. Two motors supply electric or autopilot trim, and two motors supply mach tirm. The two electric/autopilot trim motors can be operated by thumbwheel controllers on the control wheels or, when the autopilot is engaged, from the Pitch Trim System (Ref. 22-18-00). These two motors operate in parallel and either motor provides full electric or autopilot trim capability.

The pilot operated thumbwheel controller is mounted on the outboard grip of both control wheels. The thumbwheel operates a miniature rate generator which produces an output voltage that is proportional to the thumbwheel rotation rate. The output of the electric/autopilot trim motors is applied to the feel spring of the left feel/trim assembly, and through the trim synchronizing torque tube, to the feel spring of the right feel/trim assembly. The feel spring force is then applied to both stabilizer servo linkage system to reposition the stabilizer to the trim position. When the autopilot is engaged, the thumbwheel control circuits are disabled and the trim motors are controlled from the Auto Trim System.

The Mach trim motors are provided to improve the longitudinal stability in the 0.55 to 0.925 Mach speed range by compensating for a nose down pitching moment. This pitching moment is produced by a rearward movement of the wing center of lift as aircraft speed increases. The system receives electrical signals from the Trim Augmentation Computer (Ref. 22-18-00). The output of the Mach trim motors is mechanically summed with the manual electric/autopilot trim outputs. Mach trim output is applied to the feel springs of both feel/trim assemblies and to both stabilizer servo linkage system in the same way that manual electric/autopilot trim outputs are applied.

In addition to the four electrical trim motors on the left feel/trim assembly, there are two Mach schedule motors mounted on the assembly that are coupled to the feel mechanism. These two motors operate in parallel and effect the mechanical advantage ratio between the feel system inputs and the feel spring. The feel spring rate is scheduled as a function of mach number, and is designed to produce optimum control column forces over the entire aircraft speed spectrum. The effect of this system is to stiffen the feel spring as aircraft speed increases.

The output of the dual Mach schedule motors is also applied to the feel mechanism of the mechanical feel/trim unit through the Mach schedule coupler torque shaft. Thus, both feel/trim assemblies receive identical Mach schedule commands. These commands are generated by the Trim Augmentation Computer (Ref. 22-18-00, Speed-Attitude Correction System)

Primary stops for the pitch trim system are in the feel/trim assemblies and the secondary stop is the First Officers pitch trim control assembly.

R ELECTRIC PITCH TRIM THUMBWHEEL SYSTEM - MAINTENANCE PRACTICES

R 1. General

R The Pitch Trim Control Wheel on the Captain and First Officer
R control wheel assemblies provides a convenient means of
R electrically adjusting the horizontal stabilizer from
R approximately 0.5 degrees down to 12 degrees up.

R This procedure is involved with the deactivation of an
R inoperative First Officer Pitch Trim Control Wheel and the
R operational verification of the Captain Pitch Trim Control
R Wheel.

R 2. Referenced Procedures

R 24-41-00 External Power/Ground Service System - Maintenance
R Practices

R 29-11-00 Hydraulic Power Systems - Maintenance Practices

R 3. Deactivation/Verification Procedure

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

R A. Deactivation of First Officer Pitch Trim Control Wheel -
R Electrical

R (1) Cut and trim a piece of pressure sensitive tape to a
R size where the tape will completely cover the First
R Officer Pitch Trim Control Wheel and overlap
R approximately 1/4-inch. Re-trim the tape as required
R to prevent interference with the autopilot Disconnect
R switch.

R (2) Install placard in a prominent place on the First
R Officer instrument panel, F/O PITCH TRIM CONTROL
R WHEEL-ELECTRICAL-INOP.

R (3) Make appropriate entry in the aircraft log book.

R B. Verification of Captain Pitch Trim Control Wheel -
R Electrical Operational Status

R (1) Apply electrical power, reference Maintenance Manual
R 24-41-00.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM.

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (2) Apply hydraulic power, reference Maintenance Manual
R 29-11-00.

R (3) Actuate the Captain Electrical Pitch Trim Control Wheel
R throughout the entire range while observing the
R following:

R (a) Surface Position Indicator STAB pointer follows
R the Captain Electrical Pitch Trim Control Wheel
R input.

R (b) Mechanical Pitch Trim Control Wheels on left and
R right side of the center console follow the
R Captain Electrical Pitch Trim Control Wheel input.

R (c) Adjust the Captain Electrical Pitch Trim Control
R Wheel for a Surface Position Indicator readout of
R 0.5 degree nose down trim.

R (d) Turn off hydraulic power, reference Maintenance
R Manual 29-11-00.

R (e) Turn off electrical power, reference Maintenance
R Manual 24-41-00.

HORIZONTAL STABILIZER TRIM CONTROL SYSTEM - ADJUSTMENT AND TEST

1. General

These procedures must be used to perform an operational test (Ref. Para. 4), a rigging check and adjustment (Ref. Para. 5), and a functional test (Ref. Para. 6) of the horizontal stabilizer trim control system.

The pitch trim system primary stops are in the pitch feel/trim assemblies in the afterbody, and the secondary stop is the First Officers pitch trim control assembly.

R The maximum allowable pitch trim wheel rotational play between
R Captain and First Officers pitch trim wheels is 1/4 inch
R measured at wheel rim.

2. Equipment and Materials

Cable Tensiometer, Pacific Scientific PN T5-2002-101-00, or equivalent

Rig pins, 5/16-inch-diameter by 3 inches long (part of B734 rig pin kit)

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Operational Test

A. Horizontal Stabilizer Trim Control System

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breaker SURF POS IND (J23) is closed.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that STABILIZER SERVO circuit breakers LA or LB and RC or RD (H16-H19) are closed [Ref. Step 4A(3)].

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on one hydraulic system for each stabilizer servo: system A or B and C or D (Ref. 29-11-00).

(4) Operate pitch manual trim wheel from full NOSE UP to full NOSE DOWN through two cycles. Verify that pitch trim control system operates without binding (a ratchet-type oscillation of force is normal due to the ball detent clutch in the electrical feel/trim assembly).

NOTE: Ratchet-type oscillation of force for ball detent clutch will operate after 14 to 16.3 lbs load.

(5) Starting with trim wheel at 0 degree, position either pitch trim wheel to 10 degrees NOSE UP. Verify the following:

(a) Both control columns move aft approximately 4 inches.

(b) STAB pointers on surface position indicator shows trim position selected in Step (5) above.

NOTE: Due to the control column unbalance force it may be necessary to engage A/P A or B to CMD (on APFDS panel) before checking the surface position indicator.

(6) Position either control column full aft and full forward, and release. Verify that control column returns approximately to trim (10 degree) position.

(7) Position either manual pitch trim wheel to full NOSE DOWN (0 degrees). Verify the following:

(a) Both control columns move forward approximately 4 inches from full NOSE UP position.

(b) STAB pointers on surface position indicator show approximately 0 degrees.

R NOTE: Due to the control column unbalance force
R it may be necessary to engage A/P A or B
R to CWD (on APFDS panel) before checking the
R surface position indicator.

(8) Position either control column full forward and full aft, and release. Verify that control columns return to approximately trim (0 degrees) position.

(9) Turn off hydraulic power (Ref. 29-11-00).

(10) Turn off electrical power if no longer needed (Ref. 24-41-00).

5. Rigging Check and Adjustment

A. Horizontal Stabilizer Trim Control System

(1) Open following access doors: (Ref. 6-40-00):

(a) 112AB to forward electronic service center.

(b) 317BB to aft trim cable drum in afterbody.

(2) Position pitch trim wheels so rig pin R3 fits freely through pitch trim cable drum (1) (Ref. Fig. 501). Captains and First Officers pitch trim wheels must indicate 4 degrees and indicator pointer must point to within area of blue dot (above 4 degree mark) on both wheels. If not, perform following Steps (b) and (j) to adjust Captains wheel, or Steps (a) through (k) to adjust First Officers wheel.

(a) If electrical power is on, use caution when working in center console.

(b) Remove nuts holding Captains pitch trim control to console, and pull trim control outboard to disengage from interconnect shaft. Allow trim control to hang from electrical wires.

(c) Pull interconnect shaft outboard at least 2 inches to disengage shaft from First Officers pitch trim control gearbox.

CAUTION: ON AIRCRAFT 001-014, THE INTERCONNECT SHAFT MAY HAVE ONE END WITH A LONGER SPLINE. THE LONGER SPLINE IS NORMALLY COUPLED TO THE CAPTAINS PITCH TRIM CONTROL. IF THE INTERCONNECT SHAFT IS REVERSED, THE INTERCONNECT SHAFT CAN DISENGAGE FROM CAPTAINS TRIM CONTROL. ON THE ABOVE LISTED AIRCRAFT, VERIFY THAT THE LONG SPLINE IS ENGAGED IN THE CAPTAINS TRIM CONTROL. SB27-097 INSTALLS A RIVET AND TWO WASHERS ON THE LONG SPLINE END TO ALLOW INTERCONNECT SHAFT TO BE INSTALLED EITHER WAY.

(d) Remove console right side trim panel.

(e) Remove nuts holding First Officers pitch trim control to console.

(f) Pull First Officers pitch trim control outboard to disengage from mounting studs and then upwards to disengage from pitch trim vertical shaft (3).

(g) With rig pin in pitch cable drum (1), position indicator pointer on First Officers pitch trim control wheel to 4 degrees (within area of blue dot), and then engage First Officers pitch trim control gearbox spline to vertical shaft.

(h) While maintaining engagement of vertical shaft, install First Officers pitch trim control on mounting studs and install nuts.

(i) From Captains side, push in coupling shaft to engage First Officers pitch trim control gearbox.

R (j) With Captains pitch trim control wheel set to 4 degrees (within area of blue dot) engage Captains pitch trim control to interconnect shaft and mounting studs. Install attaching nuts.

(k) Install trim panel.

(3) With rig pin R3 in pitch trim drum (1), rig pin R3 must fit freely through aft pitch trim drum (4), and the trim cable tension must conform to temperature conversion chart (Ref. Fig. 501). If not, adjust turnbuckles (5) and (6).

(4) Remove all rig pins.

(5) If a rigging adjustment is made, perform an operational test (Ref. Para. 4).

(6) Close access doors opened in Step 5A(1).

6. Functional (Friction) Test

A. Horizontal Stabilizer Trim Control System

(1) Position pitch trim to 2 degrees NOSE UP.

(2) Put armament tape with loop of safety wire on rim of either pitch trim wheel.

(3) Attach a 0-20 pound spring scale to wire loop on rim of trim wheel.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Verify electrical pitch trim system is on (Ref. 22-18-00, Fig. 101).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn one hydraulic system for each stabilizer servo (A or B and C or D) (Ref. 29-11-00).

(7) Pull on spring scale and record force required to break out ball detent clutch at 2 degrees of NOSE UP trim. Repeat test for 8 degrees of NOSE UP trim.

NOTE: Ball detent clutch break-out will be indicated by a sharp drop in spring scale force as ball detent clutch disengages and engages.

(8) Restrain spring scale and operate electrical trim thumb wheel very slowly to provide nose down trim. At 2 and

8 degrees of trim, record force on spring scale as ball detent clutch breaks out.

(9) Subtract force obtained while operating electrical trim from force obtained while operating manual trim wheel. Divide by 2. This is trim system friction. It should not exceed 5 pounds at either 2 or 8 degrees of trim.

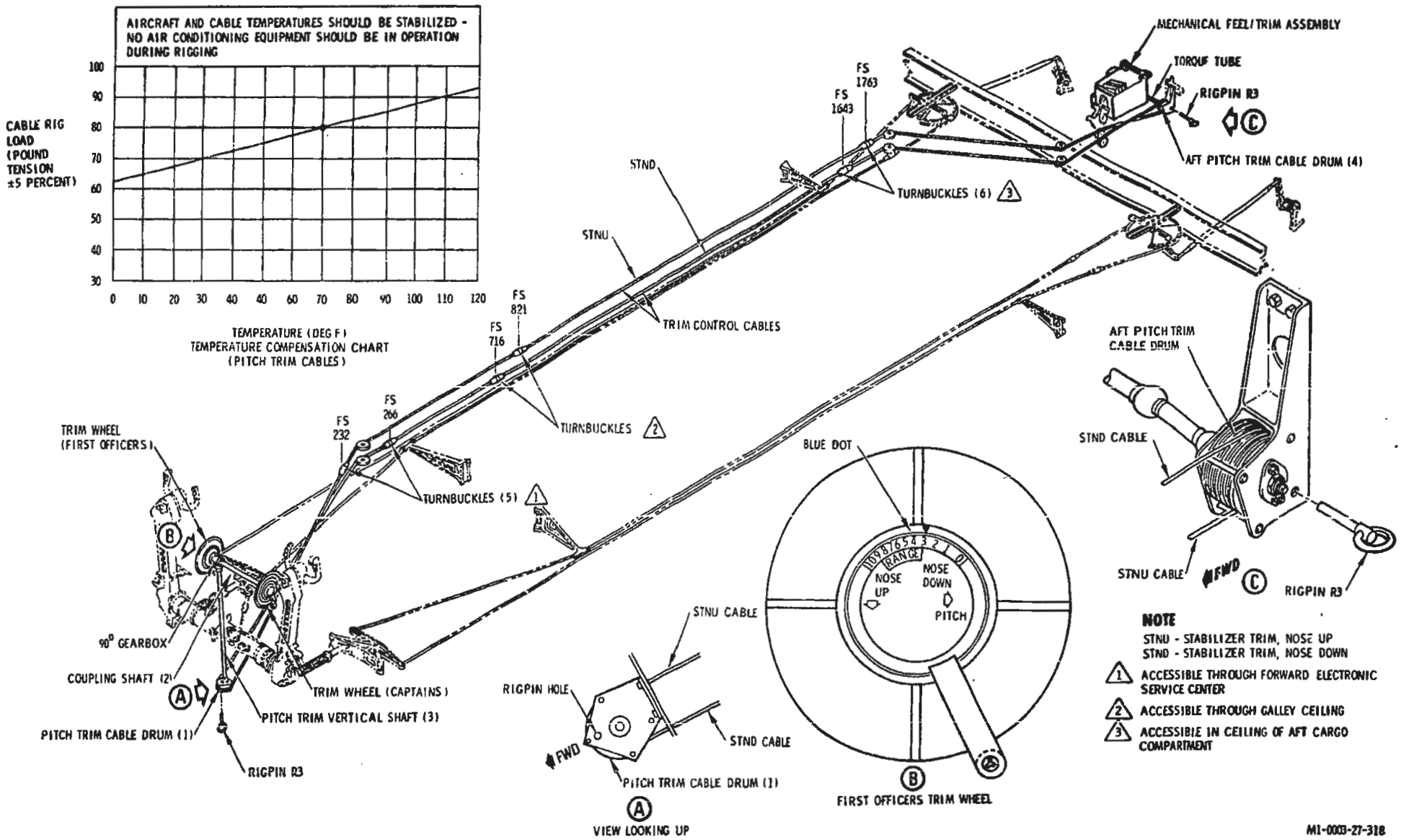
NOTE: The system friction test should also be conducted at trim settings that have been reported as jamming or binding, as well as at the 2 and 8 degree trim settings. R

(10) If trim friction is excessive, see 27-41-00 Fault Isolation, Figure 105.

(11) Remove tape and safety wire from trim wheel.

(12) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(13) Turn off electrical power if no longer required (Ref. 24-41-00).



R Horizontal Stabilizer Trim Control System
R Rigging Check and Adjustment
R Figure 501

EFFECTIVITY: ALL

001B

PITCH TRIM CONTROL (CAPTAINS) - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig Pin, 5/16-inch diameter, 3-inches long (R3)

2. Referenced Procedures

20-24-04	Electrical Bonding and Grounding Connections - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
25-13-05	Center Console Trim Covers - Removal and Installation
27-42-00	Horizontal Stabilizer Trim Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices
31-22-00	Proximity Switch System/Aural Warning System - Adjustment and Test

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R NOTE: Maximum allowable pitch trim wheel rotational play
R between Captain and First Officers pitch trim wheels is
R 1/4 inch measured at wheel rim.

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify circuit breakers THROT STAND (M5) and T/O AURAL WRNG (H7) are open and tagged.

(2) Position pitch trim wheel to 4 degrees. Install rig pin (R3) through bracket and forward pitch trim cable drum located below the flight station floor (access from forward electronic service center).

(3) Remove center console trim panel on left side (Ref. 25-13-05).

(4) Identify wires for reinstallation. Remove five wires (trim control edge lighting and aural warning switch) from throttle stand terminal module (Ref. Fig. 401).

CAUTION: REMOVE PITCH TRIM CONTROL ONLY BY METHOD PRESCRIBED; DO NOT DISASSEMBLE.

(5) Remove three nuts attaching pitch trim control to throttle stand. Move trim control outboard to disengage from mounting studs and interconnect shaft. Remove trim control.

CAUTION: INSTALL LOCK-WIRE AND TAG THROUGH HOLE IN THE PITCH TRIM CONTROL HANDWHEEL AND PITCH TRIM CONTROL MOUNTING HOLE TO PREVENT THE PITCH TRIM FROM BEING POSITIONED PAST NORMAL TRAVEL OR THE AURAL WARNING SWITCH ACTUATOR CAN BE DAMAGED.

B. Installation

(1) Verify rig pin is installed in the forward pitch trim cable drum and the First Officers pitch trim wheel pointer indicates 4 degrees (within the area of the blue dot).

(2) Remove lock-wire and tag through pitch trim handwheel and mounting plate if installed). Position Captains pitch trim wheel pointer to 4 degrees (within area of the blue dot).

CAUTION: DO NOT POSITION HANDWHEEL PAST NORMAL TRAVEL OR THE AURAL WARNING SWITCH ACTUATOR MAY BE DAMAGED.

(3) Prepare surfaces around attaching studs for electrical bonding (Ref. 20-24-04).

(4) Engage Captains trim control to interconnecting shaft spline and the three mounting studs.

(5) Verify both trim control trim settings are at 4 degrees (within area of the blue dot).

(6) Install the three trim control mounting nuts.

(7) Install the five electrical wires in throttle stand terminal module.

R (8) Remove rig pin (R3) from bracket and forward pitch trim
R cable drum located below flight station floor (access
R from forward electronic service center).

R (9) Remove tags and close circuit breakers opened in Step 3A(1).

R (10) Turn on electrical power (Ref. 24-41-00).

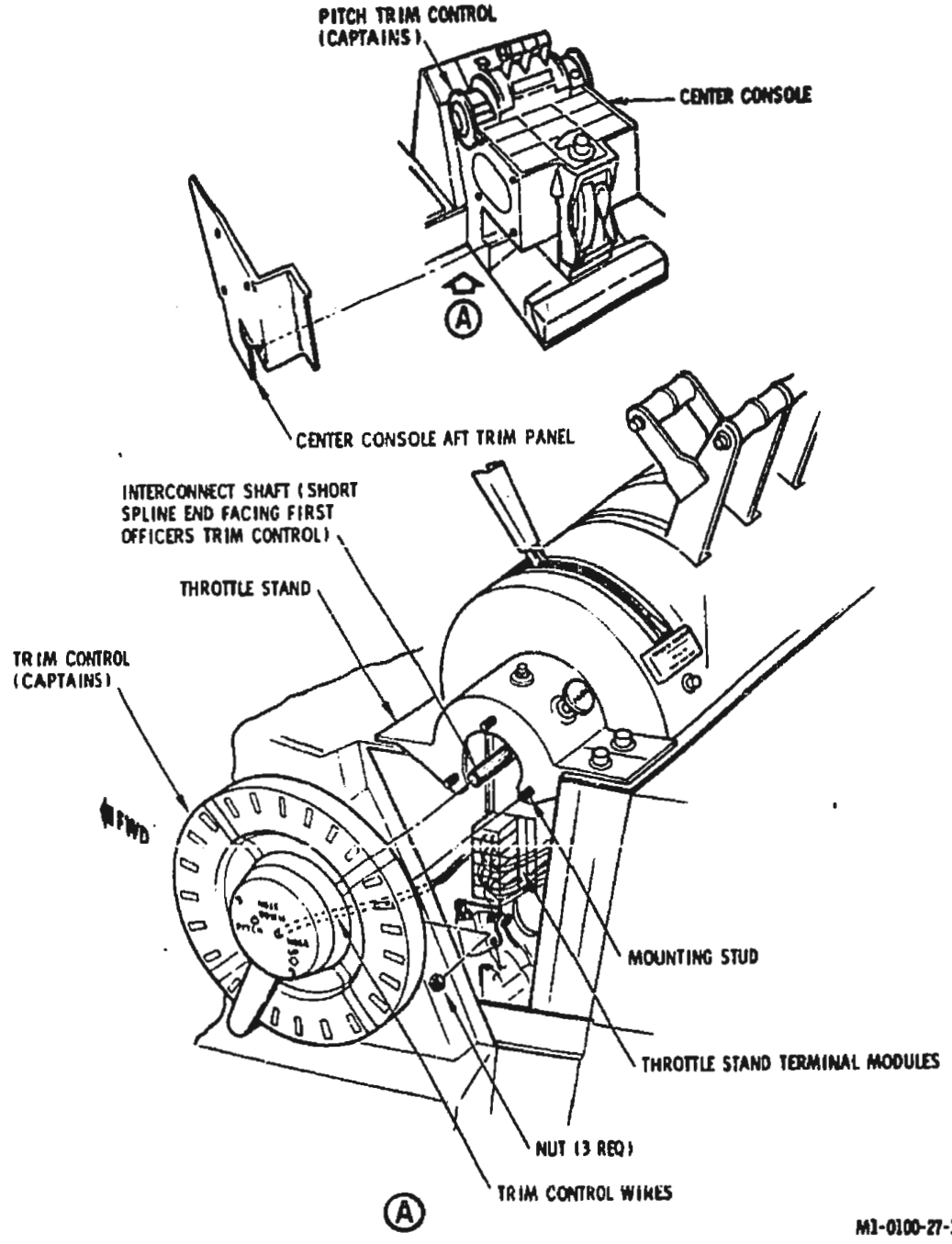
R (11) Verify trim control edge lighting is on.

R (12) Remove tags from hydraulic control panels.

R (13) Perform Horizontal Stabilizer Trim Control System Operational Test (Ref. 27-42-00).

R (14) Perform Aural Warning System Functional Test (Ref. 31-22-00). Accomplish only the Unsafe Takeoff Warning Test (Para. 6C).

R (15) Install center console trim panel.



R Captains Pitch Trim Control - Removal and Installation
R Figure 401

PITCH TRIM CONTROL (FIRST OFFICERS) - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rig pin, 5/16-inch diameter, 3 inches long (R3)

2. Referenced Procedures

20-24-04	Electrical Bonding and Grounding Connections - Maintenance Practices.
24-41-00	External Power/Ground Service System - Maintenance Practices
25-13-05	Center Console Trim Covers - Removal and Installation
27-42-00	Horizontal Stabilizer Trim Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R NOTE: Maximum allowable pitch trim wheel rotational play
R between Captain and First Officers pitch trim wheels is
R 1/4 inch measured at wheel rim.

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify circuit breaker THROT STAND (M5). is open and tagged.

(2) Position pitch trim wheel to 4 degrees. Install R3 rig pin in bracket and cable drum beneath flight station floor (access through forward electronic service center).

R (3) Remove center console trim panel on right-hand side
R (Ref. 25-13-05).

(4) Identify wires for reinstallation. Remove two wires (trim control edge lighting) from throttle stand terminal module (Ref. Fig. 401).

CAUTION: REMOVE PITCH TRIM CONTROL ONLY BY METHOD PRESCRIBED; DO NOT DISASSEMBLE.

(5) Remove three nuts attaching pitch trim control to throttle stand. Move trim control outboard to disengage from mounting studs and interconnecting shaft.

NOTE: Interconnect shaft is splined at both ends and is free floating. Disengaging interconnecting shaft will probably require reaching underneath to disengage shaft from trim control.

(6) Tilt top of trim control outboard and raise to disengage from vertical shaft. Remove trim control.

B. Installation

(1) Verify rig pin is installed in pitch trim forward cable drum.

(2) Verify Captains pitch trim wheel pointer is set at 4 degrees (within area of the blue dot located just above 4 degree number).

(3) Position First Officers pitch trim wheel pointer to 4 degrees (within area of the blue dot).

(4) Prepare surfaces around mounting studs for electrical bonding (Ref. 20-24-04).

(5) Engage replacement pitch trim control on vertical shaft, then on interconnecting shaft and mounting studs.

(6) Verify both pitch trim control pointers are still set at 4 degrees (within area of the blue dot). Install the three trim control mounting nuts.

(7) Install the two trim control electrical wires in throttle stand terminal module.

(8) Close circuit breaker opened in Step A(1).

(9) Turn on electrical power (Ref. 24-41-00).

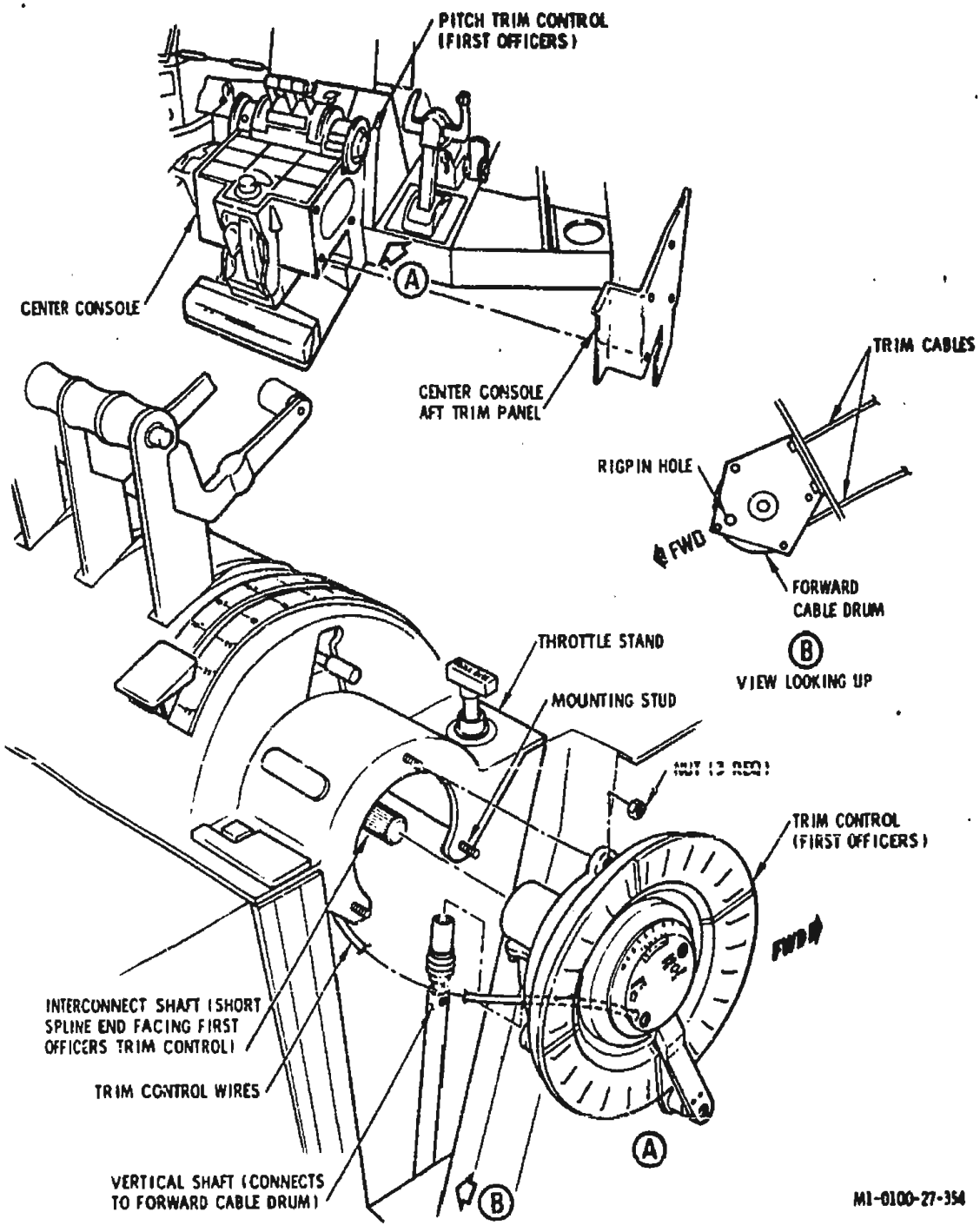
(10) Verify trim control edge lighting is on.

(11) Remove tags from hydraulic control panels.

(12) Remove rig pin from forward trim cable drum.

(13) Perform Horizontal Stabilizer Trim Control System Operational Test (Ref. 27-42-00).

(14) Install center console trim panel.



R First Officers Pitch Trim Control - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

PITCH TRIM FORWARD CABLE DRUM - REMOVAL AND INSTALLATION

1. Equipment and Materials

   Rig pin (2 each) - 5/16-inch diameter by 3 inches long (R3)

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
27-42-00	Horizontal Stabilizer Trim Control System - Adjustment and Test

3. Removal/Installation

   WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal (Ref. Fig. 401)

   (1) On pilots overhead circuit breaker panel CB1, zone 210, verify that following circuit breakers are opened and tagged: TRIM AGMT AC and DC (A7, A8, A25, and A26).

   (2) Position First Officers pitch trim wheel to 4 degrees.

   (3) Remove the center console aft trim panel on the right side of console (trim panel located just below First Officers trim control).

   (4) Open access panel 317BB on bottom of afterbody to gain access to pitch aft cable drum (Ref. 6-40-00).

   (5) Insert rig pin R3 through bracket and aft cable drum (Ref. Fig. 401).

   (6) Open access door 112AB to forward electronic service center (FESC) (Ref. 6-40-00).

   NOTE: As an aid in reinstalling trim cables, mark the openings in the floor beams with chalk through which the pitch trim cables run. (Mark the opening for left cable and right cable.)

(7) Attach bungee cables (shock cord) or apply cable clamp blocks to the pitch trim cables to prevent fouling of slack cables during trim drum removal and installation.

(8) On the right side of the FESC, disconnect pitch trim cables at the turnbuckles at FS 232 and 266.

(9) Remove the cable guard pin at FS 248 pulleys to allow the stabilizer trim nose down (STND) cable to be removed with the drum assembly.

(10) Remove four bolts attaching cable drum support to floor beam. Move drum assembly downward to disengage vertical shaft from First Officers trim control gearbox and remove drum assembly and vertical shaft.

(11) Remove vertical shaft from drum shaft by removing attaching bolt.

(12) Remove cables from drum as follows:

(a) Remove cable guard pins.

(b) Remove lock-wire on top and bottom of drum that retains cable balls in keyhole slots.

(c) Remove cables from drum.

(d) Reinstall cable guard pins.

R B. Installation (Ref. Fig. 401)

(1) Install cables on replacement drum assembly as follows:

(a) Remove cable guard pins.

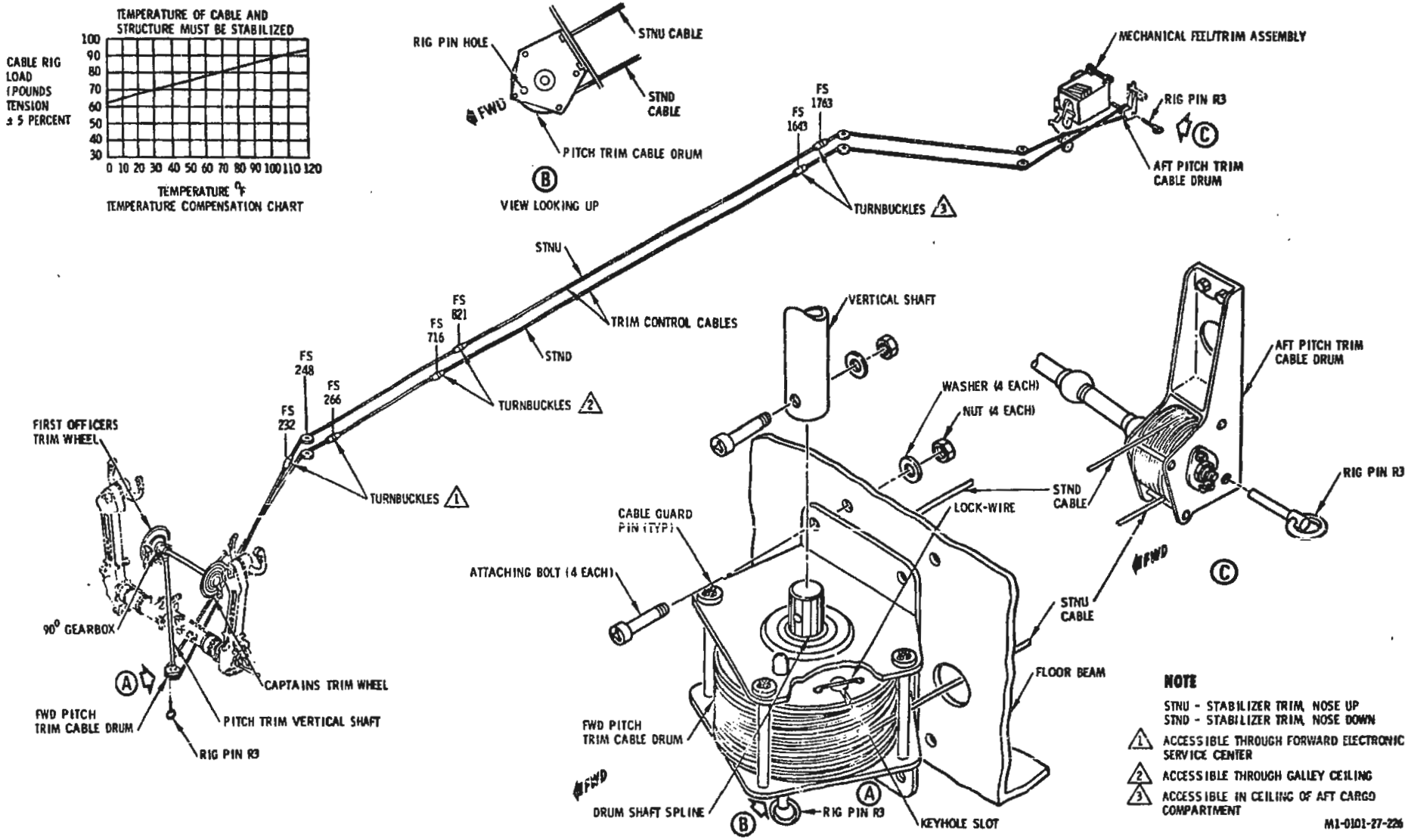
(b) Insert the ball of the longer cable (STND) in the top keyhole slot and wrap the cable around the drum 2.75 turns.

(c) Insert the ball end of the shorter cable (STNU) in the bottom keyhole slot and wrap the cable around the drum 2.75 turns.

(d) Install the cable guard pins.

(e) Install lock-wire through holes on both sides of keyhole slots to retain cable balls.

(2) Couple the universal end of the vertical shaft to the drum shaft so bolt holes are aligned. Install bolt, washer, and nut. Install cotter pin.



R Pitch Trim Forward Cable Drum - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

0018

R (3) Insert rig pin R3 through forward cable drum to lock drum in the 4-degree rig position.

R (4) Verify that First Officers pitch trim wheel is R positioned to 4 degrees.

R (5) With a man in flight station to guide and couple the R vertical shaft to the First Officers trim control R spline shaft, position drum assembly in mounted position. Install four bolts, washers, and nuts attaching drum assembly to floor beam.

R (6) Verify that First Officers pitch trim wheel is still at 4 degrees.

R (7) Carefully route trim cables through floor beam openings and connect to turnbuckles.

R (8) Tighten turnbuckles to remove all slack in trim cables.

R (9) Remove cable clamp block or bungee cables installed on R cables during removal procedure.

R (10) Install the cable guard pin at the FS 248 pulleys.

R (11) Carefully inspect cable runs from drum assembly to turnbuckles. Verify that cables are routed correctly (cables must not ride edge of openings in floor beam).

R (12) Rig pitch trim cables: With rig pin R3 in aft cable drum, adjust cable turnbuckles until cable tension conforms to temperature compensation chart (Ref. Fig. 401) and rig pin R3 fits freely through the forward trim drum.

R (13) Remove all rig pins.

R (14) After rigging cables, safety turnbuckles.

R (15) Remove tags and close circuit breakers opened in Step R A(1).

R (16) Remove tags from hydraulic control panels.

R (17) Perform an Operation Test of the trim control system (Ref. 27-42-00).

R (18) Install center console access panels.

PITCH TRIM AFT CABLE DRUM ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Rig pins 5/16-inch diameter by 3 inches long (R3) (2 each); 5/16-inch diameter by 6 inches long (R6)

R 2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
6-50-00	Interior Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers:

NO. 1 SYSTEMS - TRIM AGMT - AC and DC (A7, A8)

NO. 2 SYSTEMS - TRIM AGMT - AC and DC (A25, A26)

(2) Position pitch trim wheel to 4 degrees. From the forward electronic service center, insert rig pin R3 through the forward pitch trim cable drum.

(3) Gain access to the aft cargo compartment. Remove the bulkhead access panel 161AR to gain access to the aft waste tank area (Ref. 6-50-00).

(4) Remove aft cargo compartment ceiling access panels 165BR and 165DR to gain access to the pitch trim cable turnbuckles.

(5) Remove safety on both the stabilizer trim nose up (STNU) and stabilizer trim nose down (STND)

turnbuckles. Loosen turnbuckles to disconnect trim cables. Tag cables for identification: outboard cable is STNU cable, inboard cable is STND cable.

CAUTION: TIE CABLES TO ADJACENT STRUCTURE OR ATTACH BUNGEE CHORD TO FORWARD CABLE RUNS TO REMOVE CABLE SLACK AND PREVENT CABLES FROM FOULING.

(6) Remove pitch trim cable fairlead rollers at FS 1725.

(7) Remove pitch trim cable pulley guard pins in the aft waste tank area.

(8) From the waste tank area, remove the screws attaching the cable bulkhead pressurization seals to the bulkhead. Separate the bulkhead seal assembly and remove the split ball seal. Retain ball seals for reinstallation.

(9) Open access door 317BB in the lower afterbody to gain access to the pitch aft trim cable drum (Ref. 6-40-00).

(10) Remove the four bolts attaching the trim cable drum assembly to the bulkhead. Move assembly inboard to disengage the drum shaft from the pitch feel/trim assembly spline shaft. Remove the trim cable drum assembly and cables from the aircraft.

NOTE: While pulling cables through the pressure bulkhead, catch the cable seal assemblies and retain for reinstallation.

R B. Installation

(1) Open access door 317CB on the bottom right hand side of the lower afterbody to gain access to the right stabilizer servo and mechanical pitch feel/trim area.

(2) Remove access panel 316CB on the bottom right hand side of the lower afterbody to gain access to the input bellcrank; just forward of the bulkhead (FS. 1860).

(3) Disconnect the parallel trim output pushrod from the input bellcrank by removing the cotter pin, nut, washer and bolt from input bellcrank clevis. Use caution when removing the bolt as the feel/trim spring load is applied to the pushrod.

(4) On the front of the mechanical pitch feel/trim assembly, and with the parallel trim output pushrod disconnected, insert rig pin R6 through the -4 DEG RIG HOLE and the output arm. If output arm does not line

up for rig pin insertion, rotate the manual trim spline shaft until rig pin can be inserted.

R R R R NOTE: The manual trim spline shaft will not rotate if the control columns are restricted in any way. Verify that the control columns are free to move before operating the manual trim spline shaft.

(5) On the pitch cable drum assembly, install rig pin R3 through the bracket and the cable drum (-4 degree rig position).

(6) Install the cable drum assembly by engaging the drum spline shaft on the mechanical pitch feel/trim assembly spline shaft. Install the four bolts attaching the cable drum assembly to the bulkhead.

(7) Verify that the R6 rig pin in the mechanical feel/trim output arm is still a free fit. If not, remove drum assembly, rotate manual trim spline shaft to free R6 rig pin and reinstall drum assembly.

NOTE: Tag cable drum cables for identification: the shorter cable is the STNU cable, the longer cable is the STND cable.

(8) Route trim cables over pulleys and through the pressure bulkhead. From the aft waste tank area, position pressure bulkhead seals over the cables before routing cables over the pulleys in the aft cargo compartment area. (Verify that the cable seal plates are positioned so the O-ring is facing the bulkhead.)

(9) Couple the trim clabes to the turnbuckles. Tighten the turnbuckles to take up all the cable slack. Remove the bungee cord or cable ties that were used to prevent forward cable run slack.

NOTE: Verify that trim cables are properly routed and are not crossed or fouled. Refer to Figure 401 cable routing.

(10) Check the split ball pressure bulkhead seals for condition. If the cable hole through the split ball is elongated, replace the split ball.

(11) Install the split ball seals around the cables and between the seal plate and retainer. Install screws attaching cable seal assemblies to the bulkhead but do not tighten at this time.

R R (12) Install the cable pulley guard pins and the fairlead rollers.

R (13) Remove rig pin from the aft cable drum.

R (14) Rig pitch trim cables: With rig pin in the forward cable drum, adjust cable turnbuckles until the following:

(a) Cable tension conforms to the temperature compensation chart (Ref. Fig. 401).

(b) Rig pin R3 can be freely installed in the aft cable drum.

NOTE: After making a turnbuckle adjustment, check for minimum thread engagement by verifying that no more than three threads are exposed on the cable terminal. Also verify that cable terminals do not extend into the hole in the center of the turnbuckle and prevent proper engagement of locking clips.

(c) Install turnbuckle locking clips or lockwire.

R (15) Remove all rig pins.

R R R (16) Reconnect parallel trim output pushrod to input bellcrank using bolt, washer, and castellated nut. Safety with cotter pin.

R (17) From flight station, cycle pitch trim wheel from full nose down to nose up. Verify that trim system operates normally without binding (a racket-type oscillation of the pitch trim force is normal due to ball detent clutch in the electrical feed/trim assembly). Verify that the trim control wheel operates through the full pitch trim range of zero to 10 degrees NOSE-UP trim.

R (18) While operating pitch trim wheel, verify normal operation of the aft trim drum.

R (19) Verify that the trim cables are properly seated in the various cable pulleys and fairleads. Verify that pulley cable guards pins are properly installed and positioned over the cables.

R R (20) Tighten the aft pressure bulkhead cable seal assembly screws.

R R (21) Remove tags and close circuit breakers opened in Step (1).

(22) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(23) Turn on electrical power (24-41-00).

(24) Turn on any one of the four hydraulic systems (Ref. 29-11-00).

(25) On the pilots control wheel, operate the pitch trim thumbwheel (electric control). Verify that pitch trim control system operates smoothly without binding.

(26) Operate the thumbwheel to position trim wheel to full NOSE-DOWN trim. Verify that stabilizer positions to full nose-down trim (use surface position indicator to verify stabilizer position).

(27) Operate the thumbwheel to position trim wheel to full NOSE-UP trim. Verify that stabilizer positions to full nose-up trim (use surface position indicator).

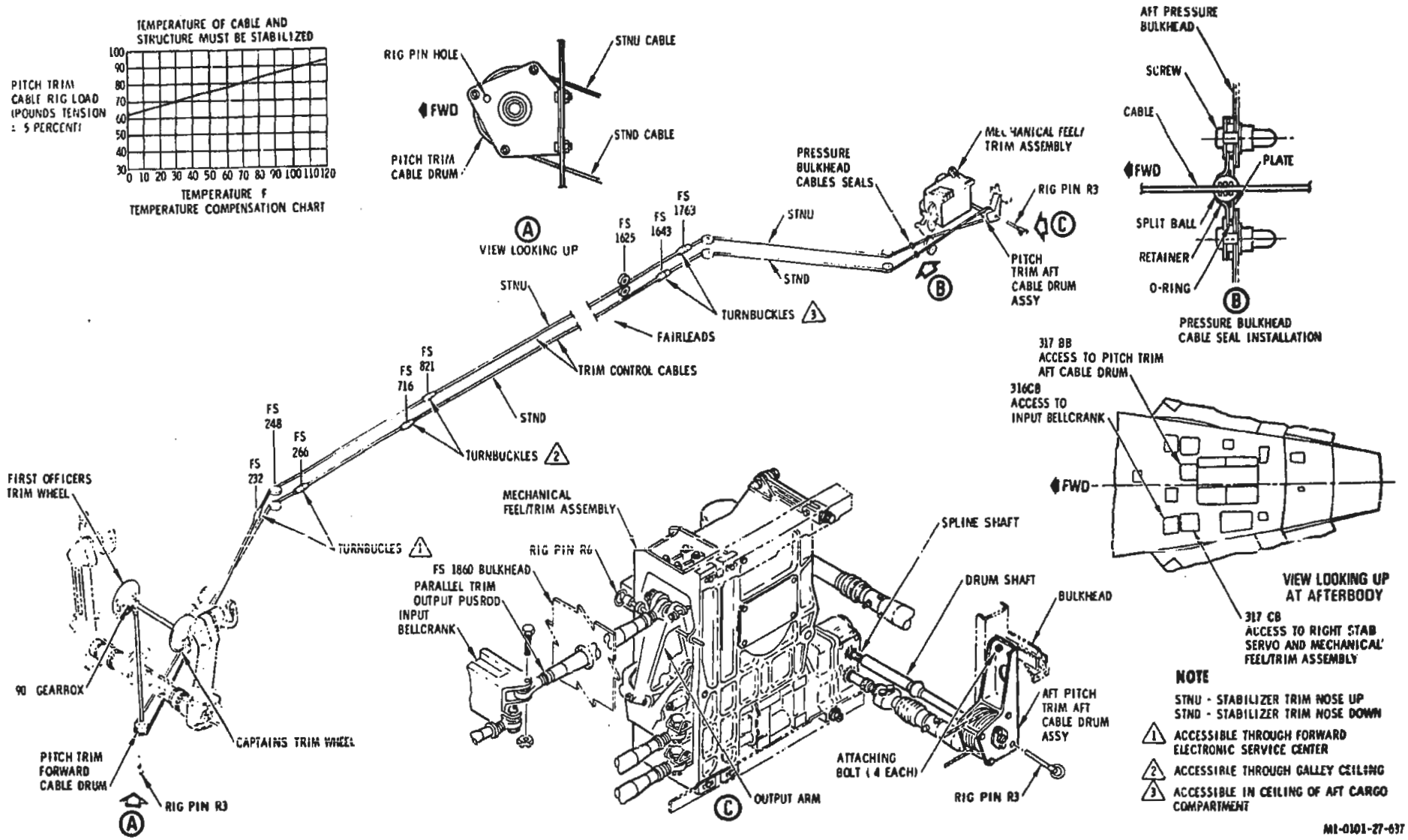
(28) Reposition trim wheel to 4 degrees.

(29) Shut off electrical power if no longer required (Ref. 24-41-00).

(30) Close all access panels and doors.

R CAUTION: AFTER CLOSING THE STABILIZER SERVO ACCESS DOOR (317AB or 317CB), SLOWLY CYCLE STABILIZER THROUGH FULL STABILIZER THROWS TO CHECK FOR ANY INTERFERENCE BETWEEN THE DOOR BAFFLE AND THE STABLILIZER SERVO OPERATING LINKAGE. CORRECT INTERFERENCE AS REQUIRED BY TRIMMING BAFFLE AND/OR ASSOCIATED STIFFENER.

(31) Turn off hydraulic power if no longer required (Ref. 29-11-00).



R Trim Aft Cable Drum Assembly - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

PITCH TRIM CONTROL WHEEL EDGE LIGHTED PANEL REMOVAL AND INSTALLATION

1. General

This procedure provides for removal and installation of pitch trim control wheel edge lighted panels. These panels are sub-assemblies of the pilot trim controls which are also line replaceable units.

This procedure may also be used for replacement of edge lighted panel light bulbs. Replacement of light bulbs may be accomplished following removal of edge lighted panel.

R 2. Referenced Procedures

31-22-00 Proximity Switch System/Aural Warning System - Adjustment and Test

3. Removal and Installation

A. Removal

(1) Remove edge lighted panel attach screws (Ref. Fig. 401).

(2) Remove edge lighted panel.

NOTE: On aircraft 007-036, it may be necessary to pry lightly around support arm to separate the electrical connector.

(3) Note and record edge lighted panel part number.

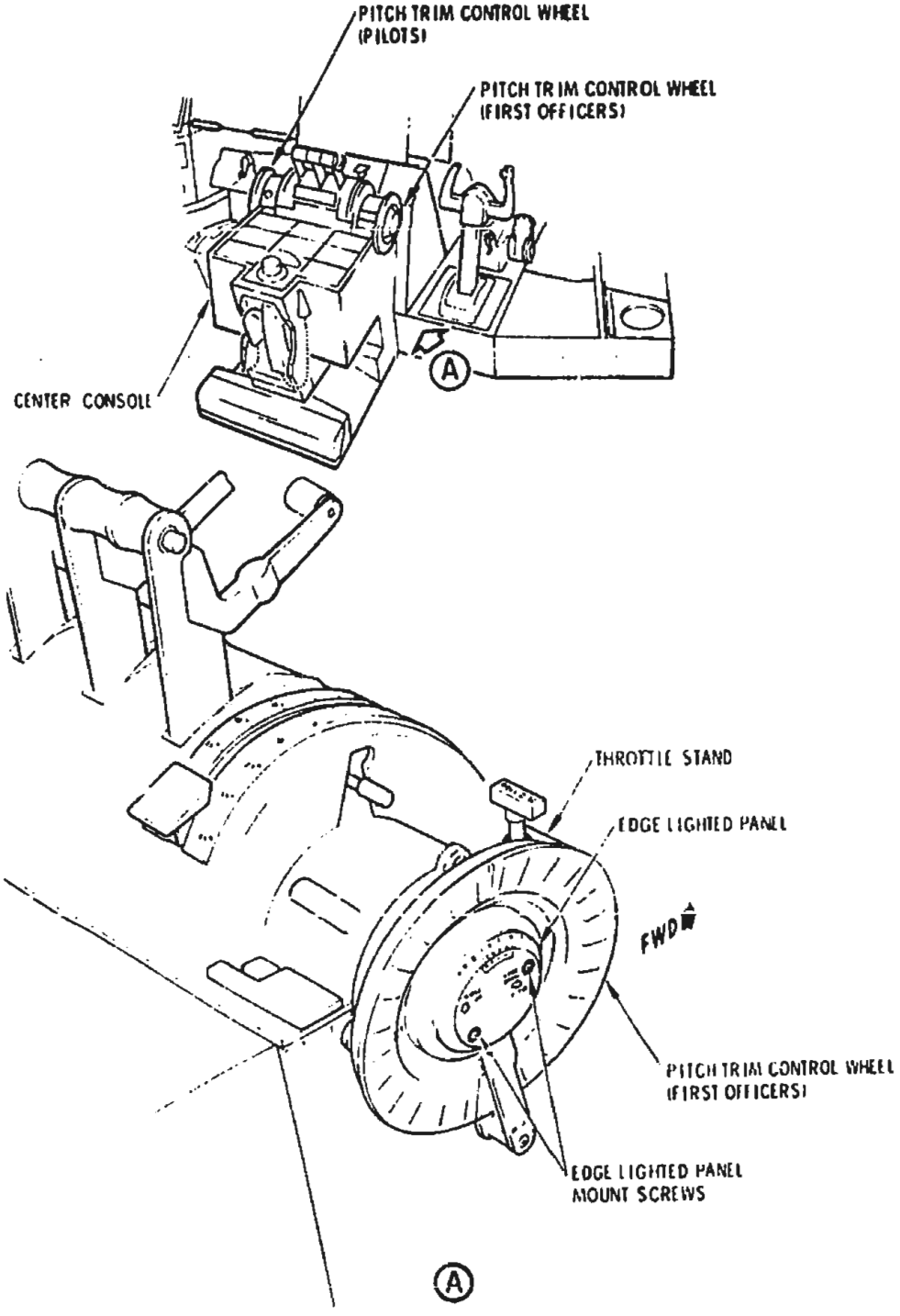
B. Installation

WARNING: VERIFY CORRECT PART NUMBER OF EDGE LIGHTED PANEL. USE OF EXACT REPLACEMENT PART NUMBER UNIT IS MANDATORY.

(1) Check part number of replacement unit. Verify part number of edge lighted panel to be installed is the same as the unit that had been removed.

(2) Position edge lighted panel on pitch trim wheel hub and attach with two screws (Ref. Fig. 401).

(3) Perform Unsafe Takeoff Warning Test (Ref. 31-22-00, Adjustment and Test, Paragraph 6C).



MI-0000-27-1094

Edge Lighted Panel - Removal and Installation
Figure 401

RIGHT FEEL UNIT BELLCRANK - REMOVAL AND INSTALLATION

1. Equipment and Materials

Corrosion Preventive Hard Film Compound, MIL-C-11796 Class 1 - Cold Application

Cotter Pin, MS24665-153

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
27-42-00	Horizontal Stabilizer Trim Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal and Installation

A. Removal

(1) Verify all hydraulic systems are off (Ref. 29-11-00). Placard Flight Engineer/Second Officers Hydraulic System Panel, Zone 215 and Hydraulic Service Panel, Zone 147 against operation.

(2) Install control column and trim wheel locks.

(3) Placard flight controls against operation of elevator.

R WARNING: VERIFY HYDRAULIC SYSTEMS ARE OFF AND PLACARDED AGAINST OPERATION. VERIFY FLIGHT CONTROLS ARE PLACARDED AGAINST OPERATION BEFORE PERFORMING MAINTENANCE ON RIGHT FEEL UNIT BELLCRANK.

(4) Open access panel 316CB (Ref. 6-40-00).

(5) Disconnect all five rods connected to bellcrank (Ref. Fig. 401).

NOTE: Do not remove bushing, where applicable, at the disconnect points. Retain all attaching hardware for reuse.

(6) Remove bolt attaching lower support link to mounting angles.

NOTE: Do not remove bushings from mounting angles. Retain all attaching hardware for reuse.

(7) Support bellcrank and remove three bolts attaching upper support bracket to bulkhead. Remove bellcrank assembly.

(8) Remove nut and washer at base of feel bellcrank assembly and remove lower support link.

(9) Remove pin from top of feel bellcrank assembly and remove upper support bracket.

B. Installation

(1) Verify control column and trim wheel locks are installed and hydraulic power is off. Verify elevator flight controls and hydraulic control panels are placarded against operation.

R WARNING: VERIFY HYDRAULIC SYSTEMS ARE OFF AND PLACARDED AGAINST OPERATION. VERIFY CONTROL COLUMN AND TRIM WHEEL LOCKS ARE INSTALLED AND ELEVATOR CONTROLS ARE PLACARDED AGAINST MOVEMENT.

(2) Install upper support bracket on bellcrank and install pin on top of bellcrank.

(3) Install lower support link on bellcrank and install washer and nut on base of bellcrank.

(4) On aircraft with SB27-257, apply corrosion preventive compound on each ball bearing upper surface with a putty knife to dimensions shown in Figure 402.

(5) Position right feel unit bellcrank assembly in aircraft and attach upper support bracket assembly to aircraft bulkhead with three bolts (Ref. Fig. 401).

(6) Install bolt attaching lower support link to mounting angles.

(7) Connect all five rods to bellcrank assembly. Torque nuts and install cotter pins.

R (8) Close access panel 316CB (Ref. 6-40-00).

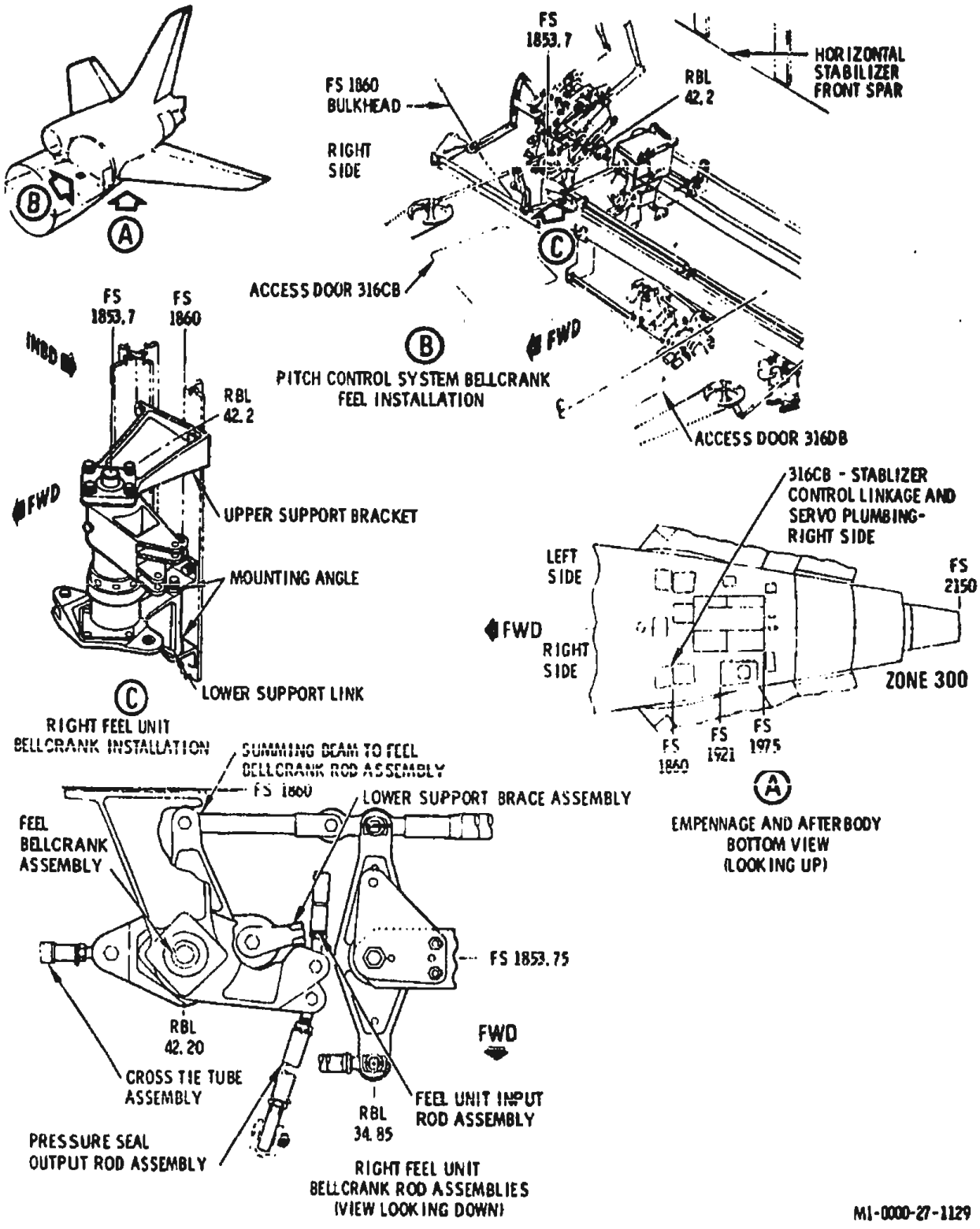
R (9) Remove placard from flight controls.

R (10) Remove control column and trim wheel locks.

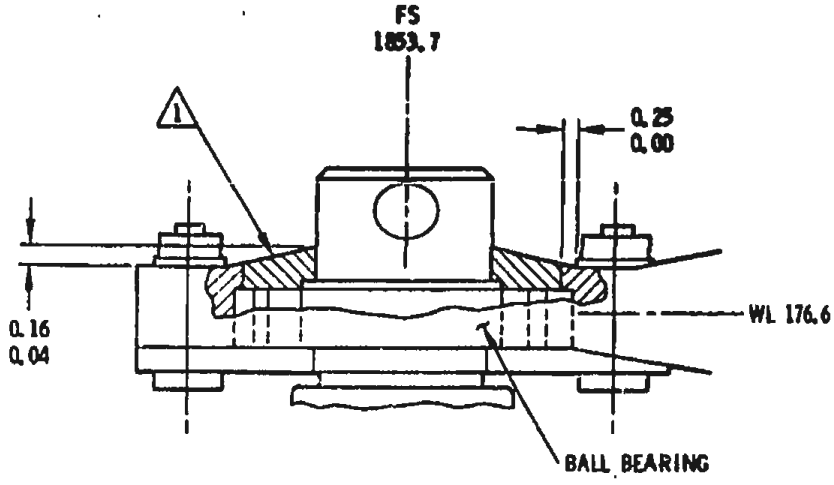
R WARNING: VERIFY FLIGHT CONTROL SURFACE TRAVEL AREAS ARE
R CLEAR OF PERSONNEL AND EQUIPMENT.

R (11) Remove placards installed in Step 3A(1) and turn on
R hydraulic systems (Ref. 29-11-00).

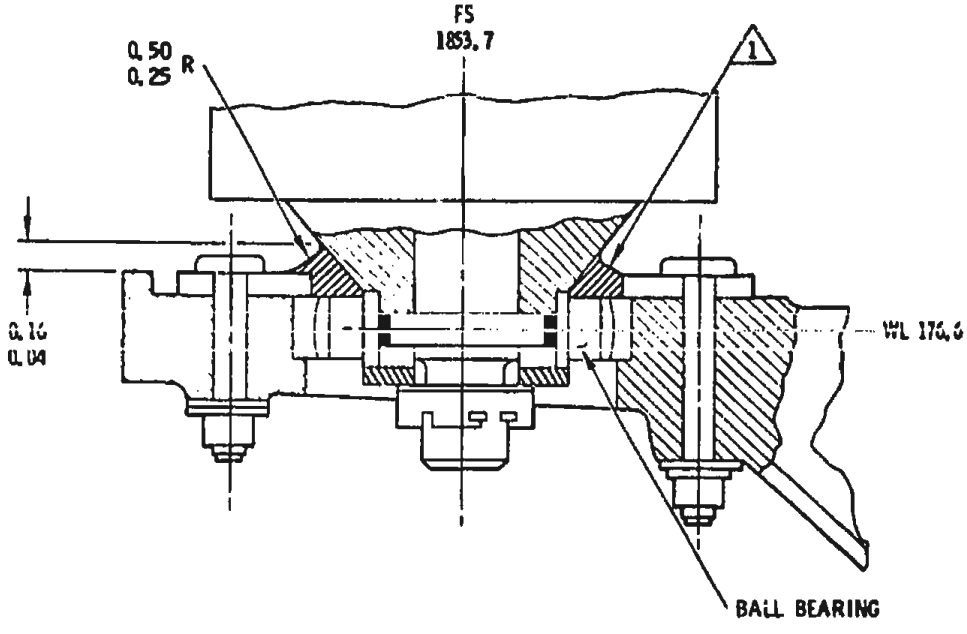
R (12) Perform operational test (Ref. 27-42-00).



Right Feel Unit Bellcrank - Removal and Installation
Figure 401



UPPER SUPPORT BRACKET BEARING



LOWER SUPPORT LINK BEARING

NOTE

1. FILL ENTIRE CAVITY ABOVE BEARING AS SHOWN WITH MIL-C-11796, CLASS 1, CORROSION PREVENTATIVE HARD FILM COMPOUND - COLD APPLICATION

M1-0000-27-1130

Right Feel Unit Bellcrank Corrosion Preventive Compound Installation
Figure 402

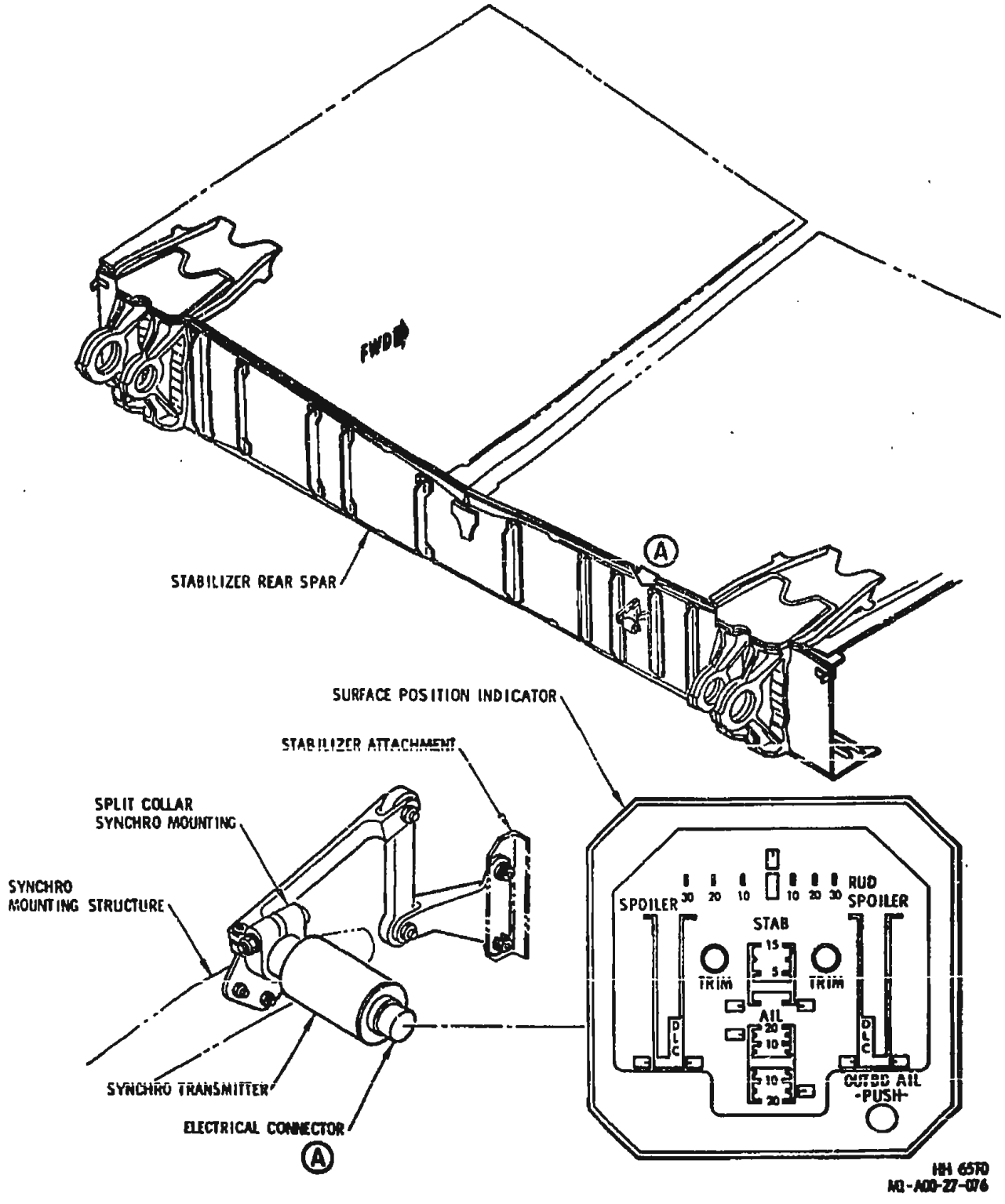
HORIZONTAL STABILIZER POSITION INDICATING SYSTEM DESCRIPTION AND OPERATION

1. General

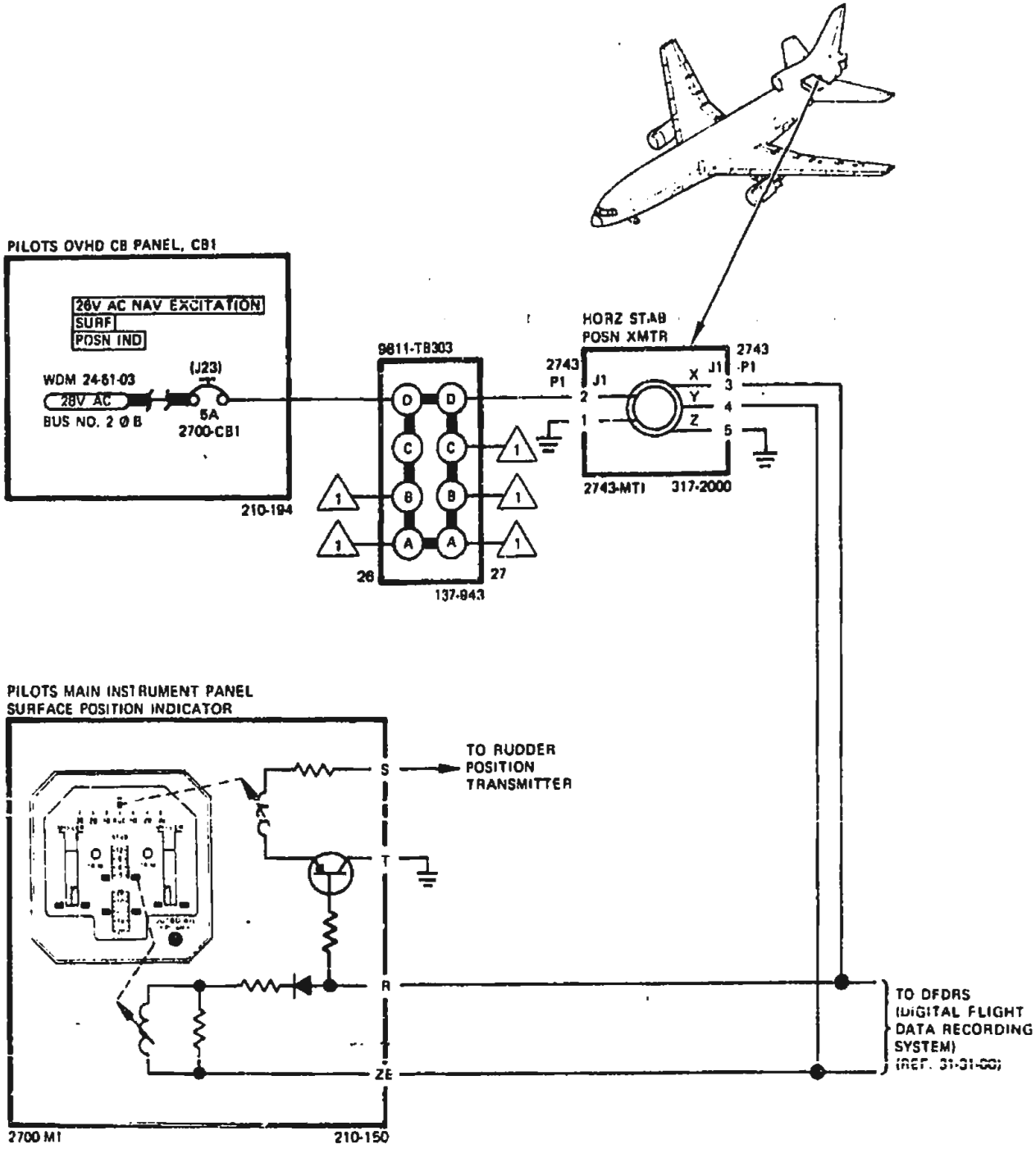
The horizontal stabilizer position indicating system consists of a surface position indicator (Ref. 27-00-00) on the Pilots main instrument panel and a synchro transmitter coupled to the stabilizer surface (Ref. Fig. 1 and 2). The stabilizer scale on the position indicator reads from 0 degrees (faired) to 12 degrees leading edge down (pitch up). A dual pointer is used to display stabilizer position.

The transmitter installation consists of a synchro mounted in a bracket that is attached to the fuselage structure, and an actuating link coupled to the stabilizer. The synchro mounting bracket incorporates a split collar arrangement so that the synchro can be nulled by loosening the collar locking bolt and rotating the synchro. The synchro mounting bracket is attached to the fuselage structure just behind the stabilizer rear spar and approximately 36 inches to the right of the fuselage centerline. Access to the synchro installation is gained
R through access door 316BB located on the lower right side of the afterbody, to the rear of the stabilizer pivot bearing installation.

The synchro actuation arm is connected by a four-inch non-adjustable link to a bracket mounted on the rear spar of the stabilizer. The link pivots consist of sealed ball bearings.



Horizontal Stabilizer Position Indicating System
Figure 1



WIRING DIAGRAMS
27 43 01

NOTE

1. TO AILERON, RUDDER, AND SPOILER POSITION TRANSMITTERS (REF. 27-13-00, 27-23-00, 27-02-00)

EM1-0102-27-332

R Horizontal Stabilizer Position Indicating System
R Electrical Schematic
R Figure 2

R HORIZONTAL STABILIZER POSITION INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

R If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in this section.

R Table 101

FIGURE	TITLE
101	Component Locator Index
102	Component Locator Diagram
103	Stabilizer Position Indication Inoperative
SCHEM 1	Stabilizer Position Indicating System Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
SURFACE POSITION INDICATOR	1	PILOTS MAIN PANEL	27-00-00
SURFACE POSIT'ON TRANSMITTER	1	AFTERBODY; 317BB	27-43-01

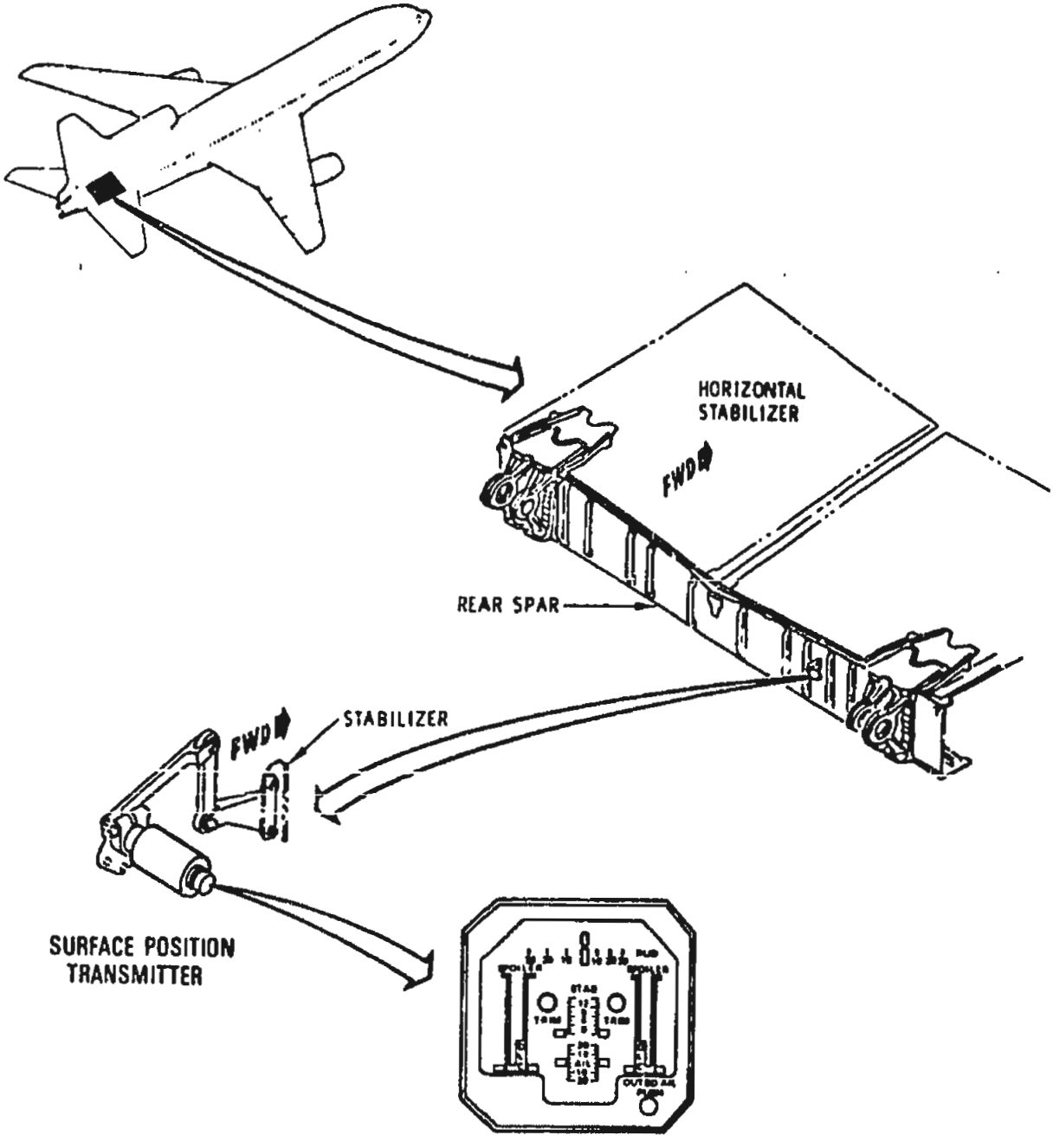
M1-0000-27-298

R
R

Component Locator Index
Figure 101

EFFECTIVITY: ALL

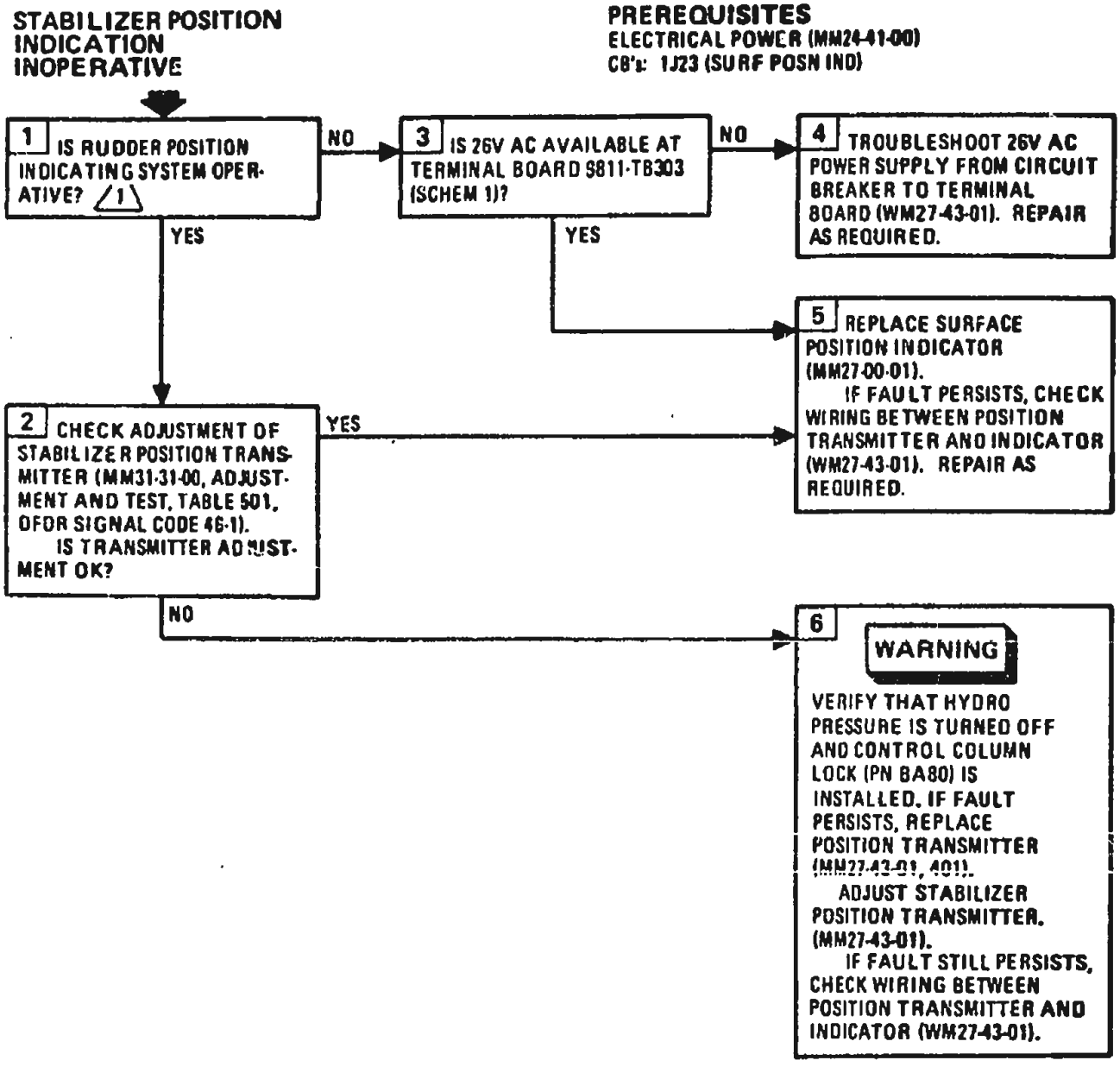
0018



M1-0001-27-581

R
R

Component Locators Diagram
Figure 102


STABILIZER POSITION INDICATION INOPERATIVE
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB's: 1J23 (SURF POSN IND)
1 IS RUDDER POSITION INDICATING SYSTEM OPERATIVE? /1\
NO
3 IS 26V AC AVAILABLE AT TERMINAL BOARD 9811-TB303 (SCHEM 1)?
NO
4 TROUBLESHOOT 26V AC POWER SUPPLY FROM CIRCUIT BREAKER TO TERMINAL BOARD (WM27-43-01). REPAIR AS REQUIRED.
YES
YES
5 REPLACE SURFACE POSITION INDICATOR (MM27-00-01).
IF FAULT PERSISTS, CHECK WIRING BETWEEN POSITION TRANSMITTER AND INDICATOR (WM27-43-01). REPAIR AS REQUIRED.
2 CHECK ADJUSTMENT OF STABILIZER POSITION TRANSMITTER (MM31-31-00, ADJUSTMENT AND TEST, TABLE 501, DFDR SIGNAL CODE 46-1).
IS TRANSMITTER ADJUSTMENT OK?
YES
NO
6
WARNING
VERIFY THAT HYDRO PRESSURE IS TURNED OFF AND CONTROL COLUMN LOCK (PN BA80) IS INSTALLED. IF FAULT PERSISTS, REPLACE POSITION TRANSMITTER (MM27-43-01, 401).
ADJUST STABILIZER POSITION TRANSMITTER. (MM27-43-01).
IF FAULT STILL PERSISTS, CHECK WIRING BETWEEN POSITION TRANSMITTER AND INDICATOR (WM27-43-01).

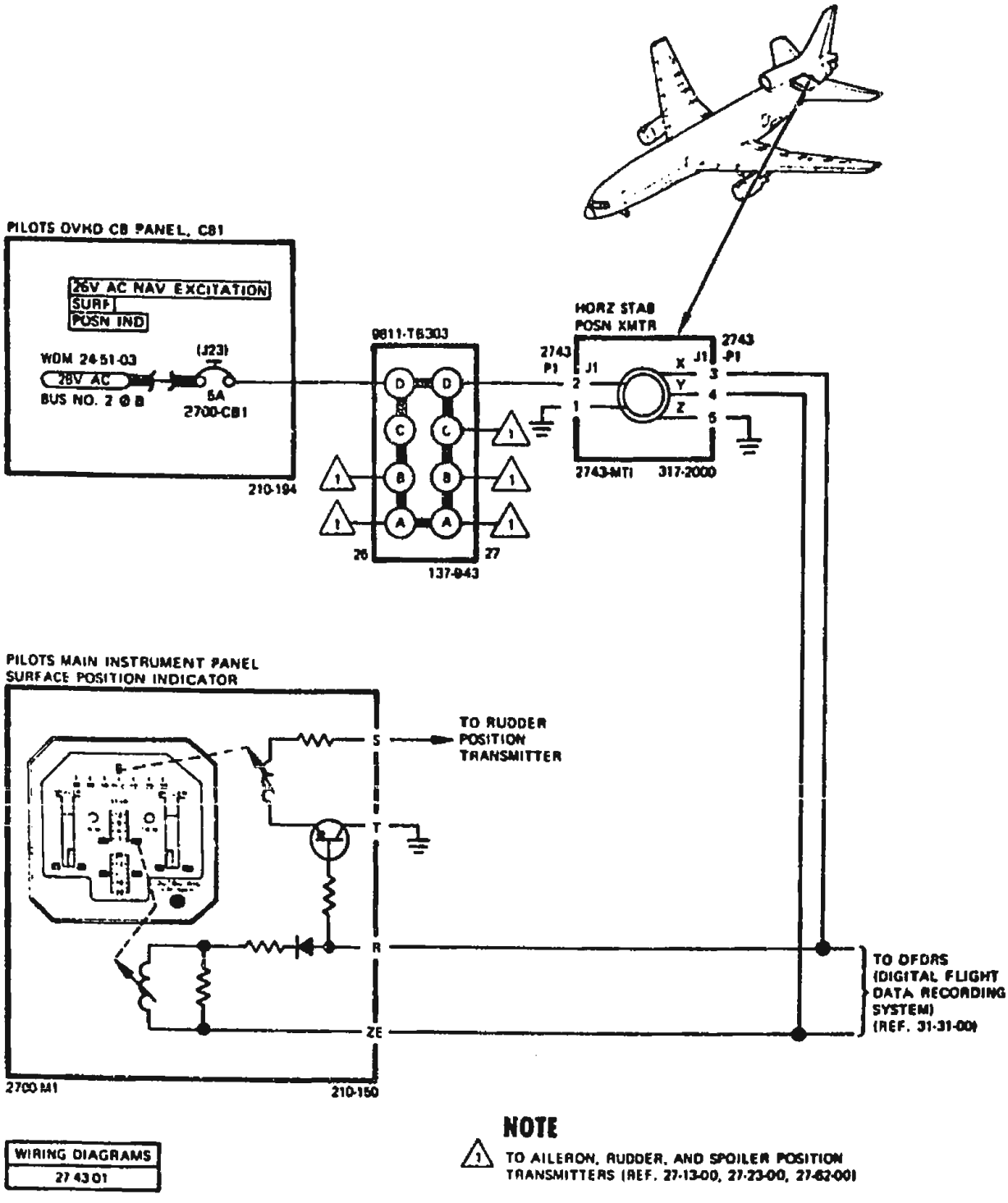
/1\ NOTE
THE STABILIZER POSITION TRANSMITTER PROVIDES A REFERENCE SIGNAL FOR THE RUDDER INDICATION (REF. SCHEM 1).

M1-0105-27-534

R R Stabilizer Position Indication Inoperative
Figure 103

EFFECTIVITY: ALL

0018



WIRING DIAGRAMS
27 43 01

NOTE

1. TO AILERON, RUDDER, AND SPOILER POSITION TRANSMITTERS (REF. 27-13-00, 27-23-00, 27-62-00)

EM1-0102-27-332

R Stabilizer Position Indicating System Electrical Schematic
R SCHEM 1

EFFECTIVITY: ALL

001B

STABILIZER SURFACE POSITION TRANSMITTER (SINGLE) REMOVAL AND INSTALLATION

1. Equipment and Materials

Control Column and Trim Wheel Lock, PN BA80, or equivalent

Position Transducer Breakout Box G/ITEL No. 22-13-05

AC Voltmeter capable of reading 100 mv full scale, Triplet Model 601, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal (Ref. Fig. 401)

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker 28 VAC NAV EXCITATION - SURF POSN IND (J23).

(2) Install control column lock.

R (3) Open fuselage afterbody access door 316BB (Ref. 6-40-00). Gain access to stabilizer area. Crawl over stabilizer to right side of stabilizer rear spar.

(4) Disconnect electrical connector from transmitter (Ref. Fig. 401).

(5) Remove clamp bolt from arm at transmitter shaft end.

(6) Remove transmitter mount clamp bolt and remove transmitter.

B. Installation (Ref. Fig. 401)

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

R WARNING: VERIFY THAT ALL HYDRAULIC POWER IS TURNED OFF, HYDRAULIC CONTROL PANELS TAGGED, AND CONTROL COLUMN LOCK INSTALLED.

(2) Verify that stabilizer is in the +1-degree position.

NOTE: Normally the stabilizer rests at the +1-degree position with hydraulic power off.

(3) Verify that EZ (electrical zero) index mark on transmitter shaft is aligned with EZ mark on housing.

R CAUTION: TRANSMITTER MUST BE ALIGNED SINCE INTERNAL STOPS WILL BE DAMAGED IF SHAFT IS ROTATED BEYOND 90° FROM EZ MARK.

(4) Insert transmitter partially into mount clamp to allow clearance to connect arm. Install transmitter so EZ marks are visible.

(5) Hold arm in position and insert transmitter into mount clamp and transmitter shaft into arm.

(6) Install bolt, washer, and nut in arm. Tighten bolt.

(7) Install bolt, washer, and nut in transmitter mount clamp. Temporarily tighten bolt. Groove in transmitter housing must be aligned with mount clamp holes to insert bolt.

(8) Turn on electrical power (Ref. 24-41-00).

(9) Verify that control column lock is installed.

(10) Adjust transmitter as follows:

CR (a) With stabilizer in the +1 degree position (normal CR position with hydraulic turned off) rotate CR transmitter housing until stabilizer pointer on CR surface position indicator moves up off bottom CR stop.

CR (b) Slowly rotate transmitter housing in reverse CR direction until bottom edge of stabilizer pointer CR just touches bottom graduation on scale.

CR (c) Tighten clamp bolt 30 to 35 pound-inches. Verify
CR that surface position indicator still reads +1
CR degree.

(11) Remove tags from hydraulic control panels.

(12) Remove the control column and trim wheel lock.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(13) Turn on one of the four hydraulic systems (A, B, C, or D) (Ref. 29-11-00).

CR (a) Verify that stabilizer pointer is centered on zero
CR degree graduation plus or minus one half a pointer
CR width.

CR (b) Operate pitch trim wheel to 4 degrees. Verify
CR that stabilizer pointer is centered within one
CR half a pointer width on 4 degree graduation.

CR NOTE: Allow control column to be free.

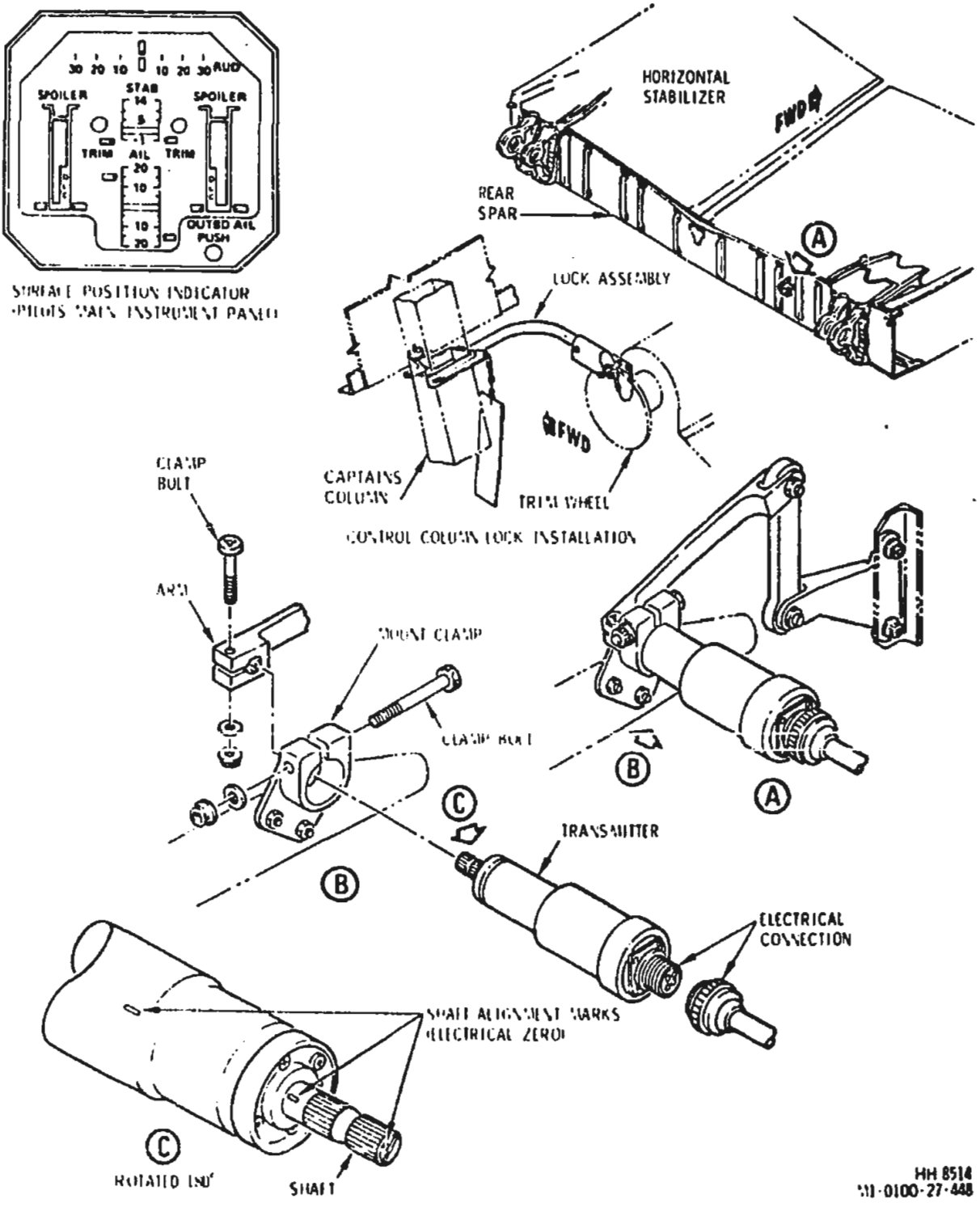
(14) Slowly operate stabilizer through full pitch throws. Verify that surface position indicator follows stabilizer travel.

(15) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(16) Turn off electrical power if no longer required (Ref. 24-41-00).

(17) Verify that stabilizer work area is clear of all equipment.

(18) Close access door. Remove tag and close circuit breaker opened in Step 3A(1).



R Stabilizer Surface Position Transmitter (Single)
R Removal and Installation
R Figure 401

TRAILING EDGE FLAP SYSTEM - DESCRIPTION AND OPERATION

1. General

The trailing edge flap system (Ref. Fig. 1) includes four double-slotted Fowler flaps and vanes on each wing. The flaps and vanes are installed aft of the rear spar and auxiliary beam, as shown in Fig. 2, between trailing edge structure commonly known as torque boxes. The torque boxes incorporate tracks on which roller carriages operate to support and guide the flaps and vanes.

Each vane is operated by two actuators which slave the vane to the flap. Each flap is actuated by two ballscrew-type actuators mounted to the torque boxes. All actuators are driven by a common torque shaft system mounted to the wing rear spar and auxiliary beam structure. The torque shaft system is operated by a power drive unit (PDU) located in the hydraulic service center, zone 147. The PDU incorporates two integrally mounted hydraulic motors, one pressurized by hydraulic system A and the
R other by hydraulic system C. In case of single hydraulic system failure, the remaining system is capable of extending the flaps against reduced loads. The flap actuation system will operate with or without electrical power.

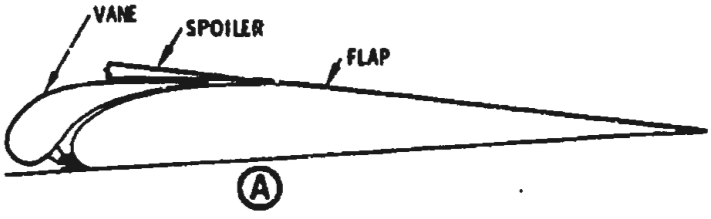
An asymmetry control system is provided to shut down and lock the flap system when a significant asymmetrical condition develops. It includes an asymmetry brake and a rotary transducer in each wing at the outboard end of the torque shaft drive system, and an asymmetry comparator located in the mid electrical service center zone 137. The system limits flap asymmetry, as measured by the transducers, to approximately seven degrees.

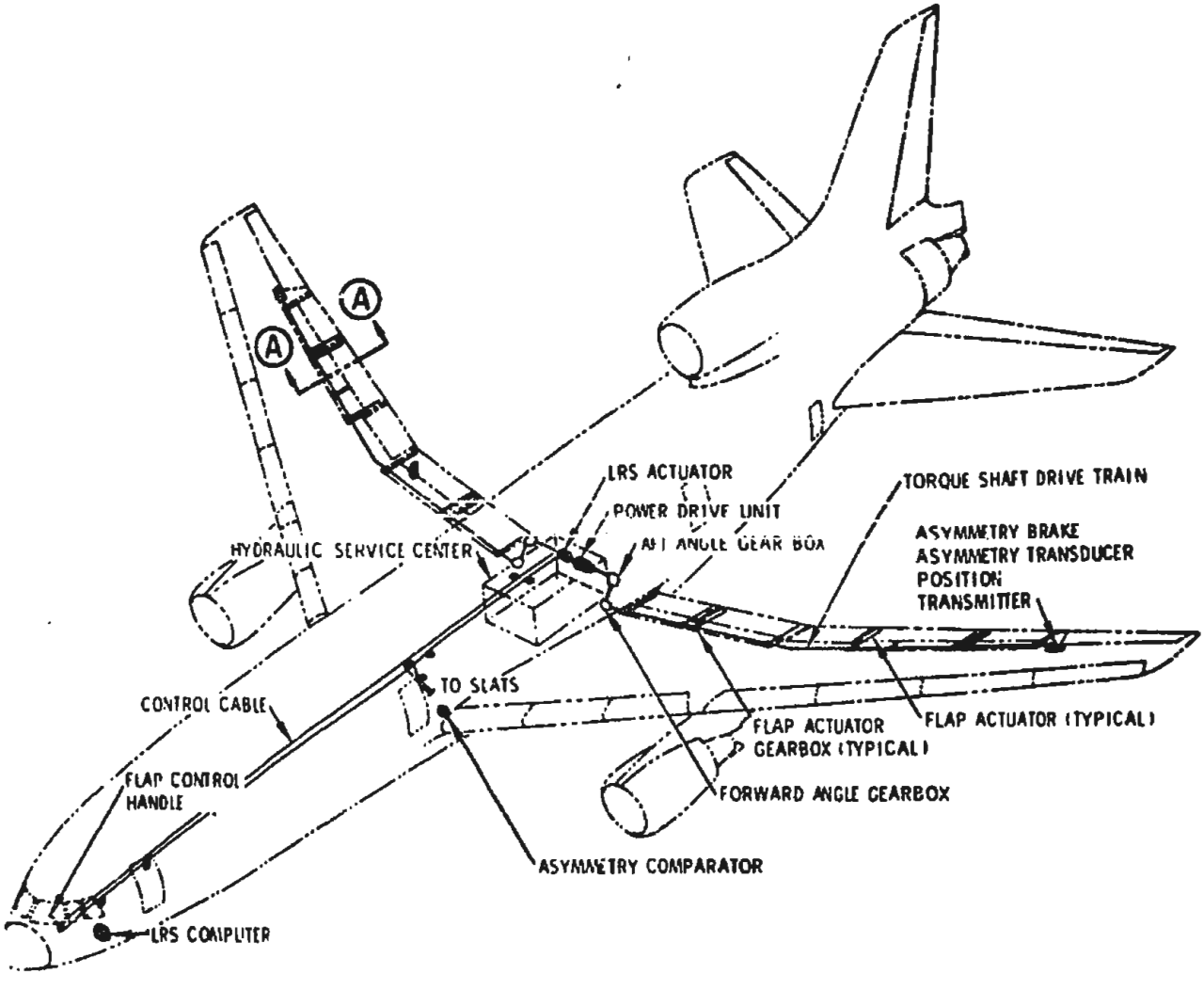
A flap load relieving system (LRS) is incorporated in the flap PDU input linkage to preclude flap extension beyond 28 degrees when airspeed is in excess of 164 KIAS. The system includes a computer, an actuator, and an override switch.

The flap position indicating system is described in 27-52-00.

Flap panels No. 1 and 2, and panels No. 3 and 4 on each wing are linked together near the trailing edge with a fail-safe coupling. This coupling will, in the case of failure of a flap support, prevent loss of the flap since it is supported by the adjacent flap.

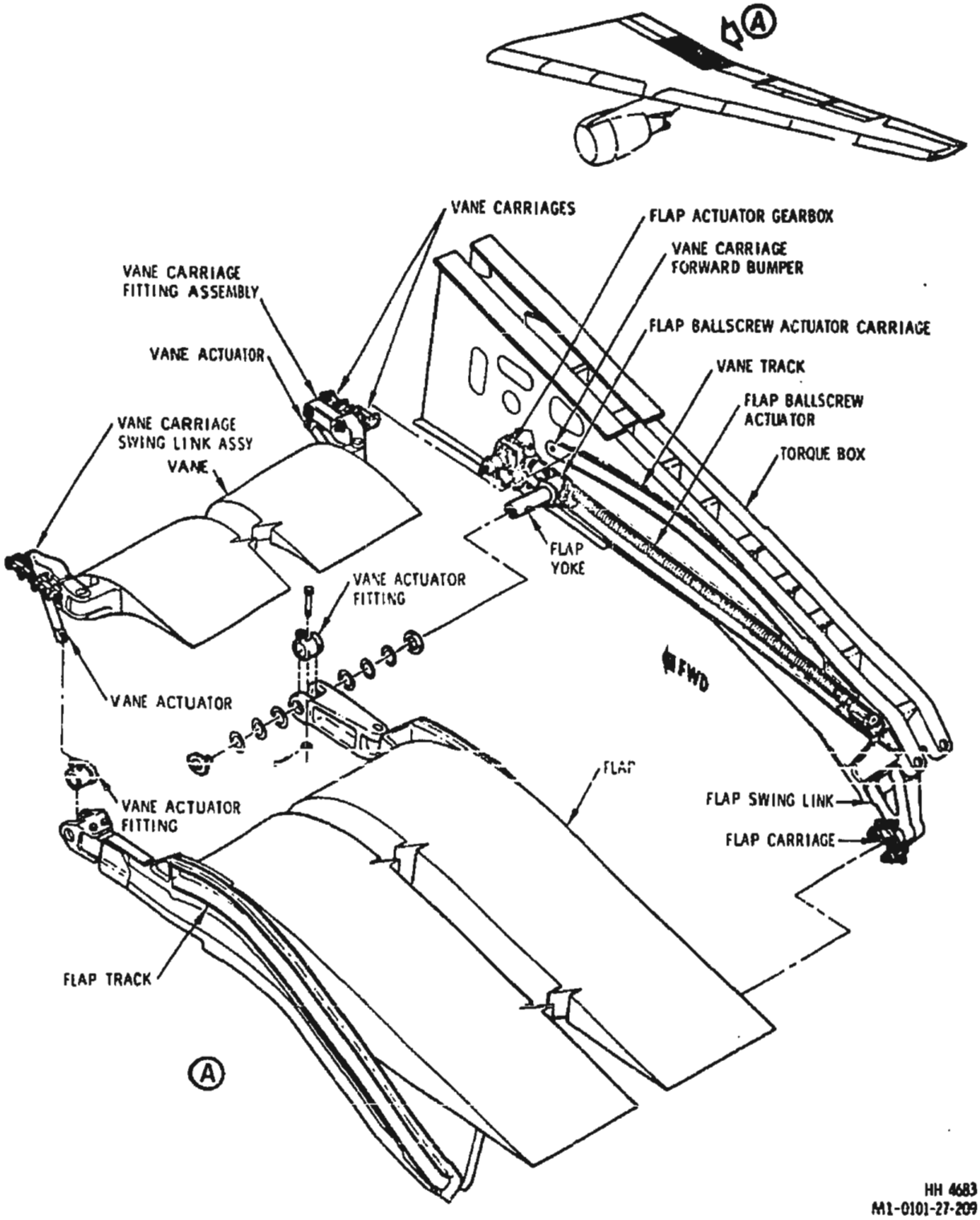
C A flap limit switch provides "flaps in landing or not in
C landing" information to the Ground Proximity Warning System.





M1-A00-27-208

Flap System Components Location
Figure 1



HH 4683
M1-0101-27-209

R Flap and Vane Installation
R Figure 2

EFFECTIVITY: ALL

050B

2. Operation

A. General

The trailing edge flaps are operated by the hydraulic-driven power drive unit (PDU). The PDU is controlled primarily by the flap control handle through a cable system and input linkage which operates hydraulic control valves and switches to regulate fluid flow to the motors (Ref. Fig. 3). Additionally, solenoid-operated hydraulic shutoff valves are provided on the PDU to shut down the system under the following conditions:

(1) Flap retraction cycle completed.

(2) Flap asymmetrical condition.

(3) Failure in flap PDU (divergence switches).

(4) Failure in flap control cable system (cable break detector switches).

The flap control handle mechanism is spring-loaded to lock in detents at the following flap positions:

0 degrees - Up

4 degrees - Takeoff (Slats fully extend)

10 degrees - Takeoff

18 degrees - Takeoff

C 22 degrees - Approach

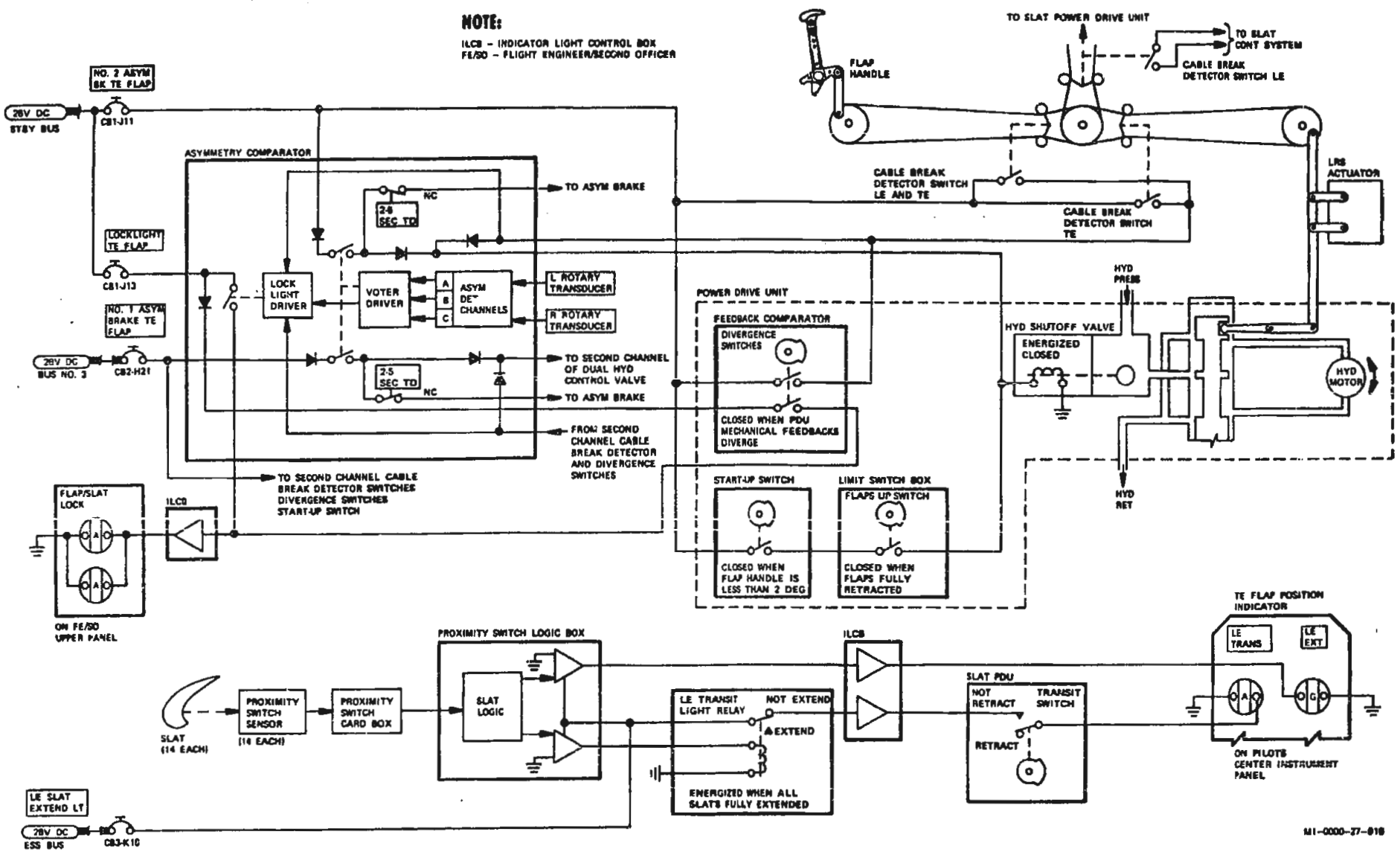
C 33 degrees - Landing

C In addition to the detents, flap control handle movement is
C restricted by a mechanical gate at the 4-degree position.

C A takeoff warning switch is provided on the PDU. It is
C closed to energize the takeoff warning system when the flaps
CR are in any position other than 10 or 18 degrees (Ref.
C 27-00-00).

B. Normal Operation

Movement of the flap control handle from the 0-degree detent (flaps up) position to the 4-degree detent position simultaneously energizes the trailing edge flap system and the leading edge slat system (Ref. Fig. 3). As the flaps move to the 4-degree position, the slats move to the fully



R Flap Control Simplified Schematic
R Figure 3

EFFECTIVITY: ALL

001B

extended position. Approximately 10 seconds are required for the slats to extend fully.

A finger-latch on the underside of the handle must be depressed to release the pawl from the detent at each
C position. At the 4-degree position, the finger-latch must
C be released and again depressed to pass through a mechanical
C gate. During flap operation, a feedback mechanism monitors PDU output shaft travel and causes the output shaft to stop at the preselected position of the input mechanism.

C When the flap control handle is moved in the flaps-up
C direction to the four-degree position, further handle
C movement is restricted by the mechanical gate. When the flaps have retracted to the four-degree position the finger-latch must be depressed again to permit handle movement to the UP position. When the flaps are fully retracted, the PDU hydraulic shutoff valve solenoids are energized to valve-closed position and the system is shut down. These valves are also energized closed whenever a fault is detected by the PDU feedback comparator, the control cable break detectors, or the asymmetry control system.

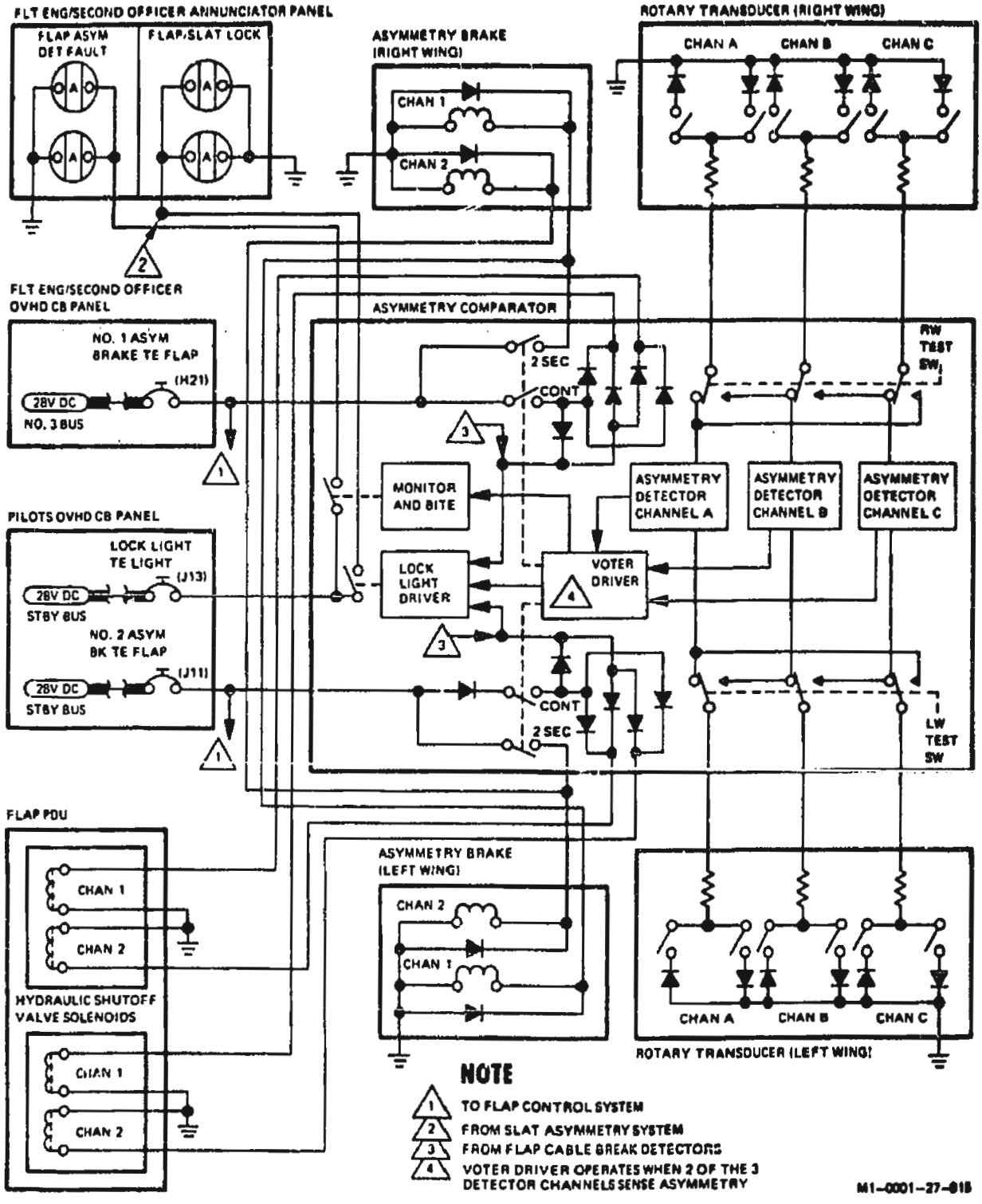
C. Asymmetry Control System Operation

Signals from the two rotary transducers, one mounted on each flap asymmetry brake, are compared by the flap asymmetry comparator (Ref. Fig. 4). When an asymmetrical condition is detected, the hydraulic shutoff valves on the PDU are energized closed, the asymmetry brakes are tripped to the applied position, and the FLAP/SLAT LOCK light on the Flight Engineer/Second Officer annunciator panel comes on. After an asymmetry shutdown, the brakes can only be released on the ground by manually resetting the trip mechanism; the flight crew has no override capability.

D. Flap Load Relieving System (LRS) Operation
C (Only on aircraft prior to incorporation of MO 98686) (Ref. Fig. 5)

The load relieving system (LRS) utilizes airspeed signals from the two central air data computers and the flap system input command from the flap control handle to prevent flap extension beyond 28 degrees whenever airspeed exceeds 164 knots. The LRS actuator has two modes of operation. They are as follows:

(1) When the flap control handle is set for a flap position less than 28 degrees, or when airspeed signals are less than 164 knots, the LRS actuator input and output arms are phased (parallel) and operate together.



R
R Flap Asymmetry Control Simplified Schematic
Figure 4

(2) When the flap control handle is set for a flap position greater than 28 degrees and the airspeed signals exceed 164 knots, the actuator output arms are automatically positioned to the 28-degree flap position.

A FLAP LRS OVRD switch is located on the center control pedestal. When the switch is released (out) (override mode), the system is disabled through a magnetic-latching shutdown relay and the input and output arms of the actuator are driven to the in-phase non-relieved position (Ref. Fig. 5). The shutdown relay can only be reset by a manual test switch on the LRS computer.

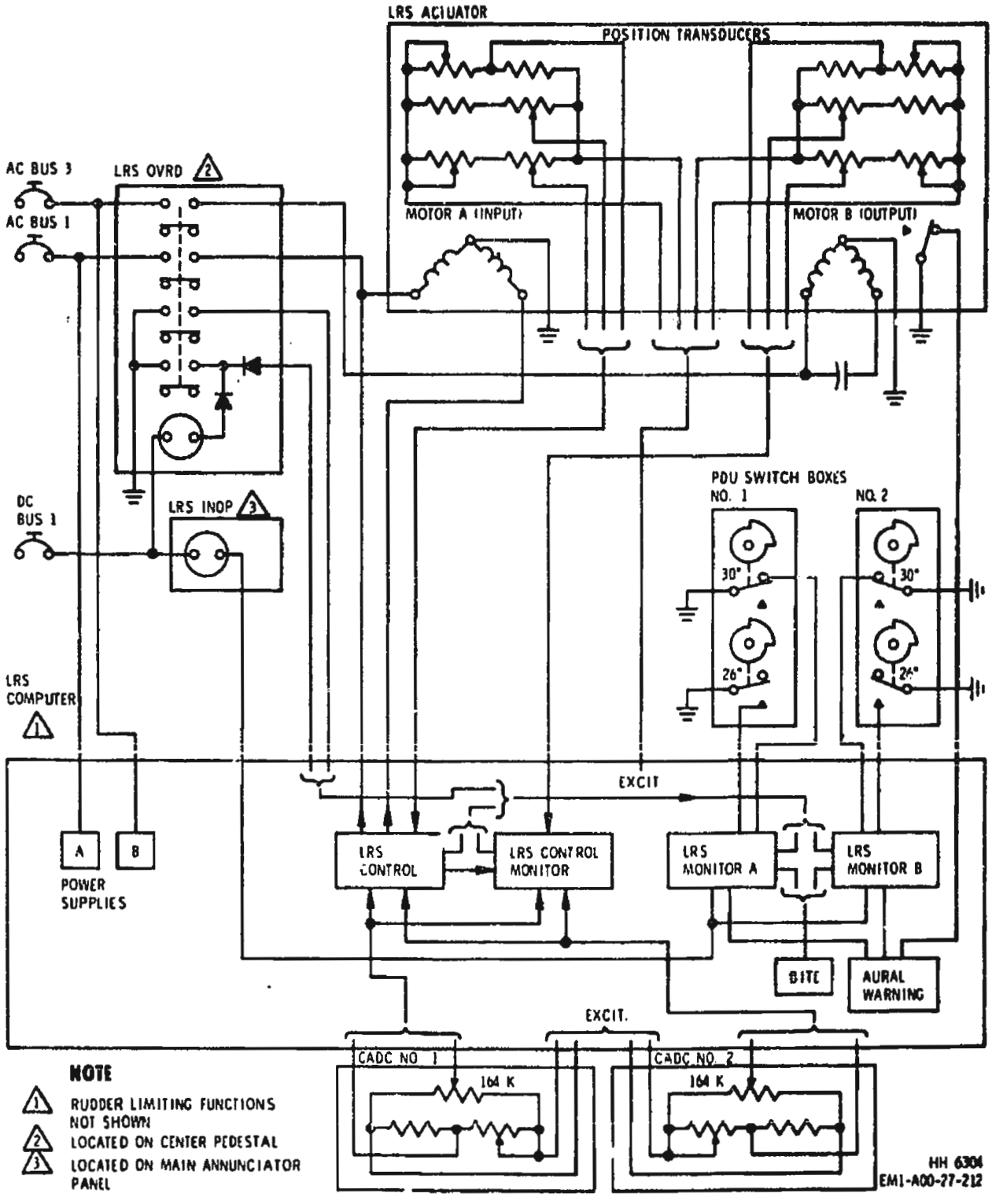
3. Flap Control Handle Mechanism

A. Description

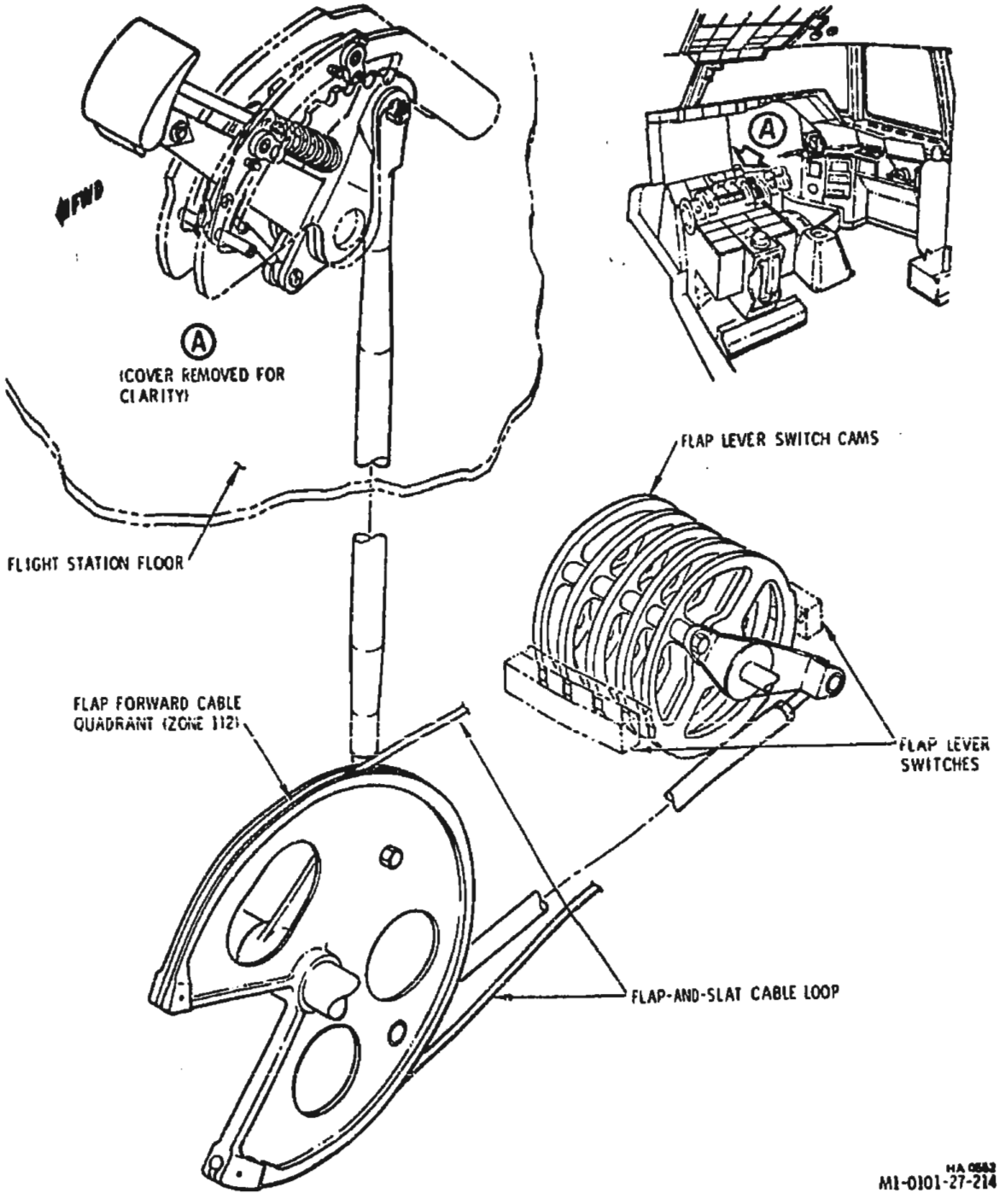
The flap control handle is located on the right side of the pilots center control pedestal (Ref. Fig. 6). A pushrod connects the handle to the flap forward cable quadrant located below the flight station floor in the forward avionics service center, zone 112. A spring-loaded finger-latch under the forward surface of the handle raises a pawl out of a detent when depressed. Both the handle and the pushrod incorporate redundancy features to provide a dual load path to the cable quadrant: The handle bellcrank is made of two similar parts riveted together; the pushrod has inner and outer tubes.

The flap forward cable quadrant drives the flap-and-slat cable loop (Ref. Para. 4); it also operates the flap lever switches mounted immediately aft of the quadrant. The flap lever switches control functions in the direct lift control and landing gear warning systems. The switches are cam-actuated through a pushrod connection to the cable quadrant.

The flap control quadrant incorporates detents at the various flap positions (Ref. Para. 2). A two-way mechanical gate is provided at the 4-degree position. The handle finger-latch must be depressed again to pass through this gate. The purpose is to provide a delay to allow full slat travel at this point of flap operation. During flap retraction, handle movement through the four-degree flap position is prevented by a gate. When the trailing edge flaps have retracted to four degrees, the handle finger-latch is again depressed and the handle is positioned to the zero-degree detent to retract the slats and the flaps.



Flap Load Relieving Schematic
Figure 5



Flap Control Handle Mechanism
Figure 6

4. Flap Control Cable System

A. Description

A cable system, as shown in Fig. 7, connects the flap forward cable quadrant in the forward electronic service center, zone 112, with the flap aft cable quadrant in the hydraulic service center, zone 147. The system includes two cable loops which interconnect at the flap-and-slat programmer located in the mid electrical service center, zone 137.

The flap-and-slat programmer incorporates a cam mechanism which interconnects the common flap-and slat cable with both the flap input cable and the slat input cable. A cable break detector for each cable loop incorporates switches which operate to energize solenoid valves and shut off hydraulic pressure at the power drive unit when cable tension is lost.

Dual pushrods at the aft cable quadrant provide input to the flap load relieving actuator which is also connected to the power drive unit. Turnbuckles in each cable loop and rig pin holes in each quadrant are provided to facilitate system rigging.

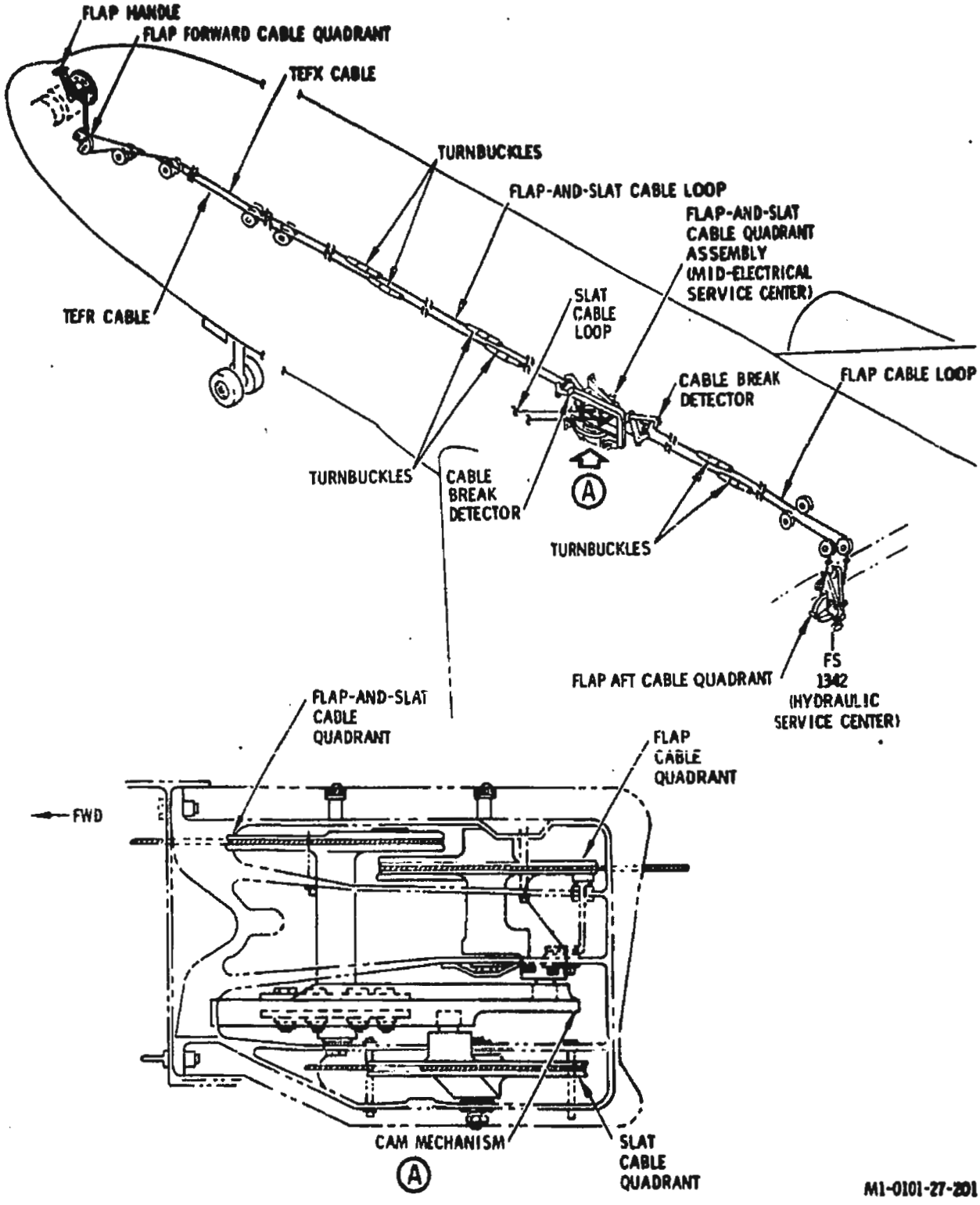
5. Load Relieving System (LRS) Computer

C (Only on aircraft prior to incorporation of MO 98686)

A. Description

The load relieving system (LRS) computer compares airspeed signals and flap control system input commands to determine when input command modification is required to limit flap loads. This comparison generates the computer command to energize the LRS actuator and modify the flap control system input command to the power drive unit (PDU). The LRS computer is configured to prevent flap extension beyond 28 degrees whenever airspeed exceeds 164 knots. The LRS computer also provides the command to operate the rudder limiting system (Ref. 27-21-00). The computer is installed on the center rack in the forward electronic service center, zone 112 (Ref. Fig. 8).

The LRS system has been improved by incorporation of SB 27-084 which replaces the -117 computer with the -119 computer. SB27-084 only applies to aircraft 001-018, subsequent aircraft have intent of SB27-084 incorporated in productionThe differences in the two computers are covered in the following description and operation.



Flap Control Cable System
Figure 7

The LRS computer control panel contains a four-position BITE selector switch, four fault indicator flags and, on the -119 computer, a toggle switch (FIM SW). The functions of the switches and flags are as follows:

(1) BITE Switch Positions

(a) RESET - Will reset latching fault relays in flap portion of computer and will drive the LRS actuator output arms in phase with the input arms.

(b) RUN - This is the normal operating position.

(c) TEST 1 - Inhibits annunciations from all No. 2 channel monitors in computer. (All flap and rudder limiting systems have dual monitors. In each case both monitors drive the same annunciator. In order to check that the No. 1 channel monitors are operating, the No. 2 channel monitors are inhibited).

(d) TEST 2 - Same as TEST 1, except channel No. 1 monitors are inhibited.

(2) Fault Indicators

(a) COMP - Indicates a problem within LRS computer computation circuits.

(b) CADC - Indicates a faulty input from CADC. The CADC inputs are compared and will trigger the CADC flag if they do not match.

(c) ACT - Indicates a fault in the LRS actuator. This could be a fault in the actuator or incorrect rigging from aft cable quadrant to PDU which causes the actuator motor to hunt or stall.

(d) FLAP - Indicates that the flaps did not retract to less than 30 degrees when airspeed exceeded 164 knots. Inputs are from switches on the PDU switchboxes.

(3) FIM SW (on -119 computer only) - When actuated, removes the ground inhibit and enables the fault indicator for troubleshooting.

B. Operation

The LRS computer utilizes dual channel comparison to detect system failures and faulty inputs. Channel A is normally operative while channel B is used as a comparison channel.

The flap load relieving functions of the LRS computer are as follows:

(1) Compare central air data computer (CADC) airspeed signals and deactivate the system if they do not compare.

(2) Compute channel A and channel B output signals using CADC airspeed signals and flap control system input command data from position transducers on the LRS actuator input and output arms. Compare the outputs and deactivate both channels if they do not compare.

(3) Compare the flap position feedback signals with the programmed position; deactivate both output channels if they do not compare.

(4) Activate a signal to the FLAP LRS INOP light on the pilots annunciator panel and to the FLAP LRS OVRD switchlight on pedestal when any of the above comparisons indicate a fault.

(5) Activate a signal to the aural warning system when any of the above comparisons indicate a fault and the flap control system input command is greater than zero.

(6) Activate a signal to the FLAP LRS LIMITING light on the pilots annunciator panel whenever the flap position commands are modified.

(7) Activate a signal to the LRS INOP light on the FLAP LRS OVRD switchlight whenever the LRS computer reset switch is not in the RUN position.

When the LRS computer detects a fault in the system, the following occurs:

With the -117 computer installed, the LRS system is deactivated; the FLAP LRS INOP light on the pilots caution and warning panel, and the LRS INOP light on the FLAP LRS OVRD switchlight, will come on. If the flap handle is positioned more than zero degrees, the aural warning will sound.

With the -119 computer installed (and wiring changes of SB 27-084 accomplished), the LRS actuator is inhibited, the FLAP LRS INOP light on the pilots caution and warning panel, and the LRS INOP light on the LRS OVRD switchlight, will come on. If the flap handle is positioned more than zero degrees, the aural warning will sound.

If the fault persists for ten seconds, the LRS system will be permanently deactivated. Should the fault disappear before ten seconds, the FLAP LRS INOP and LRS INOP lights will go out and system operation will be restored.

In addition, permanent deactivation of the LRS computer is inhibited whenever the flaps are less than four degrees or when the aircraft is on the ground. The ground inhibit prevents the fault indicators on the LRS computer from operating. For ground troubleshooting, the FIM SW on the computer can be actuated to enable the fault indicators.

6. Load Relieving System (LRS) Actuator

C (Only on aircraft prior to incorporation of MO 98686)

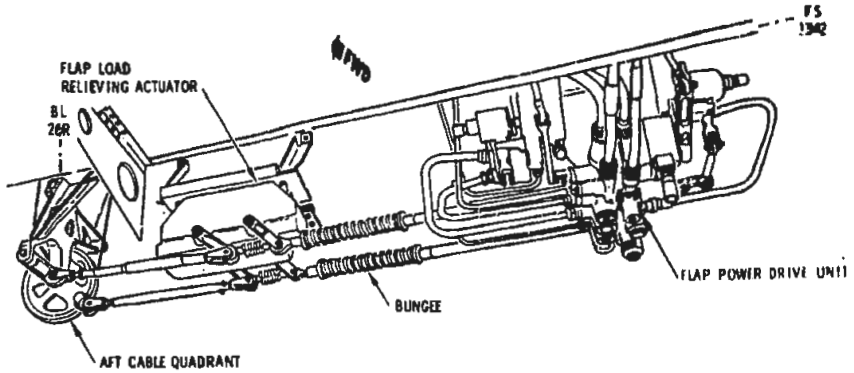
A. Description

The load relieving system (LRS) actuator acts as a variable link in the input control system to the flap power drive unit (PDU) and is located adjacent to the PDU in the hydraulic service center, zone 147. It includes linkages (Ref. Fig. 8) for straight-through coupling of mechanical commands from the flap control system, and two electromechancial modification drive trains operated by signals from the LRS computer. The dual input arms are actuated by push rods connected to the flap aft control cable quadrant. The dual output arms are each connected by a bungee to a bellcrank on the PDU.

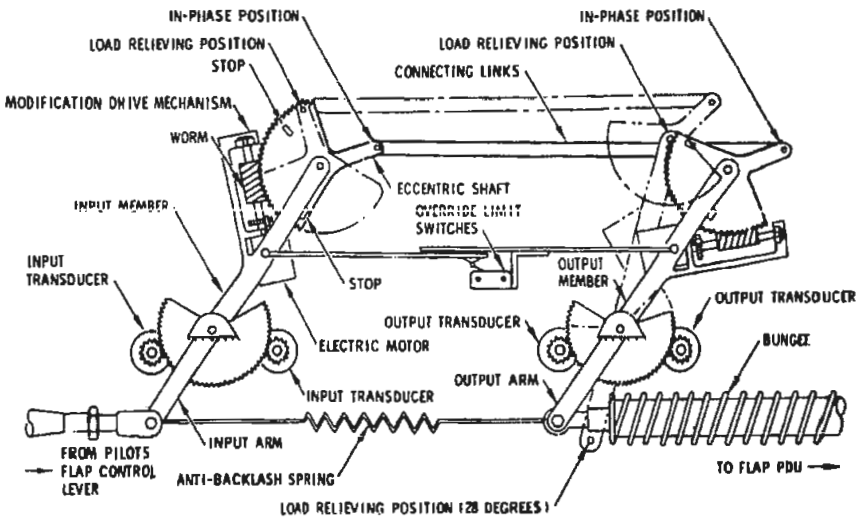
Within the actuator, the input and output members incorporate eccentric shafts to which two links are attached to connect the two members. Rotation of the eccentric shaft by the modification drive mechanism changes the distance and varies the angular relationship between the input and output members. Each of the two modification drive mechanisms, one on the input member and one on the output member, includes an electric motor and two parallel reduction gear trains which rotate the eccentric shaft. The gear train incorporates an irreversible worm gear. Four transducers, two driven by the input arms and two by the output arms, transmit position indication to the LRS computer.

B. Operation

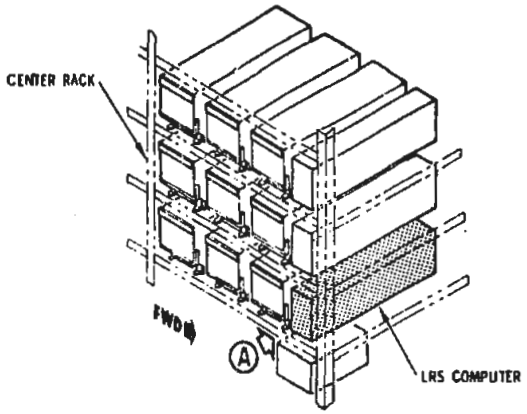
In normal nonrelieved operation, the input and output arms are phased (paralled) and the flap control handle is directly connected to the flap PDU. When the LRS computer determines load relieving is required, the input



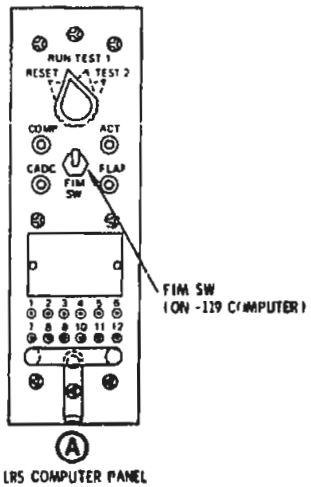
VIEW LOOKING UP AND AFT
HYDRAULIC SERVICE CENTER



NOTE
ACTUATOR INCORPORATES DUAL LOAD PATHS. ONLY ONE LOAD PATH SHOWN



FORWARD ELECTRONIC SERVICE CENTER



LRS COMPUTER PANEL

M1-0102-27-210

R LRS Computer and Actuator
R Figure 8

EFFECTIVITY: PRIOR TO INCORP. OF MO 98686

001B

modification mechanism is energized and drives the output arm to an angle equivalent to a flap position of 28 degrees. Subsequently, when the LRS computer determines that load relieving is no longer required, the input modification mechanism is again energized and drives the output arm to the in-phase nonrelieved position.

When the override switch is actuated, the output modification mechanism is driven in a direction to remove any existing modification. Position sensing limit switches mounted on linkage connected between the input and output members provide the override servo control.

7. Power Drive Unit

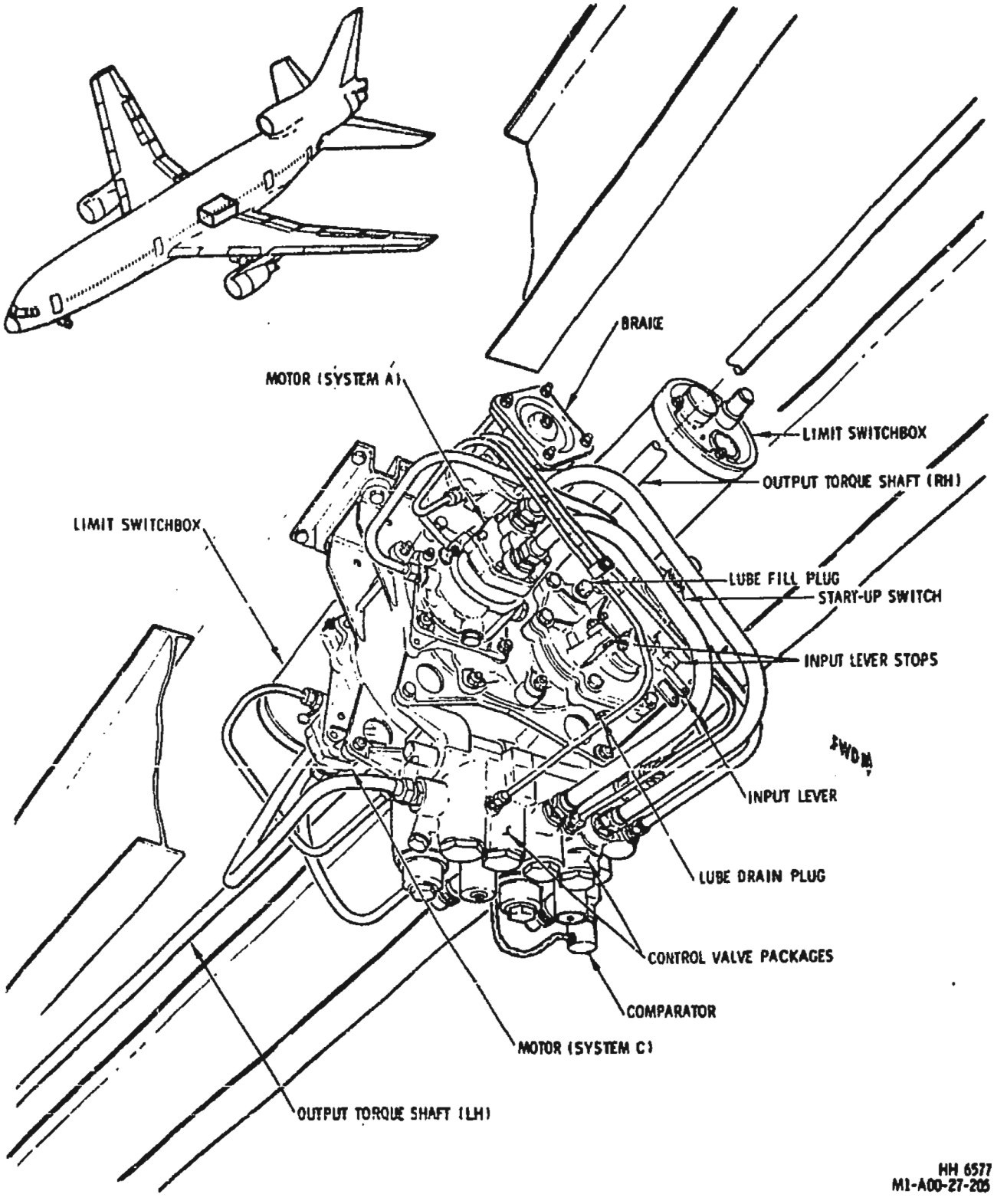
A. Description

The power drive unit (PDU) consists of a gearbox, two hydraulic motors, a brake, two hydraulic control valve packages, two limit switchboxes (Ref. Fig. 21), two start-up switches, a divergence comparator, and the input and feedback mechanism (Ref. Fig. 9). The PDU weighs approximately 100 pounds and is installed in the hydraulic service center, zone 147. Mounting provisions are incorporated in the gearbox housing.

B. Operation

PDU operation is initiated by an input command which is transmitted through mechanical linkage to the PDU input mechanism (Ref. Fig. 10). When the PDU input levers are moved away from the up-stop (flap 0-degree position), the start-up switches are opened to deenergize and open the hydraulic shutoff valves; the shutoff valves supply pressure to release the brake and provide hydraulic power to the control valve. Simultaneously a Geneva mechanism moves the control valve out of the null position. Pressure is then supplied to operate the motors. As the output shaft approaches the command position, the feed back mechanism gradually repositions the control valve spool to the null position. This stops the motors when the flaps have reached the selected position.

When the flaps reach the fully retracted position, the start-up switches and the flap up limit switches complete series circuits to energize the hydraulic shutoff valves. This closes the valves, shutting down the PDU and applying the brake. The start-up switches are actuated by the PDU input mechanism. They are normally open and close when the input mechanism is in the 0 to 2-degree flap position. The



HH 6577
M1-A00-27-205

Power Drive Unit
Figure 9

flap up switches are located in the limit switchboxes; they close at the flap fully retracted position.

The input/feedback mechanism on one side of the control valve acts as the control channel; the input/feedback mechanism on the other side acts as the reference channel and incorporates a divergence comparator. If the comparator senses a divergence in control valve spool position, switches within the comparator will energize and close the hydraulic shutoff valves to shut down the PDU.

8. Torque Shafts

A. Description

The torque shaft drive train (Ref. Fig. 11) utilizes a total of 46 torque shafts to transmit torque from the power drive unit in the hydraulic service center to the flap actuators and the asymmetry brakes. Short, unsupported, splined shafts are used between the fuselage and wing, between the two inboard flaps, and between the two outboard flaps. All other torque shafts are longer and are connected by bearing-supported universal joints. The universal joints and support bearings are integral with the torque shafts. The support bearing housings are mounted to the aft side of the wing rear spar and to ribs on the forward side of the auxiliary beam. Loop retainers are installed to restrain broken or disconnected shafts.

9. Angle Gearboxes

A. Description

Four angle gearboxes accomplish the required directional changes in the torque shaft drive train to connect the power drive unit in the hydraulic service center with the flap actuator gearboxes in the wings. Outboard of the PDU on each side, the drive train is directed forward and downward by the 90-degree aft gearbox; the 79-degree forward gearbox then directs the drive train outboard to the first flap actuator gearbox.

The 90-degree gearbox (Ref. Fig. 12) incorporates a torque-limiting brake to protect the system from excessive torque. The torque-limiting brake includes a spring coil between the input and output couplings. The couplings and coil sleeves are so designed that input or output torque in either direction of rotation is applied to the end of the spring which will tend to uncoil it. When the torque reaches approximately 120 percent of the normal torque, the

spring will uncoil sufficiently to expand against the gearbox housing and stop rotation until torque is decreased. No trip indication is provided.

The right and left 90-degree aft gearboxes are interchangeable; the 79-degree forward gearboxes are not interchangeable. The 79-degree gearboxes rotate opposite of each other.

10. Flap Actuator Gearbox

A. Description

The flap actuator gearboxes (Ref. Fig. 13) are installed in the torque shaft drive train to transmit torque and reduce rpm to the individual ballscrew actuators. A torque limiting brake similar to that in the 90-degree angle gearbox (Ref. Para. 9) is incorporated to protect the system from excessive torque. It operates to lock the flap drive system at approximately 120 percent of the normal torque. Two trip-indicating buttons are provided to indicate a locked brake. When the load is removed, the brake will release; the trip button can then be manually reset. A trip button that cannot be reset does not affect the normal operation of the gearbox. However, the gearbox should be replaced at the earliest convenience.

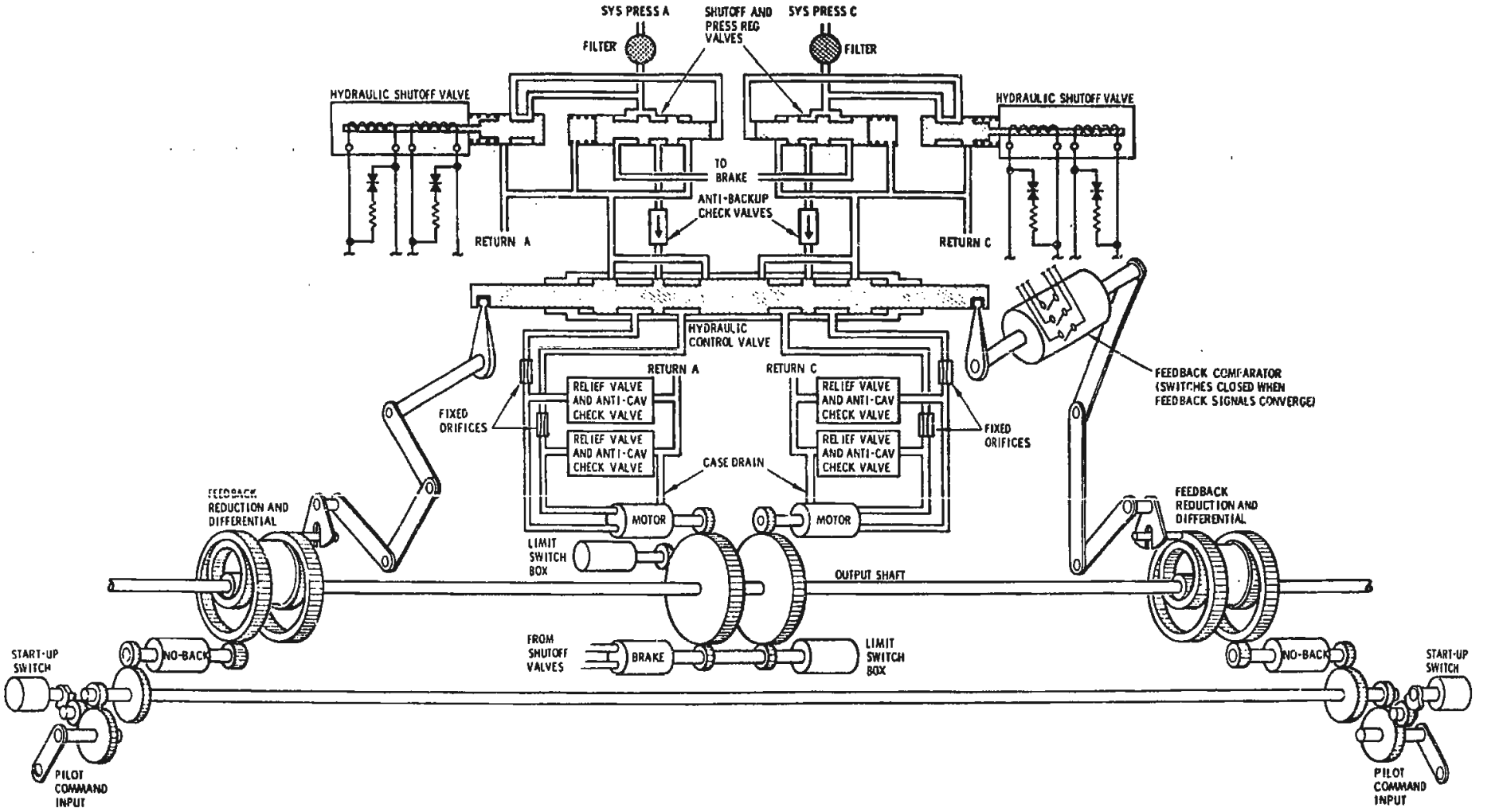
The two trip-indicator buttons on each gearbox are designed to indicate which direction the flap was traveling when the gearbox brake was applied. The forward trip pin pops out when brake is applied for flap retraction, the aft trip pin for flap extension.

The gearboxes are of four configurations: left inboard, left outboard, right inboard, and right outboard. The output drive of the inboard flap gearboxes is approximately 98 degrees to the input shaft; maximum output rpm is 264. The output drive of the outboard flap gearboxes is approximately 120 degrees to the input shaft; maximum output rpm is 247.

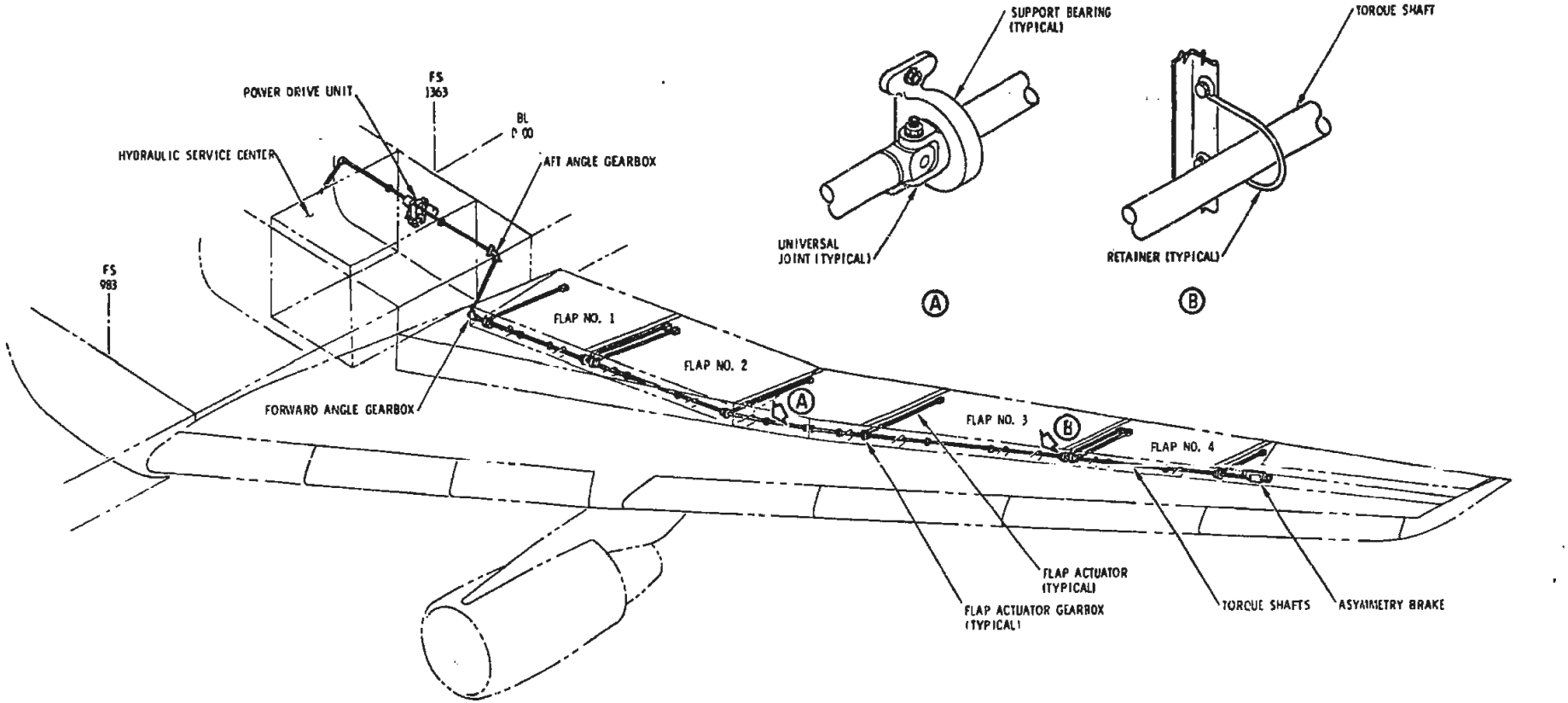
11. Ballscrew Actuator

A. Description

Two ballscrew actuators (Ref. Fig. 14) are used to actuate each flap. The actuator includes a shaft which mates with the actuator gearbox (Ref. Para. 10), a roller carriage which serves as the ballscrew nut, and a front support. The front support is secured to the flap torque box and absorbs



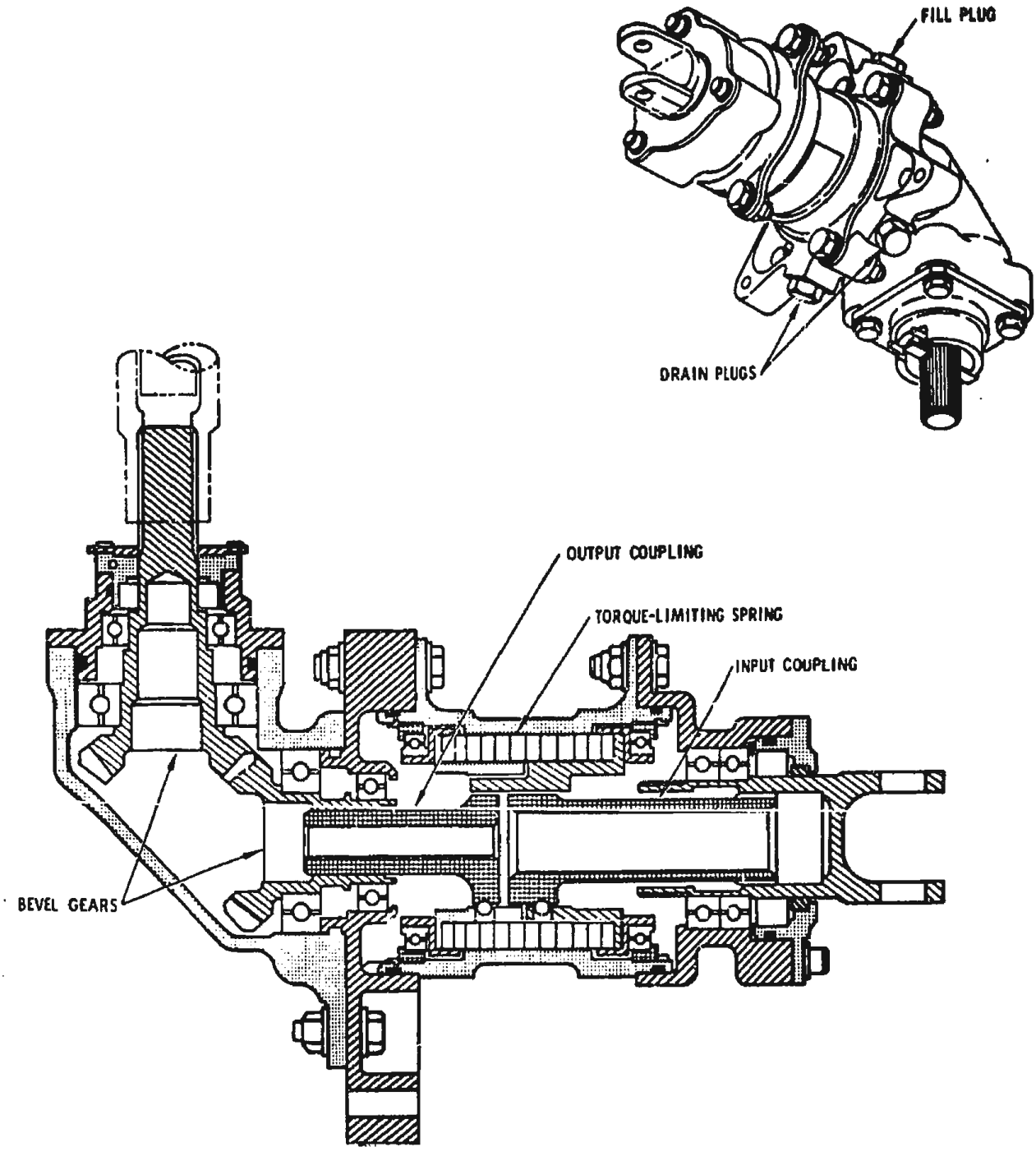
PDU Mechanical Schematic
Figure 10



C 4P
A11-A00-27-

Torque Shaft Drive Train
Figure 11

R
R
0018 EFFECTIVITY: ALL



HH 6561
M1-A00-27-217

90-degree Gearbox
Figure 12

radial loads from the shaft forward end. The actuator is supported at the aft end by the rear mount (Ref. Para. 13). The flap actuator yoke (Ref. Para. 12) attaches to the carriage and transmits actuator motion to the flap.

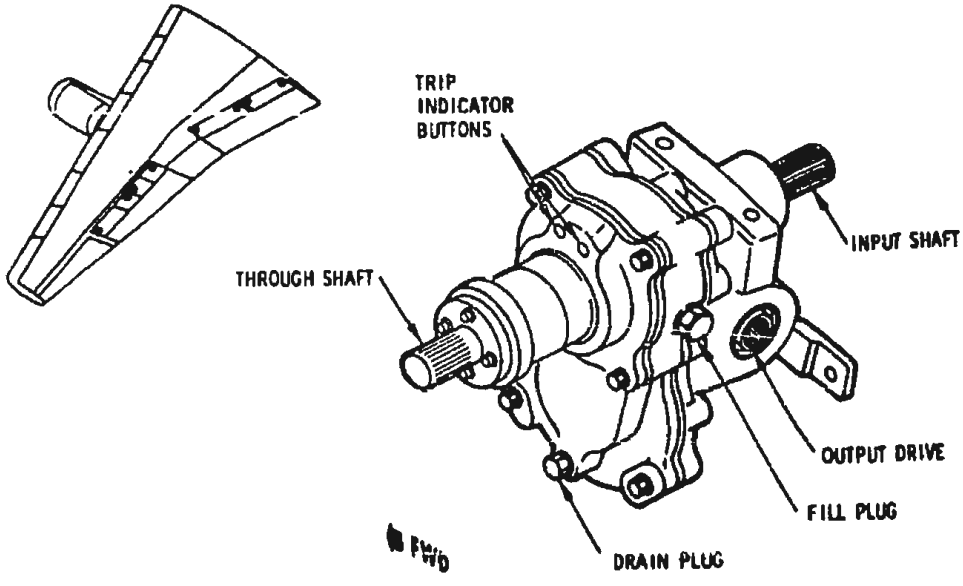
The roller carriage incorporates four roller bearings, sized according to load, at each end. The two external rollers, which operate outside the track support structure, are adjustable. Grease fittings are provided to lubricate the rollers and the ballscrew nut. Carriage travel in both directions is limited by stops.

The ballscrew actuators are identified as No. 1 through No. 8, inboard to outboard. All actuators are similar except for the length of the shaft which varies to provide carriage travel as follows:

Actuator No. 1, 2, 3 and 4	51 inches
Actuator No. 5	48 inches
Actuator No. 6 and 7	42 inches
Actuator No. 8	37 inches.

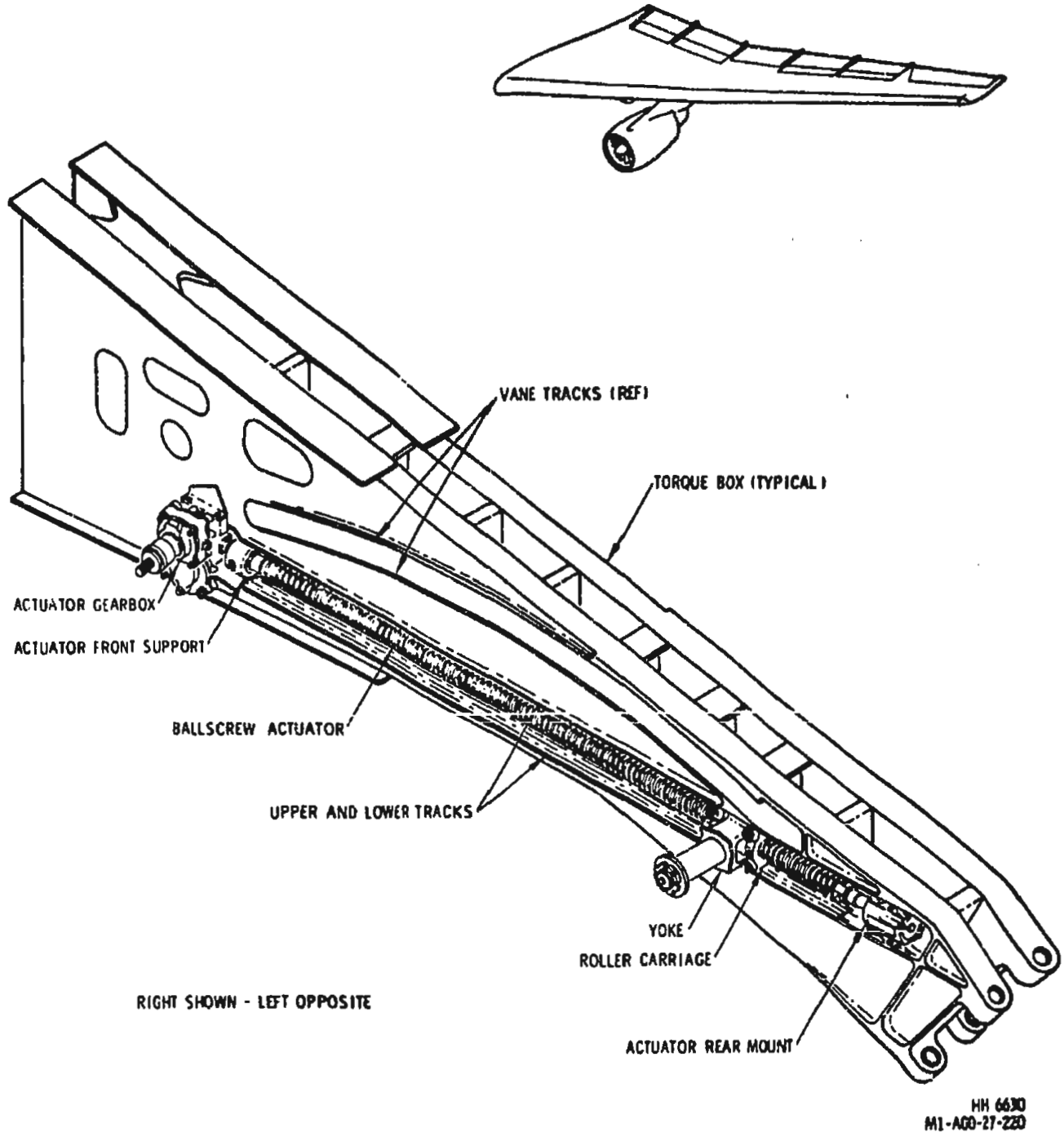
12. Actuator Yoke

A. Description



HH 6560
M1-A00-27-216

Flap Actuator Gearbox
Figure 13



Ballscrew Actuator Installation
Figure 14

The flap actuator yoke (Ref. Fig. 14) supports the flap leading edge and transmits actuator forces to the flap. The forked end of the yoke attaches to the actuator carriage; the shaft end attaches to the flap end rib. A grease fitting is provided for lubrication of the bearing surface at the flap end.

13. Actuator Rear Mount

A. Description

The ballscrew actuator rear mount (Ref. Fig. 14) is secured to the torque box. Bearings absorb both radial and thrust loads from the ballscrew actuator. The rear mounts are interchangeable between actuators. A grease fitting is provided for lubrication.

14. Flaps

A. Description

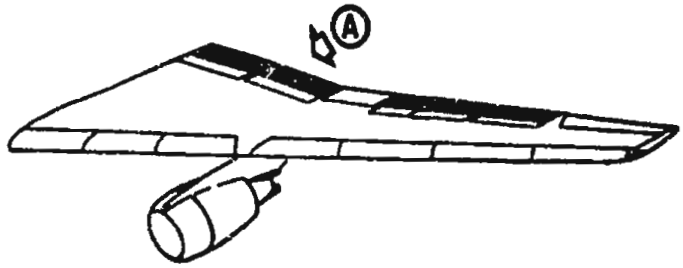
Flaps No. 1, No. 2, and No. 3 are each approximately ten feet long; flap No. 4 is approximately eight feet long. The two inboard flaps have a chord width of approximately five and one-half feet; chord width of the outboard flaps is approximately four feet. Ref. 57-50-00, Wings, for details of construction.

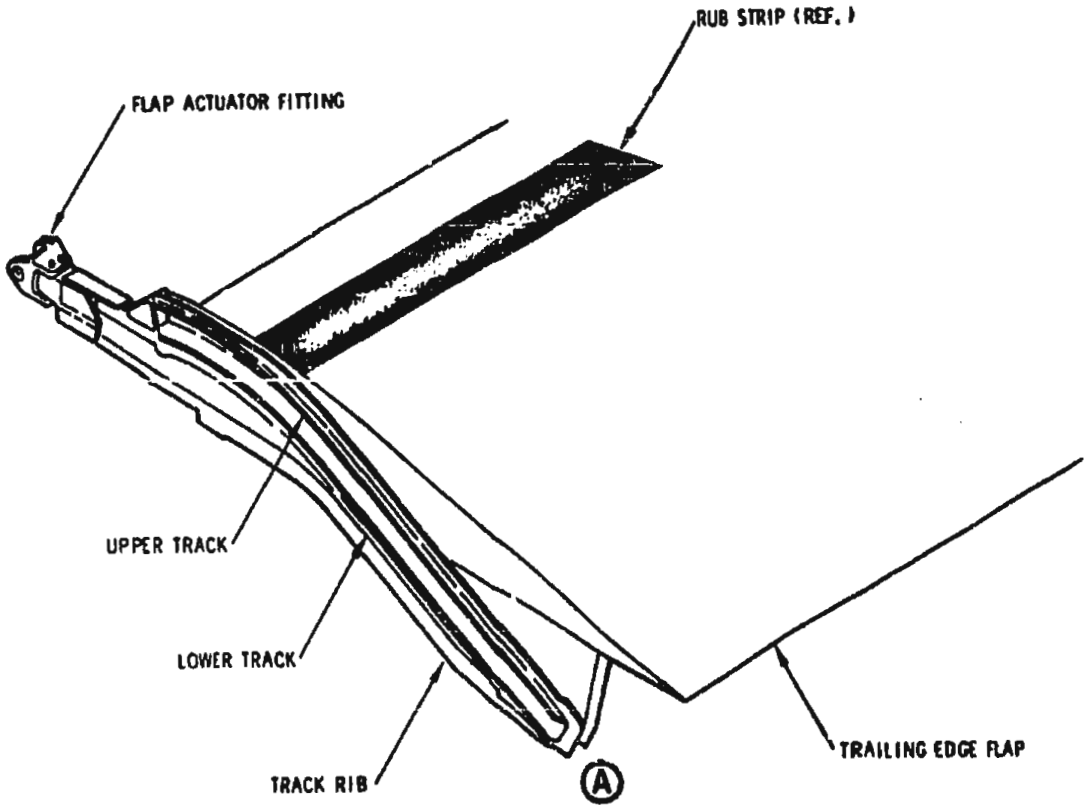
Forged ribs at either end of each flap incorporate upper and lower curved tracks as shown in Fig. 15. The tracks support and guide the flap on swing link carriages (Ref. Para. 15) which are mounted on the flap torque boxes. The flap actuator fittings are also attached to the track ribs. They connect to the actuator yokes and transmit actuator force to the flap. The inboard fitting on each flap incorporates a pivot joint to compensate for wing deflection; the outboard fitting is rigidly attached to the track rib. A fail-safe coupling (clevis and tongue) is attached to the adjacent surfaces of flaps No. 1 and 2, and No. 3 and 4. A clevis is attached to flaps No. 1 and 3 and a tongue is attached to flaps No. 2 and 4. A single bolt connects mating tongues and clevises when installed on the aircraft.

15. Flap Swing Link Carriages

A. Description

The aft end of the flaps is supported and guided by swing link carriages (Ref. Fig. 16) which operate in curved tracks





HH 6551
M1-0101-27-202

Trailing Edge Flap
Figure 15

on the flap end ribs. The carriages are mounted by eccentric pins to the swing links which are installed at the rear of the flap torque boxes.

Essentially, each carriage includes a body and two frog assemblies. Four rollers, sized according to load, are installed on each frog. The two external rollers, which operate outside the track support structure, incorporate adjustment and lubrication provisions. Adjustment of a pair of rollers is accomplished by rotating the eccentric inner race of the external roller. Similarly, a fitting at the external roller provides lubrication to both rollers in the pair.

The carriage body incorporates a monoball bearing to support the mounting pin. This ensures even load distribution through the rollers to the track.

16. Flap Vanes

A. Description

Each of the four vanes, left and right, approximately matches the corresponding flap in length; chord width varies from 15 to 22 inches, outboard to inboard. Ref. 57-50-00, Wings, for details of construction.

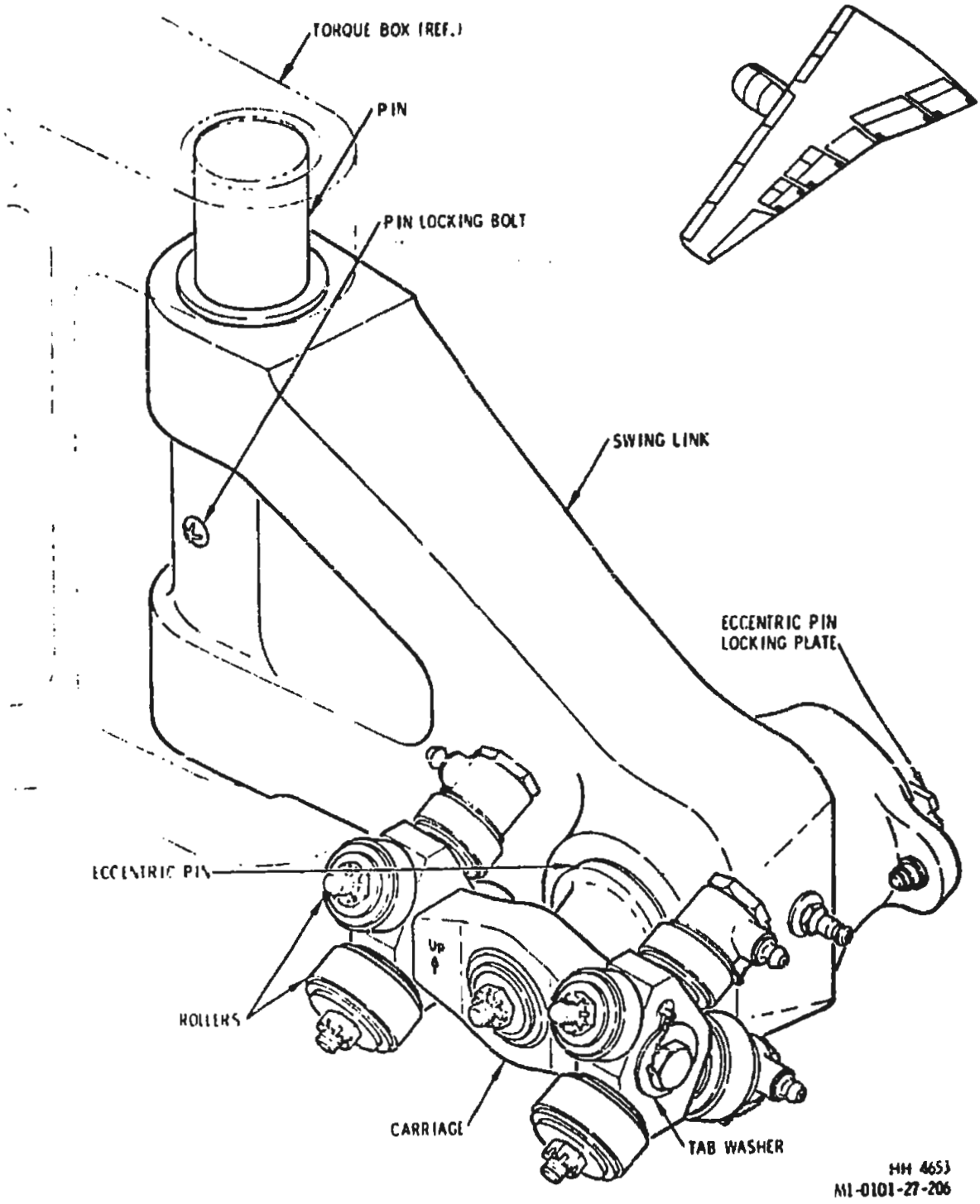
The vanes (Ref. Fig. 17) are supported at each end rib by fittings to which the roller carriages are linked. The roller carriages (Ref. Para. 17) operate in the curved tracks on the flap torque boxes. A clevis on each fitting serves as the attach point for the vane actuators (Ref. Para. 18).

17. Vane Carriages

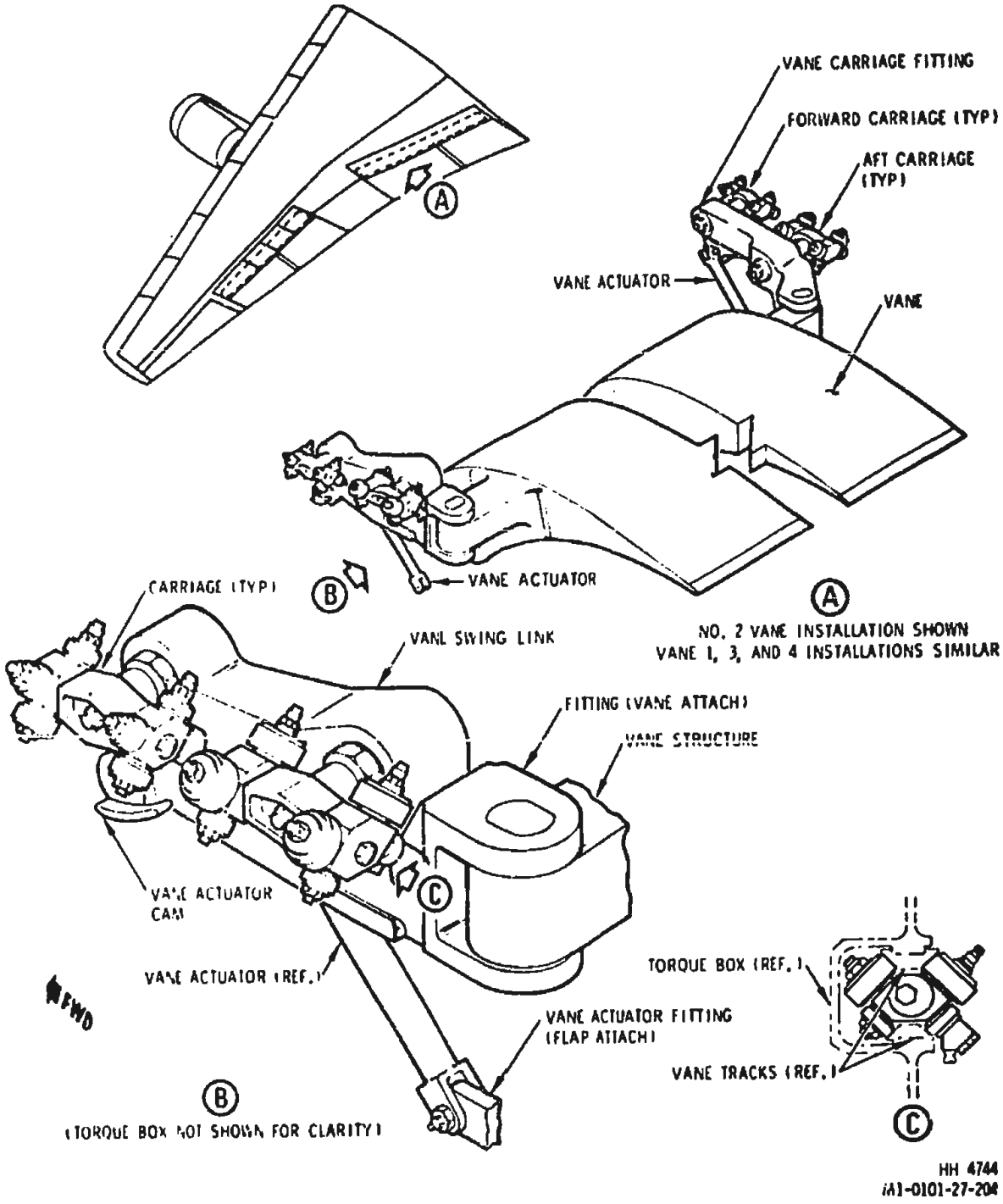
A. Description

The flap vanes are supported at each end by two roller carriages (Ref. Fig. 17) which operate in tracks on the flap torque box. Both carriages are pin-mounted to a link which connects to the vane end rib fitting.

Essentially, each carriage includes a body and two frog assemblies. Four rollers, sized according to load, are installed on each frog. The two external rollers, which operate outside the track support structure, incorporate adjustment and lubrication provisions. Adjustment of a pair of rollers is accomplished by rotating the eccentric inner race of the external roller. Similarly, a fitting at the



Flap Swing Link Carriage
Figure 16



Flap Vane
Figure 17

external roller provides lubrication to both rollers in the pair.

The carriage body incorporates a monoball bearing to support the mounting pin. This ensures even load distribution through the rollers to the track. In addition, the carriage-mounting link on one side of each vane is a swing link which compensates for wing deflection.

18. Vane Actuators

A. Description

Each vane is operated by two actuators (Ref. Fig. 18) which connect the vane to the flap; one is located at each end of each flap. The vane actuator includes two interconnecting link assemblies which permit the actuator to fold when retracting. The forward link attaches to the vane carriage fitting and the aft link attaches to the flap forward fitting. A cable connects between the aft end of the forward link and a spring-loaded retainer in the aft link. The spring-loaded cable keeps the actuator extended when the flaps and vanes are extended. A cam contacts an adjustable latch roller when flaps are retracting and causes the actuator assembly to fold.

In the flaps-up position, the vane is held against the vane carriage stop in the torque box by actuator spring pressure. As the flaps are extended, the vane remains in the stowed position until the vane actuators are fully extended and latched at approximately seven and one-half degrees flap angle. Further flap extension results in a similar extension of the vane.

19. Flap Asymmetry Comparator

A. Description

The flap asymmetry comparator (Ref. Fig. 19) is identical to the slat asymmetry comparator. Both are installed in the mid electrical service center, zone 137.

The asymmetry comparator utilizes signals from the rotary transducers which are driven by the torque shaft drive train in each wing. Three separate detection channels are provided.

The comparator contains BITE circuits which are designed to compare signals between channels in the various sections of the asymmetry system. The BITE circuits will energize the

FLAP ASYM DET FAULT light on the Flight Engineer/Second Officers annunciator panel if a fault exists in any of the following components.

(1) Right wing asymmetry brake solenoid 1 and 2.

(2) Left wing asymmetry brake solenoid 1 and 2.

(3) Hydraulic system A shutoff valve solenoid 1 and 2.

(4) Hydraulic system C shutoff valve solenoid 1 and 2.

(5) External 28VDC comparator power supply 1 and 2.

(6) Internal 5VDC comparator power supply channels 1, 2, and 3.

(7) Comparator asymmetry detector channels 1, 2, and 3.

The comparator also contains a fault isolation control panel which includes two test switches and three fault indicator lights, one for each detector channel. The test switches are used to isolate the fault to a transducer or the comparator.

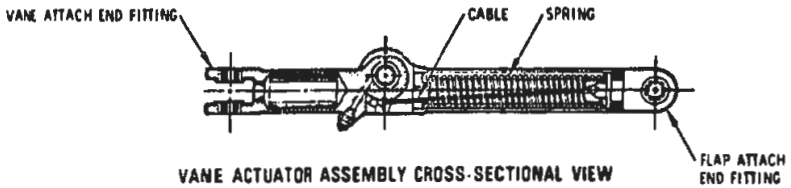
B. Operation

Each detector channel of the comparator generates a running comparison of switch actuations in both transducers (Ref. Para. 21). When one transducer has produced three switch actuations more than the other, an asymmetry signal is supplied to the voter driver. If the voter driver senses asymmetry in two of the three detector channels, it initiates signals to energize the asymmetry brakes and the power drive unit (PDU) solenoid shutoff valves. The signal to the asymmetry brakes is maintained for two seconds; the signal to the PDU solenoid valves is continuous. At the same time, a signal is supplied to the lock light driver which energizes the FLAP/SLAT LOCK light on the Flight Engineer/Second Officers annunciator panel.

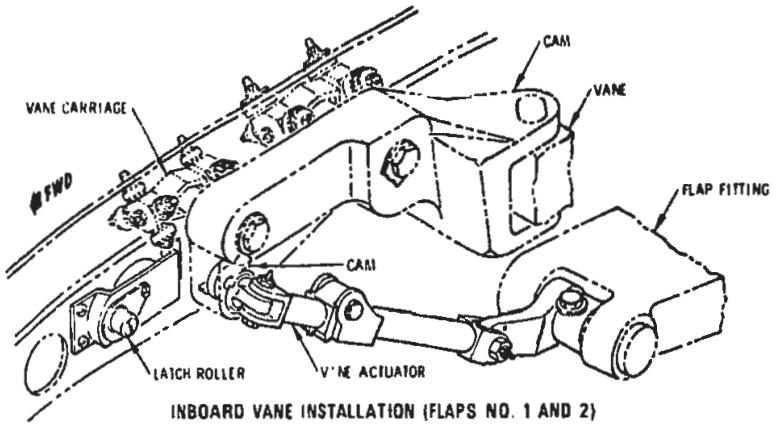
When the voter driver senses asymmetry in only one channel, the BITE circuitry will energize the FLAP ASYM DET FAULT light on the Flight Engineer/Second Officers annunciator panel.

20. Flap Asymmetry Brake

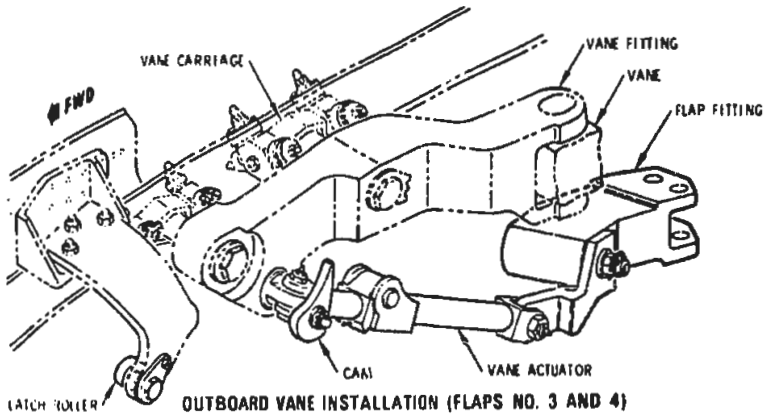
A. Description



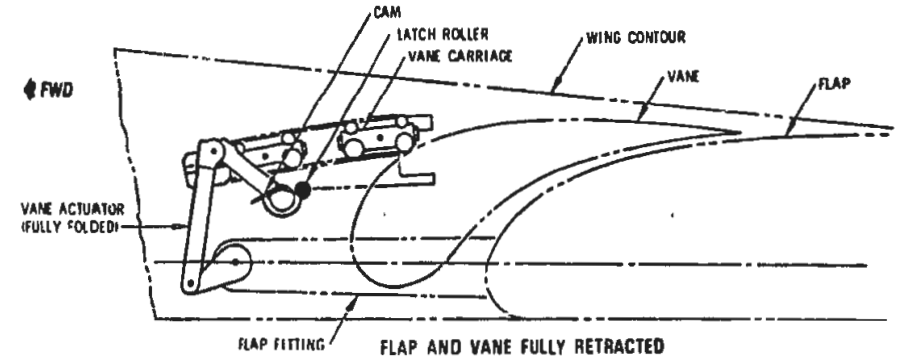
VANE ACTUATOR ASSEMBLY CROSS-SECTIONAL VIEW



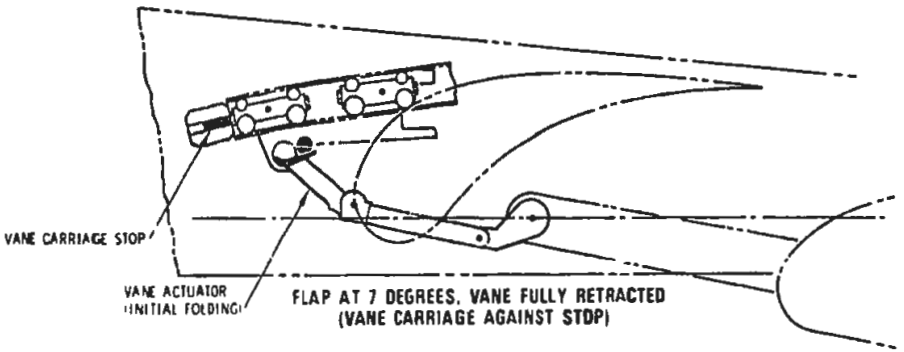
INBOARD VANE INSTALLATION (FLAPS NO. 1 AND 2)



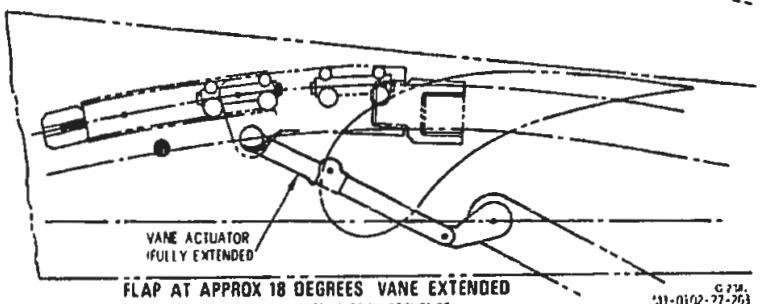
OUTBOARD VANE INSTALLATION (FLAPS NO. 3 AND 4)



FLAP AND VANE FULLY RETRACTED



FLAP AT 7 DEGREES, VANE FULLY RETRACTED (VANE CARRIAGE AGAINST STOP)



FLAP AT APPROX 18 DEGREES VANE EXTENDED

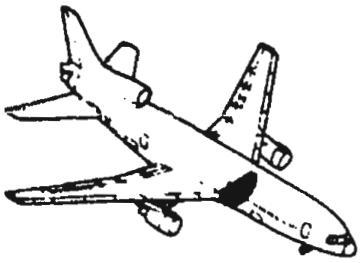
VANE ACTUATOR OPERATIONAL SEQUENCE

G P.M. 101-0102-27-203

Vane Actuator
Figure 18

R
R
001B

EFFECTIVITY: ALL



FAULT ISOLATION PROCEDURE

1. EXTEND THE FLAPS AND SLATS. IF A FAULT ISOLATION CHAN IND LIGHT FLASHES ON AND OFF WHILE THEY ARE IN MOTION, NOTE THE FLASHING CHANNEL AND RESET THE COMPARATOR BY CYCLING THE CIRCUIT BREAKERS IN ACCORDANCE WITH THE MAINTENANCE MANUAL. IF NO LIGHTS FLASH OR IF THE ASYM DET FAULT LIGHT COMES BACK ON AFTER RESET, GO TO STEP 6.

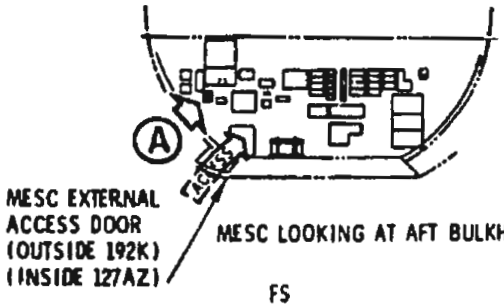
CAUTION

DEPRESSING OR RELEASING THE TRC. SELF TEST SWITCH WHILE THE FLAPS OR SLATS ARE MOVING MAY CAUSE THE SYSTEM TO LOCK UP.

2. DEPRESS AND HOLD THE LEFT WING TROUBLE TEST SWITCH AND RETRACT THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE LEFT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
3. DEPRESS AND HOLD THE RIGHT WING TROUBLE TEST SWITCH AND EXTEND THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE RIGHT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
4. IF IN STEP 2 AND 3 THE SAME CHAN IND LIGHT AS STEP 1 FLASHES, REPLACE THE ASYMMETRY COMPARATOR.
5. IF NO CHAN IND LIGHTS FLASH INDICATING NORMAL COMPARATOR AND TRANSDUCERS, OR IF RESETTING THE CIRCUIT BREAKERS DO NOT CLEAR ASYM DET FAULT LIGHT, REFER TO MAINTENANCE MANUAL CHAPTER 27-51 FLAPS (OR 27-81 SLATS), FAULT ISOLATION SECTION FOR ISOLATION TO SHUT OFF VALVES, BRAKE SOLENOIDS, 28 VOLT SUPPLIES, OR COMPARATOR.

NOTE: IF THE FLAP/SLAT SYSTEMS AND THE ASYMMETRY COMPARATOR INDICATORS ARE NORMAL BUT THE COCKPIT INDICATION IS ABNORMAL, REFER TO THE ILCR TEST IN THE MAINTENANCE MANUAL CHAPTER 33-17-00, PAGE 501.

(DECAL FOR -115 COMPARATOR)



MESC EXTERNAL ACCESS DOOR (OUTSIDE 192K) (INSIDE 127AZ)

MESC LOOKING AT AFT BULKHEAD

FAULT ISOLATION PROCEDURE

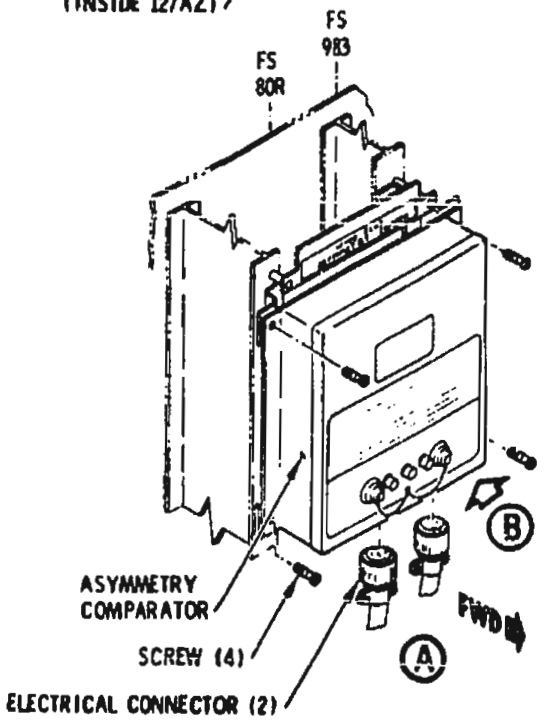
WITH FLAPS/SLATS MOVING, FULLY DEPRESS LEFT WING TROUBLE TEST SWITCH, WHILE CHAN IND IS OFF AND HOLD FOR AT LEAST FIVE SECONDS. RELEASE ONLY WHEN CHAN IND OFF. REPEAT WITH RIGHT WING TROUBLE TEST SWITCH.

CAUTION: PRESSING EITHER TROUBLE TEST SWITCH WHILE THE CHAN IND IS ON WILL CAUSE ASYMMETRY LOCKUP

IF THE LIGHTED CHAN IND EXTINGUISHES AND ANOTHER CHAN IND ILLUMINATES FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THE SWITCH CAUSING THE CHANGE.

IF CHAN IND DOES NOT CHANGE POSITION FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE THE COMPARATOR 672[illegible].

(DECAL FOR -111 COMPARATOR)



ASYMMETRY COMPARATOR

SCREW (4)

ELECTRICAL CONNECTOR (2)

FAULT ISOLATION PROCEDURE

WITH FLAPS / SLATS MOVING, PRESS AND HOLD LEFT WING THEN RIGHT WING TEST SWITCH FOR AT LEAST FIVE SECONDS EACH.

IF CHANNEL INDICATOR CHANGES POSITION FOR EITHER SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THAT SWITCH CAUSING CHANGE.

ALL OTHER COMBINATIONS OF FAILURES INDICATE A FAULTY COMPARATOR 672838

(DECAL SHOWN FOR -109 COMPARATOR)

B

M1-0003-27-223

Flap Asymmetry Comparator
Figure 19

An asymmetry brake (Ref. Fig. 20) is located at the outboard end of the torque shaft drive train in each wing. It is actuated by a signal from the asymmetry comparator or by the integral overspeed governor and is capable of holding 500 in. lb. of torque. Provisions are incorporated for mounting and driving the asymmetry rotary transducer and the flap position transmitter.

The asymmetry brake incorporates a rocker arm and roller assembly which trips a spring mechanism to set the brake. The rocker arm is tripped by a solenoid energized from the asymmetry comparator when asymmetry is detected, or by the governor when an overspeed occurs. A reset knob is provided to reset the brake; the knob position indicates if the brake is tripped.

21. Flap Asymmetry Transducer

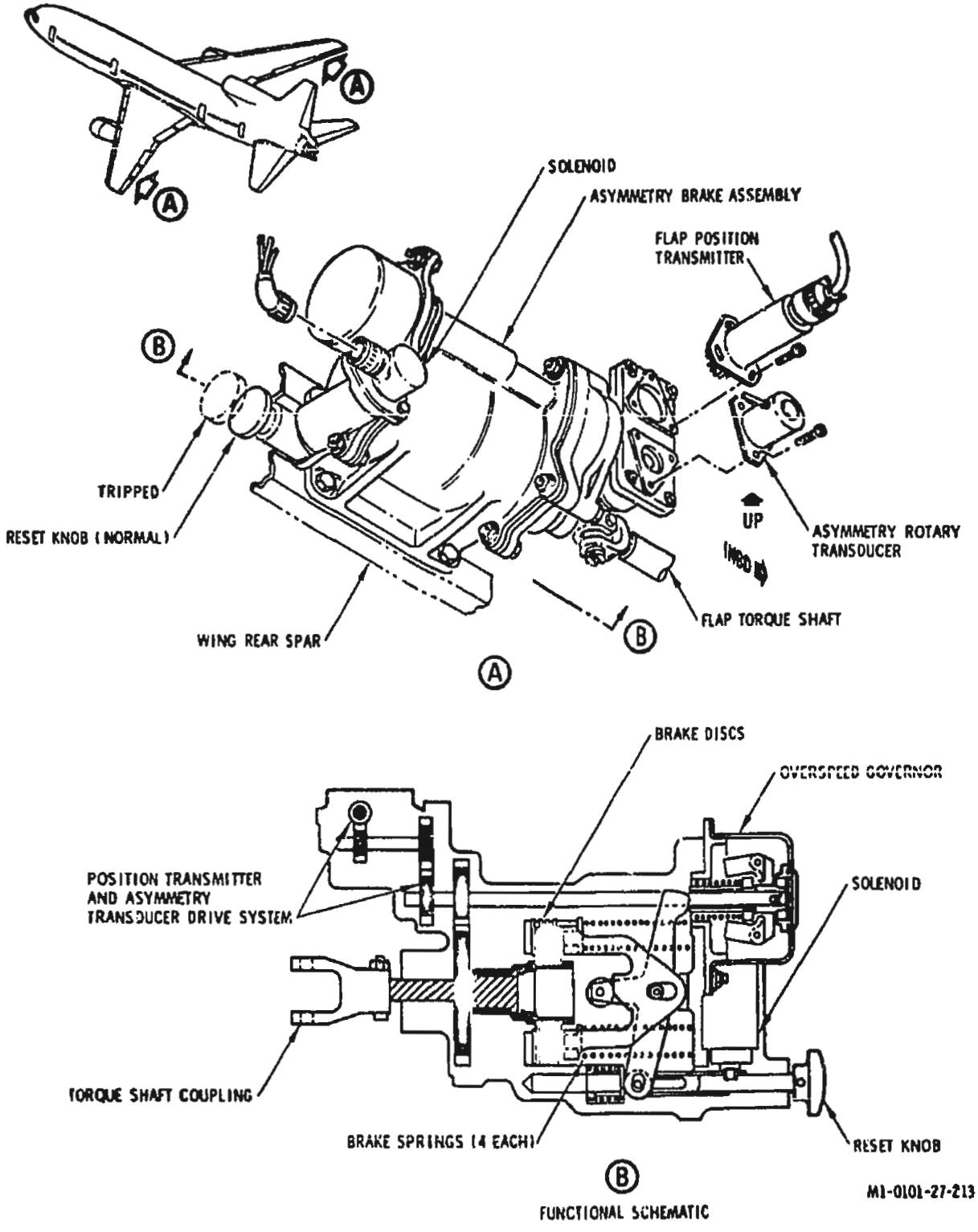
A. Description

Two rotary bi-directional transducers, identical to those in the slat asymmetry system, are incorporated in the flap asymmetry system. A transducer is mounted on, and driven by the flap asymmetry brake in each wing. The transducers rotate in opposite directions with respect to each other. Three separate switch channels in each transducer provide the input to the asymmetry comparator. Each channel incorporates two brush and commutator type switches. Rotation of the transducer shaft and commutator produces electrical signals that indicate amount and direction of shaft rotation. Each switch actuates several times during a complete revolution.

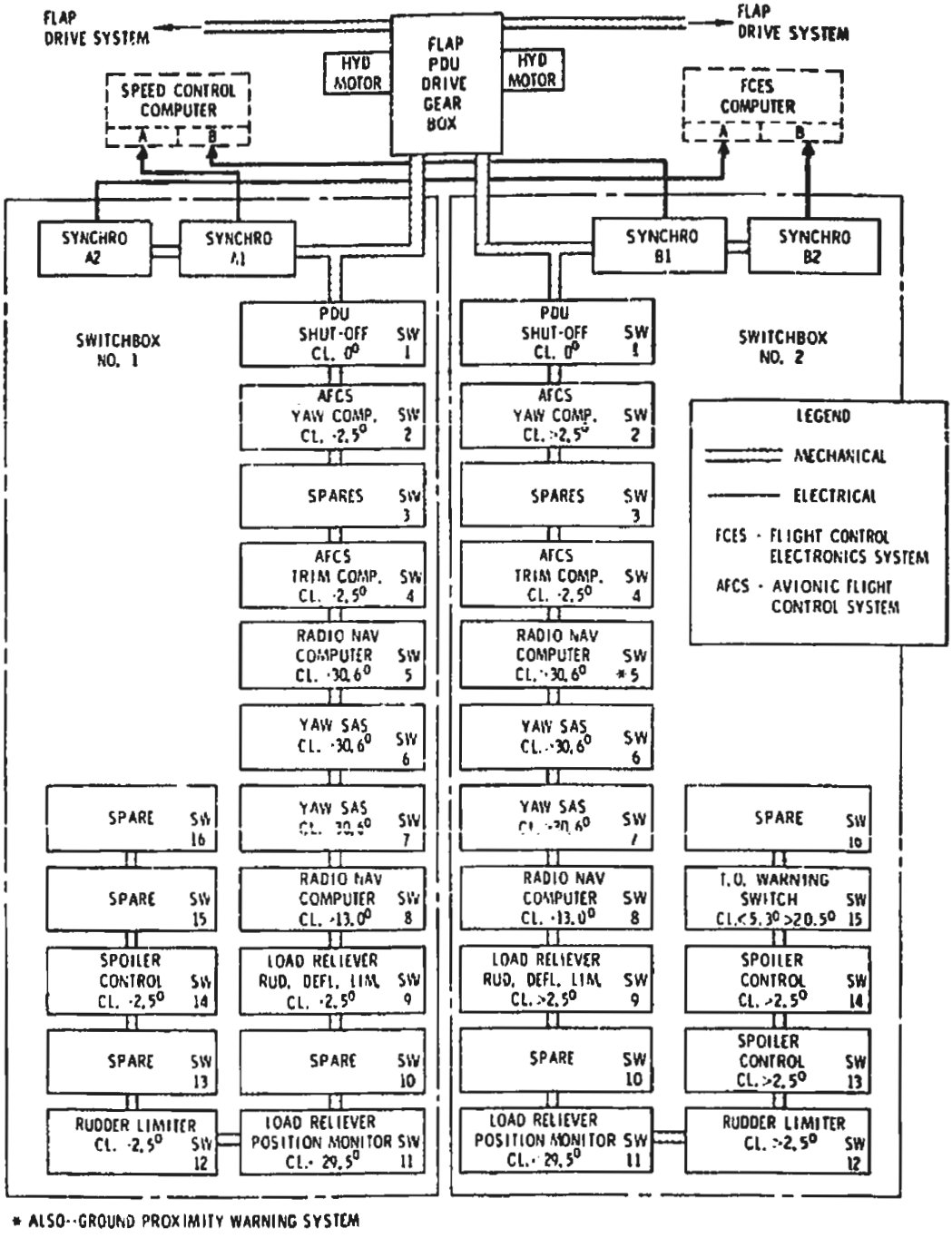
22. Flap Power Drive Unit (PDU) Limit Switchbox

A. Description

Two limit switchboxes are mounted on the flap PDU (Ref. Fig. 9); both switchboxes are identical. The switchbox contains 4 synchros and 16 switches which are used to provide flap position signals to the various flight and autoflight system components and to the Ground Proximity Warning System. Figure 21 indentifies each switch and its function.



Flap Asymmetry Brake
Figure 20


FLAP DRIVE SYSTEM
FLAP DRIVE SYSTEM
FLAP PDU DRIVE GEAR BOX
HYD MOTOR
HYD MOTOR
SPEED CONTROL COMPUTER
A I B
FCES COMPUTER
A I B
SYNCHRO A2
SYNCHRO A1
SYNCHRO B1
SYNCHRO B2
SWITCHBOX NO. 1
SWITCHBOX NO. 2
PDU SHUT-OFF CL. 0° SW 1
AFCS YAW COMP. CL. -2.5° SW 2
SPARES SW 3
AFCS TRIM COMP. CL. -2.5° SW 4
RADIO NAV COMPUTER CL. -30.6° SW 5
YAW SAS CL. -30.6° SW 6
SPARE SW 16
SPARE SW 15
SPOILER CONTROL CL. -2.5° SW 14
SPARE SW 13
RUDDER LIMITER CL. -2.5° SW 12
YAW SAS SW 7
RADIO NAV COMPUTER CL. -13.0° SW 8
LOAD RELIEVER RUD. DEFL. LIM. CL. -2.5° SW 9
SPARE SW 10
LOAD RELIEVER POSITION MONITOR CL. -29.5° SW 11
PDU SHUT-OFF CL. 0° SW 1
AFCS YAW COMP. CL. >2.5° SW 2
SPARES SW 3
AFCS TRIM COMP. CL. -2.5° SW 4
RADIO NAV COMPUTER CL. -30.6° SW *5
YAW SAS CL. -30.6° SW 6
YAW SAS SW 7
RADIO NAV COMPUTER CL. -13.0° SW 8
LOAD RELIEVER RUD. DEFL. LIM. CL. >2.5° SW 9
SPARE SW 10
LOAD RELIEVER POSITION MONITOR CL. -29.5° SW 11
SPARE SW 16
T.O. WARNING SWITCH CL. <5.3° >20.5° SW 15
SPOILER CONTROL CL. >2.5° SW 14
SPOILER CONTROL CL. >2.5° SW 13
RUDDER LIMITER CL. >2.5° SW 12
LEGEND
MECHANICAL
ELECTRICAL
FCES - FLIGHT CONTROL ELECTRONICS SYSTEM
AFCS - AVIONIC FLIGHT CONTROL SYSTEM
* ALSO--GROUND PROXIMITY WARNING SYSTEM

M1-0001-27-995

CR Flap Power Drive Unit Limit Switchbox Block Diagram
CR Figure 21

TRAILING EDGE FLAP SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagram/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

Table 101

FIGURE	TITLE
101	Component Locator Index
102	Component Locator Diagram
103	FLAP/SLAT LOCK Light (FE/SO Annunciator Panel) On
104	FLAP ASYM DET FAULT Light (FE/SO Annunciator Panel) On
105	Flaps Inoperative, FLAP/SLAT LOCK Light (FE/SO Annunciator Panel) Off
106	Jam or Binding in Flap Drive System
107	Flap PDU Inoperative On One Hydraulic System, OK On Other

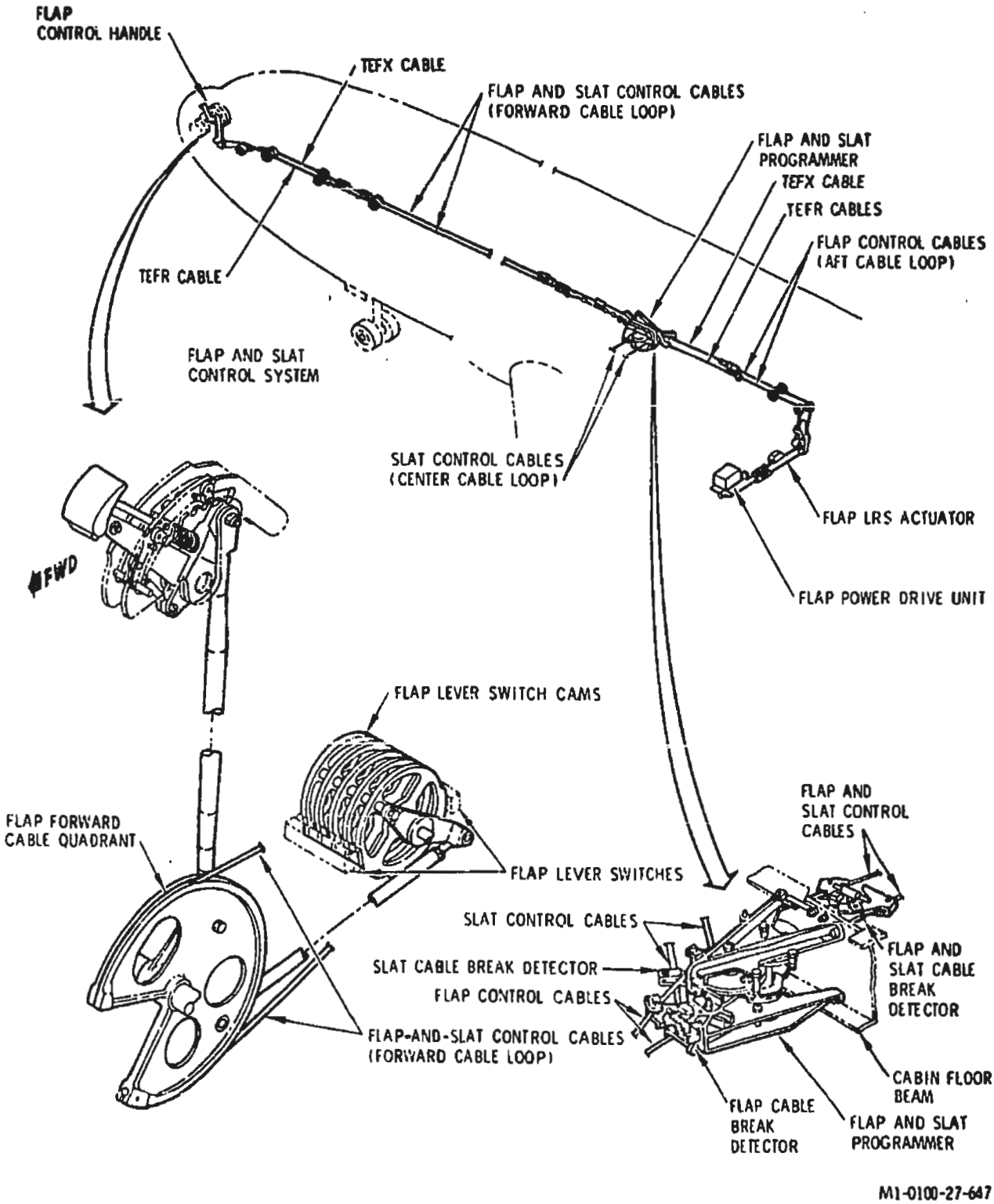
(Cont)
Table 101

FIGURE	TITLE
108	Flap Handle Force Excessive
109	Asymmetry Brake Tripped
110	LRS INOP Light (Center Console FLAP LRS OVRD Switchlight) On
111	FLAP LRS INOP Light (Pilots Annunciator) and LRS INOP Switchlight On
112	Flaps Will Not Fully Retract
SCHEM 1	Flap Lever and Throttle Switch Electrical Schematic
SCHEM 2	Flap PDU Control System Electrical Schematic
SCHEM 3	Flap Asymmetry System Electrical Schematic
SCHEM 4	Flap Load Relieving System (LRS) Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ADC	2	FESC/112AB	34-14-01
ACTUATOR - FLAP LRS	1	HSC/147AB	27-51-07
BRAKE - ASYMMETRY FLAP	2	571AB-1, 671AB-1	27-51-50
CIRCUIT BREAKERS:			
FLAP LOAD RELIEF - CHAN 1 2751-CB4	1	FLT STA/CB2-H12	
FLAP LOAD RELIEF - CHAN 2 2751-CB5	1	FLT STA/CB2-H20	
FLAP LOAD RELIEF - IND 2751-CB6	1	FLT STA/CB2-H13	
LOCK LIGHT TE FLAP 2751-CB2	1	FLT STA/CB1-J13	
NO. 1 ASYM BRAKE LE SLAT 2780-CB2	1	FLT STA/CB2-H22	
NO. 1 ASYM BRAKE TE FLAP 2700-CB3	1	FLT STA/CB2-H21	
NO. 2 ASYM BRAKE LE SLAT 2780-CB1	1	FLT STA/CB1-J10	
NO. 2 ASYM BRAKE TE FLAP 2700-CB2	1	FLT STA/CB1-J11	
POS IND TE FLAP 2752-CB1	1	FLT STA/CB3-K16	
COMPARATOR - FLAP ASYMMETRY	1	MESC/192K, 192EA	27-51-49
COMPARATOR - PDU DIVERGENCE	1	HSC/147AB	27-51-58
COMPUTER - FLAP LRS	1	FESC/112AB	27-51-06
CONTROL HANDLE ASSY - FLAP	1	FLT STA/842, 843	27-51-01
ILCB 1A27	1	MESC/192K, 192EA	33-17-34
MOTOR - HYDRAULIC, PDU	2	HSC/147AB	27-51-14
POWER DRIVE UNIT - FLAP	1	HSC/147AB	27-51-08
SWITCHBOX - FLAP PDU	2	HSC/147AB	27-51-12
SWITCH - BREAK DETECTOR	2	MESC/192K, 192EA	27-51-04
SWITCH - START UP	2	ON PDU/147AB	27-51-64
TRANSDUCER - ASYMMETRY	2	ASYM BRAKE/571AB, 671AB	27-51-51
VALVE - SOLENOID S/O, PDU	2	ON PDU/511BT	27-81-05

M1--0001--27--866

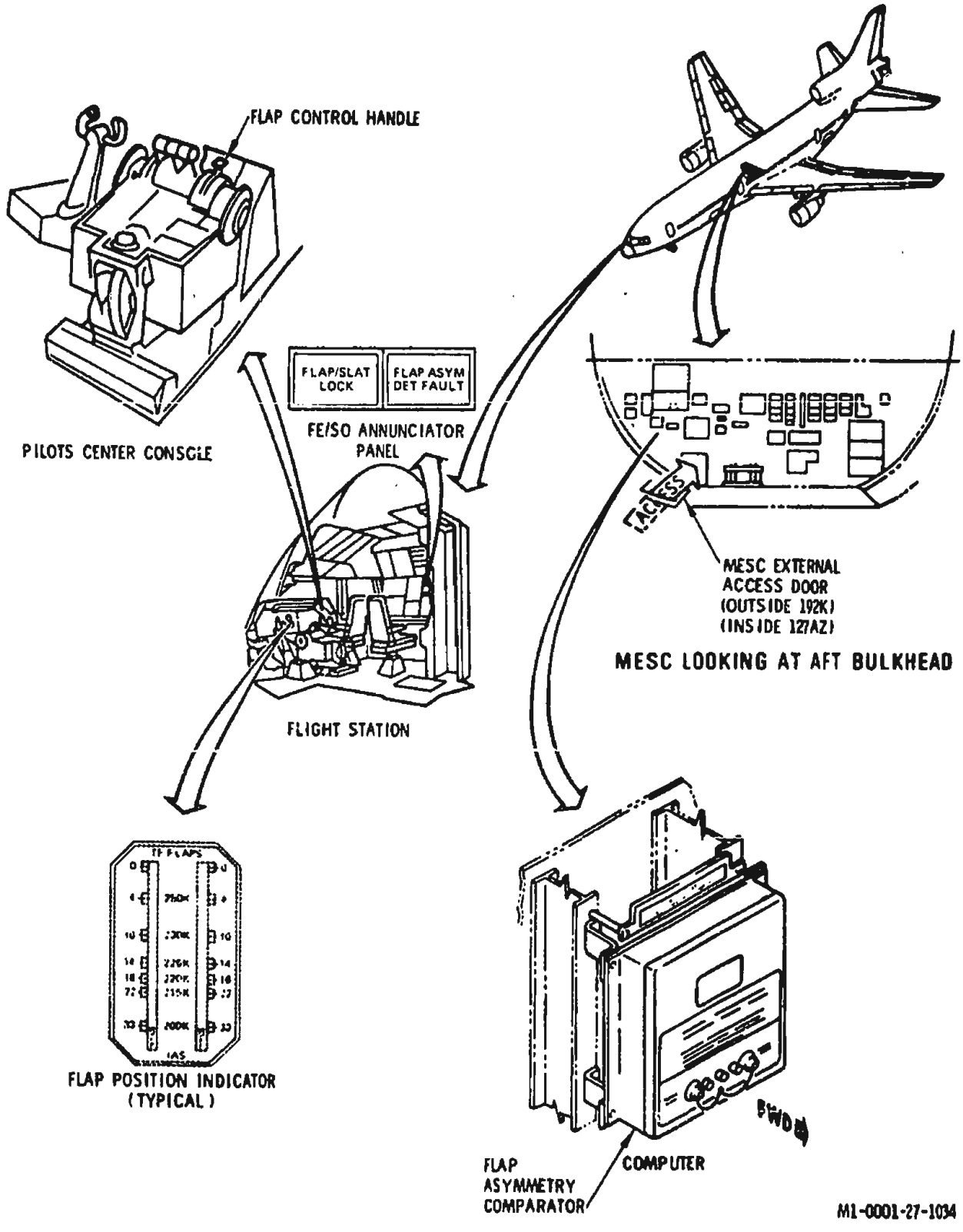
R Flap Control System Component Locator Index
R Figure 101



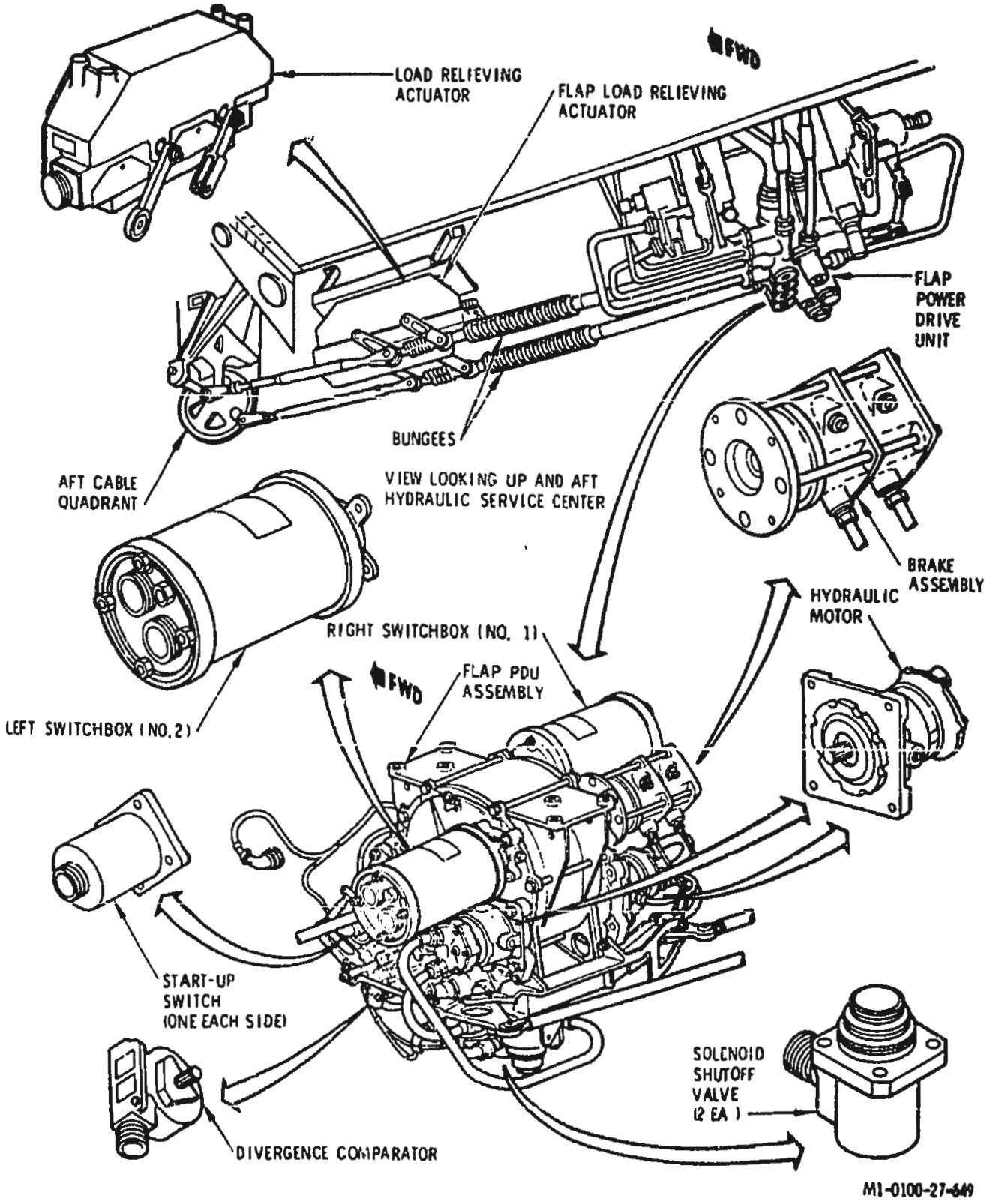
M1-0100-27-647

R Flap Control System Component Locator
R Figure 102 (Sheet 1)

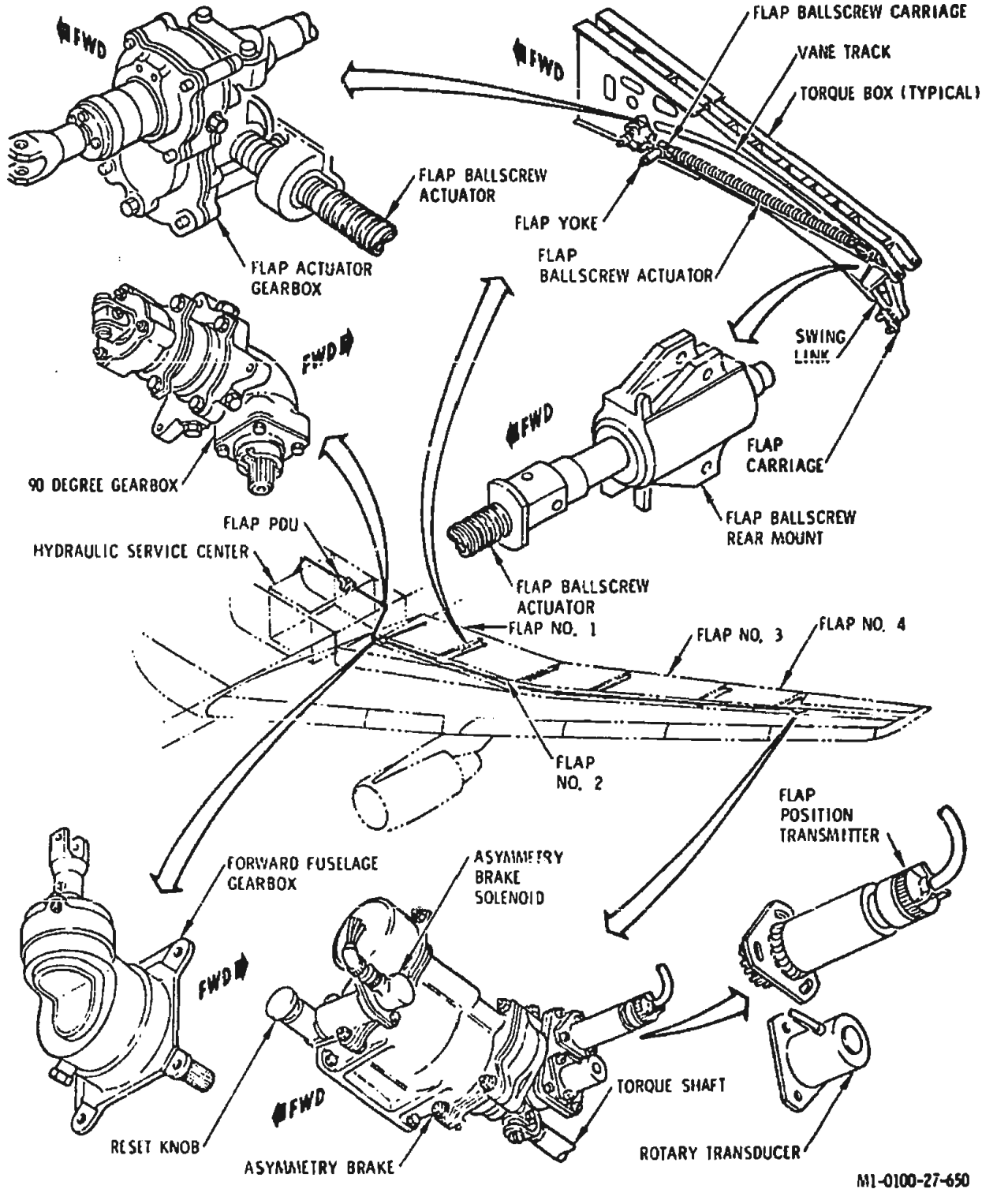
EFFECTIVITY: ALL



R Flap Control System Component Locator
R Figure 102 (Sheet 2)



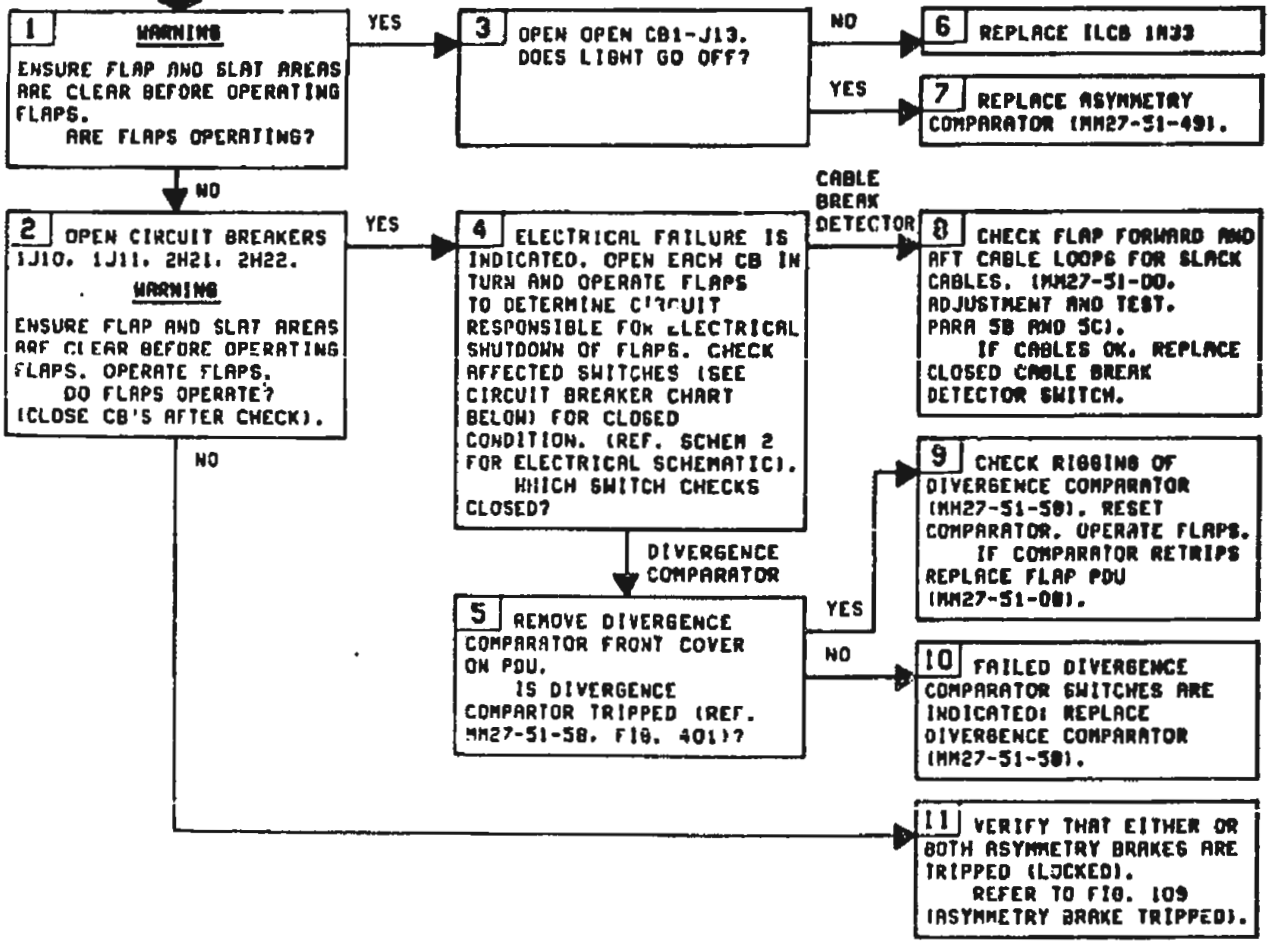
Flap Control System Component Locator
Figure 102 (Sheet 3)



R Flap Control System Component Locator
R Figure 102 (Sheet 4)

EFFECTIVITY: ALL

PREREQUISITES
HYDRAULIC POWER SYSTEM A AND C (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB7S: 1J10, 1J11, 1J13, 2H21, 2H22


FLAP/SLAT LOCK LIGHT (FE/SO PANEL) ON /1\
1 WARNING
ENSURE FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS.
ARE FLAPS OPERATING?
YES
3 OPEN OPEN CB1-J13. DOES LIGHT GO OFF?
NO
6 REPLACE ILCB 1M33
YES
7 REPLACE ASYMMETRY COMPARATOR (MM27-51-49).
NO
2 OPEN CIRCUIT BREAKERS 1J10, 1J11, 2H21, 2H22.
WARNING
ENSURE FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS. OPERATE FLAPS.
DO FLAPS OPERATE?
(CLOSE CB'S AFTER CHECK).
YES
4 ELECTRICAL FAILURE IS INDICATED. OPEN EACH CB IN TURN AND OPERATE FLAPS TO DETERMINE CIRCUIT RESPONSIBLE FOR ELECTRICAL SHUTDOWN OF FLAPS. CHECK AFFECTED SWITCHES (SEE CIRCUIT BREAKER CHART BELOW) FOR CLOSED CONDITION. (REF. SCHEM 2 FOR ELECTRICAL SCHEMATIC).
WHICH SWITCH CHECKS CLOSED?
CABLE BREAK DETECTOR
8 CHECK FLAP FORWARD AND AFT CABLE LOOPS FOR SLACK CABLES. (MM27-51-00, ADJUSTMENT AND TEST, PARA 5B AND 5C).
IF CABLES OK, REPLACE CLOSED CABLE BREAK DETECTOR SWITCH.
DIVERGENCE COMPARATOR
5 REMOVE DIVERGENCE COMPARATOR FRONT COVER ON PDU.
IS DIVERGENCE COMPARTOR TRIPPED (REF. MM27-51-58, FIG. 401)?
YES
9 CHECK RIGGING OF DIVERGENCE COMPARATOR (MM27-51-58). RESET COMPARATOR. OPERATE FLAPS.
IF COMPARATOR RETRIPS REPLACE FLAP PDU (MM27-51-08).
NO
10 FAILED DIVERGENCE COMPARATOR SWITCHES ARE INDICATED: REPLACE DIVERGENCE COMPARATOR (MM27-51-58).
NO
11 VERIFY THAT EITHER OR BOTH ASYMMETRY BRAKES ARE TRIPPED (LOCKED).
REFER TO FIG. 109 (ASYMMETRY BRAKE TRIPPED).

CIRCUIT BREAKER CHART

CIRCUIT BREAKER	CABLE BREAKER DETECTOR SWITCH /2\	DIVERGENCE COMPARATOR SWITCH /3\
CB1-J10	LE AND TE SWITCH S2	CHAN 2
CB1-J11	TE SWITCH S4	
CB2-H21	TE SWITCH S11	CHAN 1
CB2-H22	LE AND TE SWITCH S1	

81-0001-27-054

NOTE

/1\ FLAT/SLAT LOCK LIGHT CAN BE ENERGIZED BY ANY OF THE FOLLOWING:
1. FLAP ASYMMETRY SYSTEM
2. PDU DIVERGENCE COMPARATOR
3. CABLE BREAK DETECTORS

/2\ CABLE BREAK DETECTOR SWITCHES ACCESSIBLE IN MID-ELECTRICAL SERVICE CENTER (MESC)

/3\ DIVERGENCE COMPARATOR SWITCH TO PDU IN HYDRAULIC SERVICE CENTER

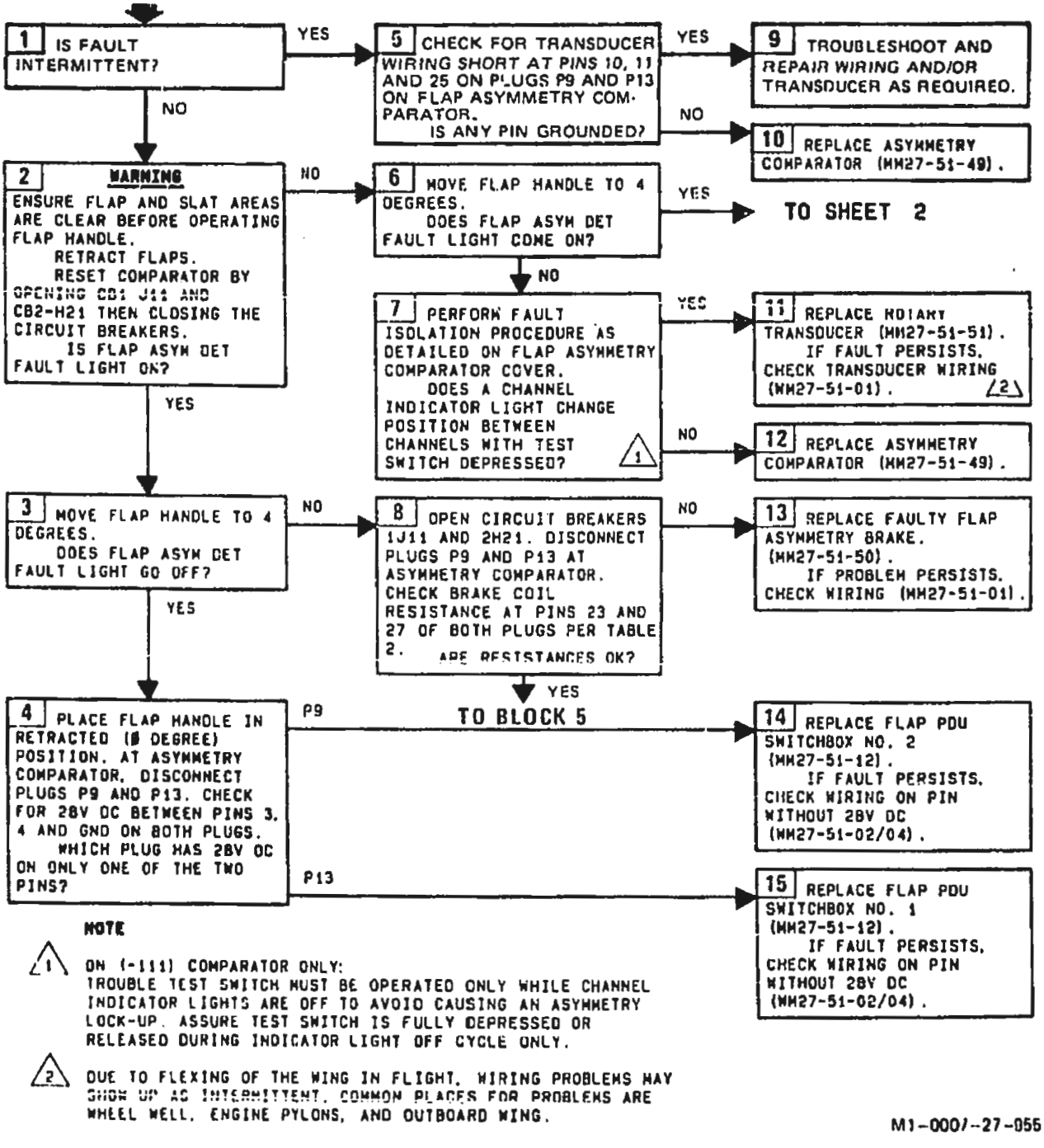
R R FLAP/SLAT Lock Light (FE/SO Annunciator Panel) On
Figure 103

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00)
CB'S: 1J11, 1J12, 1J13, 2H21

FLAP ASYM DET FAULT LIGHT ON (FE/SO ANNUNCIATOR PANEL)


1 IS FAULT INTERMITTENT?
YES
NO
5 CHECK FOR TRANSDUCER WIRING SHORT AT PINS 10, 11 AND 25 ON PLUGS P9 AND P13 ON FLAP ASYMMETRY COMPARATOR. IS ANY PIN GROUNDED?
YES
NO
9 TROUBLESHOOT AND REPAIR WIRING AND/OR TRANSDUCER AS REQUIRED.
10 REPLACE ASYMMETRY COMPARATOR (MM27-51-49).
2 WARNING ENSURE FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAP HANDLE. RETRACT FLAPS. RESET COMPARATOR BY OPENING CB1 J11 AND CB2-H21 THEN CLOSING THE CIRCUIT BREAKERS. IS FLAP ASYM DET FAULT LIGHT ON?
NO
6 MOVE FLAP HANDLE TO 4 DEGREES. DOES FLAP ASYM DET FAULT LIGHT COME ON?
YES
TO SHEET 2
NO
7 PERFORM FAULT ISOLATION PROCEDURE AS DETAILED ON FLAP ASYMMETRY COMPARATOR COVER. DOES A CHANNEL INDICATOR LIGHT CHANGE POSITION BETWEEN CHANNELS WITH TEST SWITCH DEPRESSED? 1
YES
11 REPLACE ROTARY TRANSDUCER (MM27-51-51). IF FAULT PERSISTS, CHECK TRANSDUCER WIRING (MM27-51-01). 2
NO
12 REPLACE ASYMMETRY COMPARATOR (MM27-51-49).
YES
3 MOVE FLAP HANDLE TO 4 DEGREES. DOES FLAP ASYM DET FAULT LIGHT GO OFF?
NO
8 OPEN CIRCUIT BREAKERS 1J11 AND 2H21. DISCONNECT PLUGS P9 AND P13 AT ASYMMETRY COMPARATOR. CHECK BRAKE COIL RESISTANCE AT PINS 23 AND 27 OF BOTH PLUGS PER TABLE 2. ARE RESISTANCES OK?
NO
13 REPLACE FAULTY FLAP ASYMMETRY BRAKE. (MM27-51-50). IF PROBLEM PERSISTS, CHECK WIRING (MM27-51-01).
YES
TO BLOCK 5
YES
4 PLACE FLAP HANDLE IN RETRACTED (0 DEGREE) POSITION. AT ASYMMETRY COMPARATOR, DISCONNECT PLUGS P9 AND P13. CHECK FOR 28V DC BETWEEN PINS 3, 4 AND GND ON BOTH PLUGS. WHICH PLUG HAS 28V DC ON ONLY ONE OF THE TWO PINS?
P9
14 REPLACE FLAP PDU SWITCHBOX NO. 2 (MM27-51-12). IF FAULT PERSISTS, CHECK WIRING ON PIN WITHOUT 28V DC (MM27-51-02/04).
P13
15 REPLACE FLAP PDU SWITCHBOX NO. 1 (MM27-51-12). IF FAULT PERSISTS, CHECK WIRING ON PIN WITHOUT 28V DC (MM27-51-02/04).

NOTE

1 ON (-111) COMPARATOR ONLY:
TROUBLE TEST SWITCH MUST BE OPERATED ONLY WHILE CHANNEL INDICATOR LIGHTS ARE OFF TO AVOID CAUSING AN ASYMMETRY LOCK-UP. ASSURE TEST SWITCH IS FULLY DEPRESSED OR RELEASED DURING INDICATOR LIGHT OFF CYCLE ONLY.

2 DUE TO FLEXING OF THE WING IN FLIGHT, WIRING PROBLEMS MAY SHOW UP AS INTERMITTENT. COMMON PLACES FOR PROBLEMS ARE WHEEL WELL, ENGINE PYLONS, AND OUTBOARD WING.

M1-0007-27-055

R FLAP ASYM DET FAULT Light (FE/SO Annunciator Panel) On
R Figure 104 (Sheet 1)

PREREQUISITES
SEE SHEET 1

FROM SHEET 1

1 OPEN FLAP ASYMMETRY CIRCUIT BREAKERS 1J11 AND 2H21. DISCONNECT PLUGS P9 AND P13 AT FLAP ASYM COMPARATOR. CHECK RESISTANCE AT PINS 3, 4, 23 AND 27 OF BOTH PLUGS PER TABLE 2.
ARE RESISTANCE VALUES OK?

NO → **2** REPLACE INDICATED COMPONENT(S).
IF FAULT PERSISTS, CHECK WIRING. (WM27-51-01/02/03/04).

YES → **3** REPLACE FLAP ASYMMETRY COMPARATOR (WM27-51-49).
IF FAULT PERSISTS, DISCONNECT PLUGS P9 AND P13 AT FLAP ASYMMETRY COMPARATOR. CHECK FOR 28V DC AT PIN 15 OF BOTH PLUGS.
IF NO VOLTAGE, CHECK WIRING (WM27-51-02).

TABLE 1

PLUG	PIN	COMPONENT/CIRCUIT	VOLTAGE	ATA
2751-P9	15	CIRCUIT BREAKER, CB1J11	28V DC	27-51-12
	3	PDU, NO. 2 SWITCHBOX-LH	28V DC OT 0V DC /1\	27-51-12
	4	PDU, NO. 2 SWITCHBOX-LH	28V DC OT 0V DC /1\	
2751-P13	15	CIRCUIT BREAKER, CB2H21	28V DC	
	3	PDU, NO. 1 SWITCHBOX-RH	28V DC OR 0V DC /1\	27-51-12
	4	PDU, NO. 1 SWITCHBOX-RH	28V DC OR 0V DC /1\	27-51-12

NOTE

/1\ READINGS FOR PINS 3 AND 4 ON THE SAME PLUG SHOULD BE IDENTICAL

TABLE 2

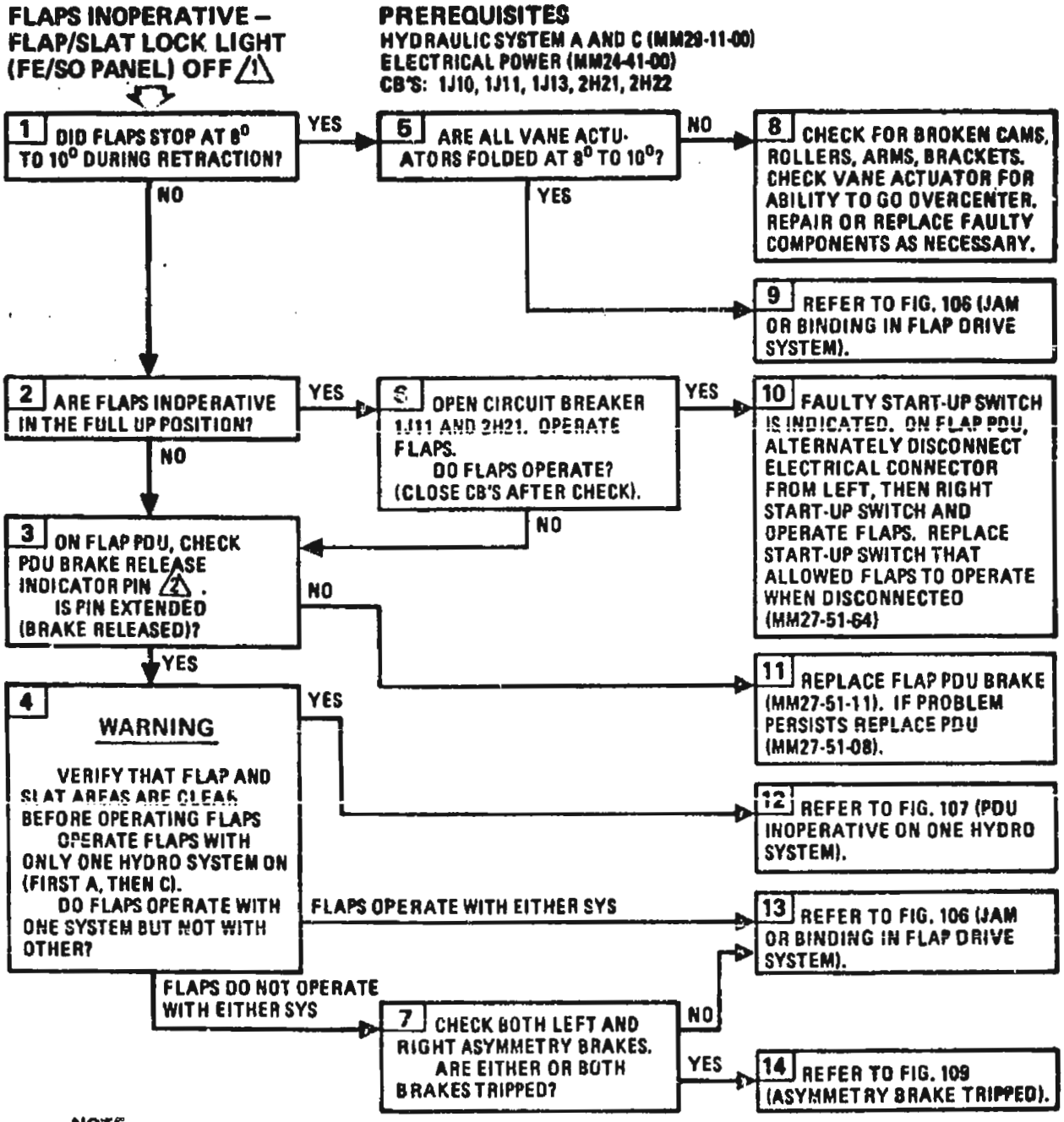
PLUG	PIN	COMPONENT/CIRCUIT	RESISTANCE	ATA
2751-P9	3	PDU, SHUTOFF VALVE SOLENOID NO. 1	APPROX 100Ω NOT OPEN	27-51-10
	4	PDU, SHUTOFF VALVE SOLENOID NO. 2	APPROX 100Ω NOT OPEN	27-51-10
	10	LH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN /2\	27-51-51
	11	LH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN /2\	27-51-51
	25	LH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN /2\	27-51-51
	23	LH FLAP ASYM. BRAKE SOLENOID	APPROX 15Ω NOT OPEN	27-51-50
	27	LH FLAP ASYM. BRAKE SOLENOID	APPROX 15Ω NOT OPEN	27-51-50
2751-P13	3	PDU, SHUTOFF VALVE SOLENOID NO. 1	APPROX 100Ω NOT OPEN	27-51-10
	4	PDU, SHUTOFF VALVE SOLENOID NO. 2	APPROX 100Ω NOT OPEN	27-51-10
	10	RH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN /2\	27-51-51
	11	RH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN /2\	27-51-51
	25	RH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN /2\	27-51-51
	23	RH FLAP ASYM. BRAKE SOLENOID	APPROX 15Ω NOT OPEN	27-51-50
	27	RH FLAP ASYM. BRAKE SOLENOID	APPROX 15Ω NOT OPEN	27-51-50

/2\ TRANSDUCER CONTAINS 2 DIODES, ONE FORWARD AND ONE REVERSE BIASED, IN PARALLEL WHICH ARE INDEPENDENTLY ACTIVATED. RESISTANCE READINGS SHOULD BE MADE WITH METER LEADS NEGATIVE TO GND, THEN POSITIVE TO GND. WHILE READINS MAY DIFFER WITH LEADS TRANPOSED, ALL READINGS WITH SAME METER LEAD ORIENTATION SHOULD BE IDENTICAL.

3 VALUES IN TABLE 2 ARE BASED ON THE USE OF SIMPSON MODEL 260 VDM OR EQUIVALENT.

M1-0004-27-909

R FLAP ASYM DET FAULT Light (FE/SO Annunciator Panel) On
R Figure 104 (Sheet 2)


FLAPS INOPERATIVE – FLAP/SLAT LOCK LIGHT (FE/SO PANEL) OFF ⚠1
PREREQUISITES
HYDRAULIC SYSTEM A AND C (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB'S: 1J10, 1J11, 1J13, 2H21, 2H22
1 DID FLAPS STOP AT 8° TO 10° DURING RETRACTION?
YES
NO
5 ARE ALL VANE ACTUATORS FOLDED AT 8° TO 10°?
NO
YES
8 CHECK FOR BROKEN CAMS, ROLLERS, ARMS, BRACKETS. CHECK VANE ACTUATOR FOR ABILITY TO GO OVERCENTER. REPAIR OR REPLACE FAULTY COMPONENTS AS NECESSARY.
9 REFER TO FIG. 106 (JAM OR BINDING IN FLAP DRIVE SYSTEM).
2 ARE FLAPS INOPERATIVE IN THE FULL UP POSITION?
YES
NO
6 OPEN CIRCUIT BREAKER 1J11 AND 2H21. OPERATE FLAPS.
DO FLAPS OPERATE? (CLOSE CB'S AFTER CHECK).
YES
NO
10 FAULTY START-UP SWITCH IS INDICATED. ON FLAP PDU, ALTERNATELY DISCONNECT ELECTRICAL CONNECTOR FROM LEFT, THEN RIGHT START-UP SWITCH AND OPERATE FLAPS. REPLACE START-UP SWITCH THAT ALLOWED FLAPS TO OPERATE WHEN DISCONNECTED (MM27-51-64)
3 ON FLAP PDU, CHECK PDU BRAKE RELEASE INDICATOR PIN ⚠2.
IS PIN EXTENDED (BRAKE RELEASED)?
NO
YES
11 REPLACE FLAP PDU BRAKE (MM27-51-11). IF PROBLEM PERSISTS REPLACE PDU (MM27-51-08).
4
WARNING
VERIFY THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS
OPERATE FLAPS WITH ONLY ONE HYDRO SYSTEM ON (FIRST A, THEN C).
DO FLAPS OPERATE WITH ONE SYSTEM BUT NOT WITH OTHER?
YES
12 REFER TO FIG. 107 (PDU INOPERATIVE ON ONE HYDRO SYSTEM).
FLAPS OPERATE WITH EITHER SYS
13 REFER TO FIG. 106 (JAM OR BINDING IN FLAP DRIVE SYSTEM).
FLAPS DO NOT OPERATE WITH EITHER SYS
7 CHECK BOTH LEFT AND RIGHT ASYMMETRY BRAKES.
ARE EITHER OR BOTH BRAKES TRIPPED?
NO
YES
14 REFER TO FIG. 109 (ASYMMETRY BRAKE TRIPPED).

NOTE

⚠1 SLATS INOPERATIVE WITH ASYMMETRY FAULT/LOCK LIGHT OFF INDICATES MECHANICAL JAM AND COMPARATOR SHOULD NOT BE REPLACED.

⚠2 BRAKE INDICATOR PIN IS FLUSH WITH HEX HEAD WHEN BRAKE ACTUATED BY INTERNAL SPRING (HYDRO SHUT OFF). PIN EXTENDS WHEN BRAKE RELEASED (HYDRO APPLIED TO PDU HYDRAULIC MOTORS AND BRAKE). BRAKE IS ON RIGHT SIDE OF FLAP PDU (MM27-51-08, FIG. 401).

M1–0003–27–956

R Flaps Inoperative, FLAP/SLAT LOCK Light (FE/SO Annunciator Panel)
R Off
R Figure 105

JAM OR BINDING IN FLAP DRIVE SYSTEM (4)

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB's: 1J10, 1J11, 1J13, 2H21, 2H22

1 DID FLAPS FAIL TO EXTEND FROM FULL-UP DURING LET-DOWN? (FLAPS MAY OPERATE NORMALLY ON GROUND).

YES → **3**

3 POSSIBLE CAUSES:

1 FROZEN ASYMMETRY BRAKES DUE TO WATER INGESTION.

DISCONNECT U-JOINT AT BOTH BRAKES AND ROTATE BRAKE INPUT SHAFT. REPLACE FROZEN BRAKE(S) (MM27-51-50).

IF BOTH BRAKES ROTATE, CHECK FOR WATER BY REMOVING BRAKE AND COVER ON U-JOINT END. (SB27-141 ADDS DRAIN HOLES TO END COVER.).

2 TORQUE TUBE BEARING FRICTION OR TORQUE TUBE LOSS OF FREE FLOAT CAUSING TORQUE TUBE JAM UNDER WING BENDING LOADS IN FLIGHT.

PROGRESSIVELY DISCONNECT TORQUE TUBES AND CHECK BEARING/FREE FLOAT. REPLACE DEFECTIVE TORQUE TUBES (MM27-51-22).

NO ↓

2 CHECK FLAP DRIVE GEARBOXES IN WINGS FOR TRIPPED INDICATOR PINS. (1) ARE ANY INDICATOR PINS TRIPPED (STICKING OUT)?

YES → **4**

4 **WARNING**

VERIFY THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS.

CHECK TRIPPED GEARBOX AND FOLLOWING COMPONENTS, DRIVEN BY TRIPPED GEARBOX, FOR CONDITION AND FREEDOM OF MOVEMENT. (DISCONNECT COMPONENTS AS REQUIRED.)

1 FLAP BALLSCREW, BALLSCREW CARRIAGE, CARRIAGE ROLLERS, QUILL SHAFT AND QUILL SHAFT RETAINING BOLT, REAR MOUNT AND TRACKS. (IF FLAPS WILL NOT RETRACT FROM FULL EXTEND OR WILL NOT EXTEND BEYOND 30° IN FLIGHT, A FAILED REAR MOUNT IS INDICATED. TO CHECK LISTEN TO REAR MOUNT WITH STETHOSCOPE OR AIRCRAFT STERO HEADSET, OR DISCONNECT FROM BALLSCREW AND HAND ROTATE REAR MOUNT.) (3)

2 VANE CARRIAGE ROLLERS AND TRACKS.

3 VANCE ACTUATOR. (IF FLAPS JAM AT 8° TO 10° DURING RETRACTION, CHECK VANE ACTUATOR RIGGING (MM27-51-00, ADJUSTMENT AND TEST, PARA 5F).

4 FLAP SWING LINK CARRIAGE ROLLERS AND TRACKS.

REPAIR, REPLACE, LUBRICATE OR RIG ABOVE COMPONENTS AS REQUIRED.

IF ABOVE COMPONENTS ARE OK, RESET TRIPPED GEARBOX INDICATOR PIN; (2) OPERATE FLAPS. IF GEARBOX INDICATOR PIN TRIPS, REPLACE GEARBOX (MM27-51-25).

NO ↓

TO SHEET 2

NOTE

(1) GEARBOX TRIP INDICATOR PINS ARE LOCATED ABOVE SPLINED SHAFT. WHEN GEARBOX OUTPUT LOAD IS EXCESSIVE, GEARBOX TORQUE BRAKE WILL BE APPLIED AND ASSOCIATED TRIP PIN WILL POP OUT AS FOLLOWS: FORWARD TRIP PIN FOR FLAP RETRACTION OVERLOAD, AFT TRIP PIN FOR EXTENSION OVERLOAD.

(2) IF TRIP INDICATOR PIN CANNOT BE RESET, GEARBOX CAN STILL FUNCTION. REPLACE GEARBOX AT EARLIEST CONVENIENCE.

(3) IF QUILL SHAFT OR QUILL SHAFT RETAINING BOLT IS SHEARED, INSPECT FAIL-SAFE LINK INSTALLATION FOR STRUCTURAL DAMAGE.

(4) FLAP DRIVE GEARBOX OVERTORQUE INDICATORS ARE PROVIDED TO HELP LOCATE FAULTY COMPONENTS WHEN JAM OR BINDING OCCURS IN FLAP SYSTEM. IF INDICATORS ARE TRIPPED IN THE ABSENCE OF OTHER FAULT INDICATIONS, RESET TRIPPED INDICATORS AND CYCLE FLAPS. IF INDICATORS DO NOT RETRIP, CONSIDER FLAP SYSTEM OPERATIONAL.

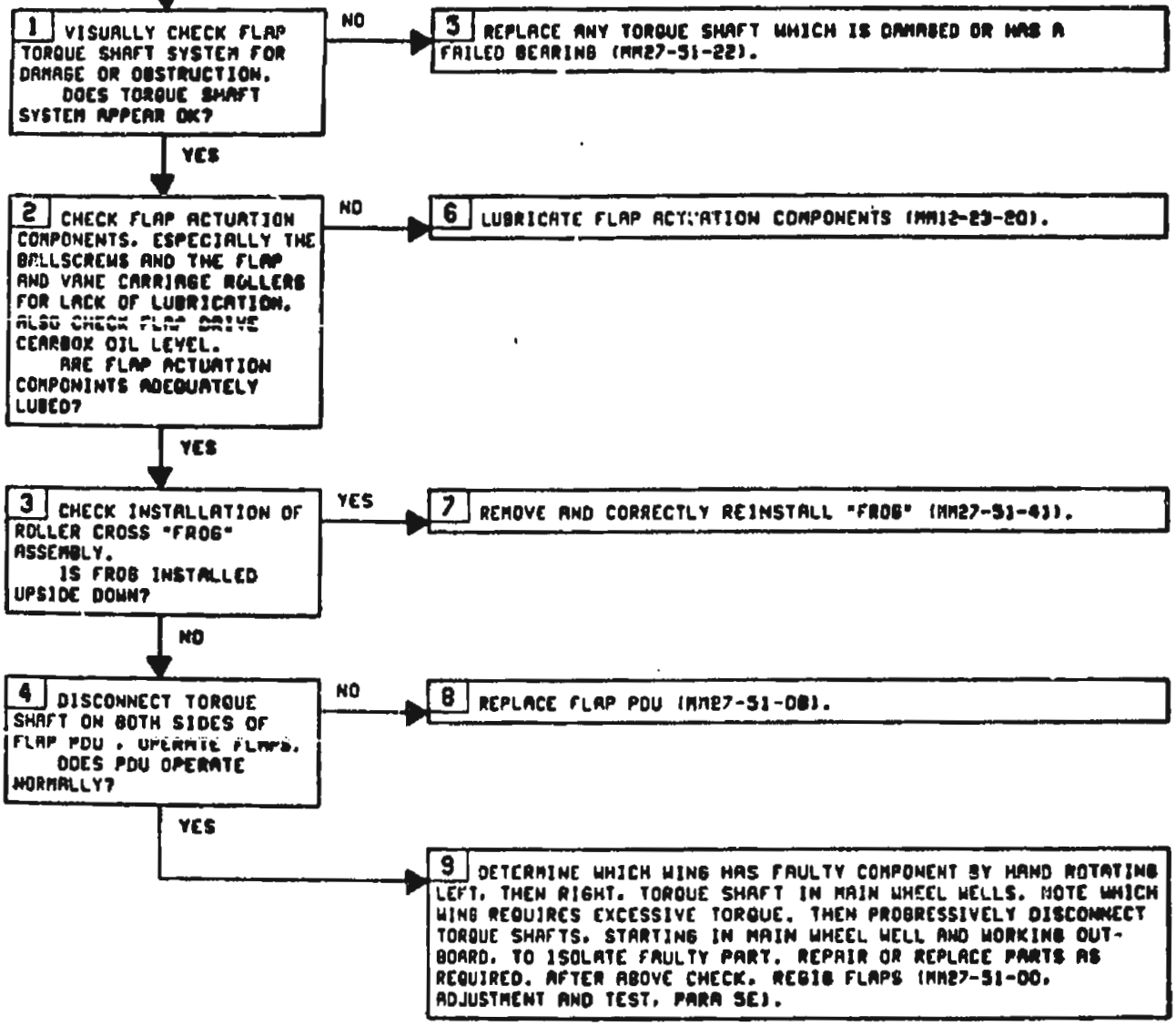
M1-0014-27-507

R Jam or Binding in Flap Drive System
R Figure 106 (Sheet 1)

PREREQUISITES
ELECTRICAL POWER (MM24-41-001.
CB'S IN: CB1-J10, J11, J13
CB2-H21, H22

WARNING
VERIFY THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS

FROM SHEET 1

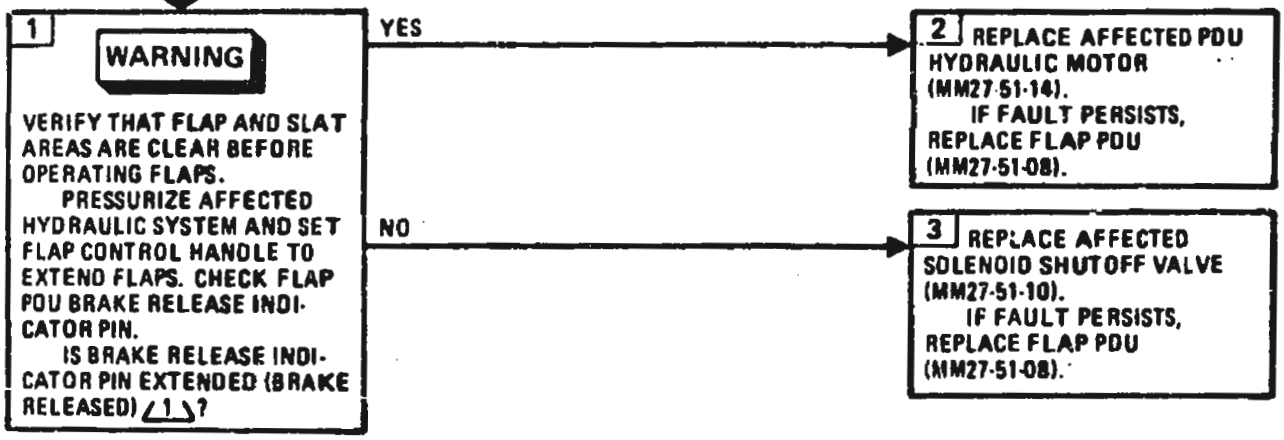

1 VISUALLY CHECK FLAP TORQUE SHAFT SYSTEM FOR DAMAGE OR OBSTRUCTION. DOES TORQUE SHAFT SYSTEM APPEAR OK?
NO
3 REPLACE ANY TORQUE SHAFT WHICH IS DAMAGED OR HAS A FAILED BEARING (MM27-51-22).
YES
2 CHECK FLAP ACTUATION COMPONENTS, ESPECIALLY THE BALLSCREWS AND THE FLAP AND VANE CARRIAGE ROLLERS FOR LACK OF LUBRICATION. ALSO CHECK FLAP DRIVE GEARBOX OIL LEVEL. ARE FLAP ACTUATION COMPONENTS ADEQUATELY LUBED?
NO
6 LUBRICATE FLAP ACTUATION COMPONENTS (MM12-23-20).
YES
3 CHECK INSTALLATION OF ROLLER CROSS "FROG" ASSEMBLY. IS FROG INSTALLED UPSIDE DOWN?
YES
7 REMOVE AND CORRECTLY REINSTALL "FROG" (MM27-51-41).
NO
4 DISCONNECT TORQUE SHAFT ON BOTH SIDES OF FLAP PDU . OPERATE FLAPS. DOES PDU OPERATE NORMALLY?
NO
8 REPLACE FLAP PDU (MM27-51-08).
YES
9 DETERMINE WHICH WING HAS FAULTY COMPONENT BY HAND ROTATING LEFT, THEN RIGHT, TORQUE SHAFT IN MAIN WHEEL WELLS. NOTE WHICH WING REQUIRES EXCESSIVE TORQUE. THEN PROGRESSIVELY DISCONNECT TORQUE SHAFTS, STARTING IN MAIN WHEEL WELL AND WORKING OUT-BOARD, TO ISOLATE FAULTY PART. REPAIR OR REPLACE PARTS AS REQUIRED. AFTER ABOVE CHECK, REGIG FLAPS (MM27-51-00, ADJUSTMENT AND TEST, PARA 3E).

R1-0001-27-003

R
R Jam or Binding in Flap Drive System
Figure 106 (Sheet 2)

PDU INOPERATIVE ON ONE HYDRAULIC SYSTEM – OK ON OTHER

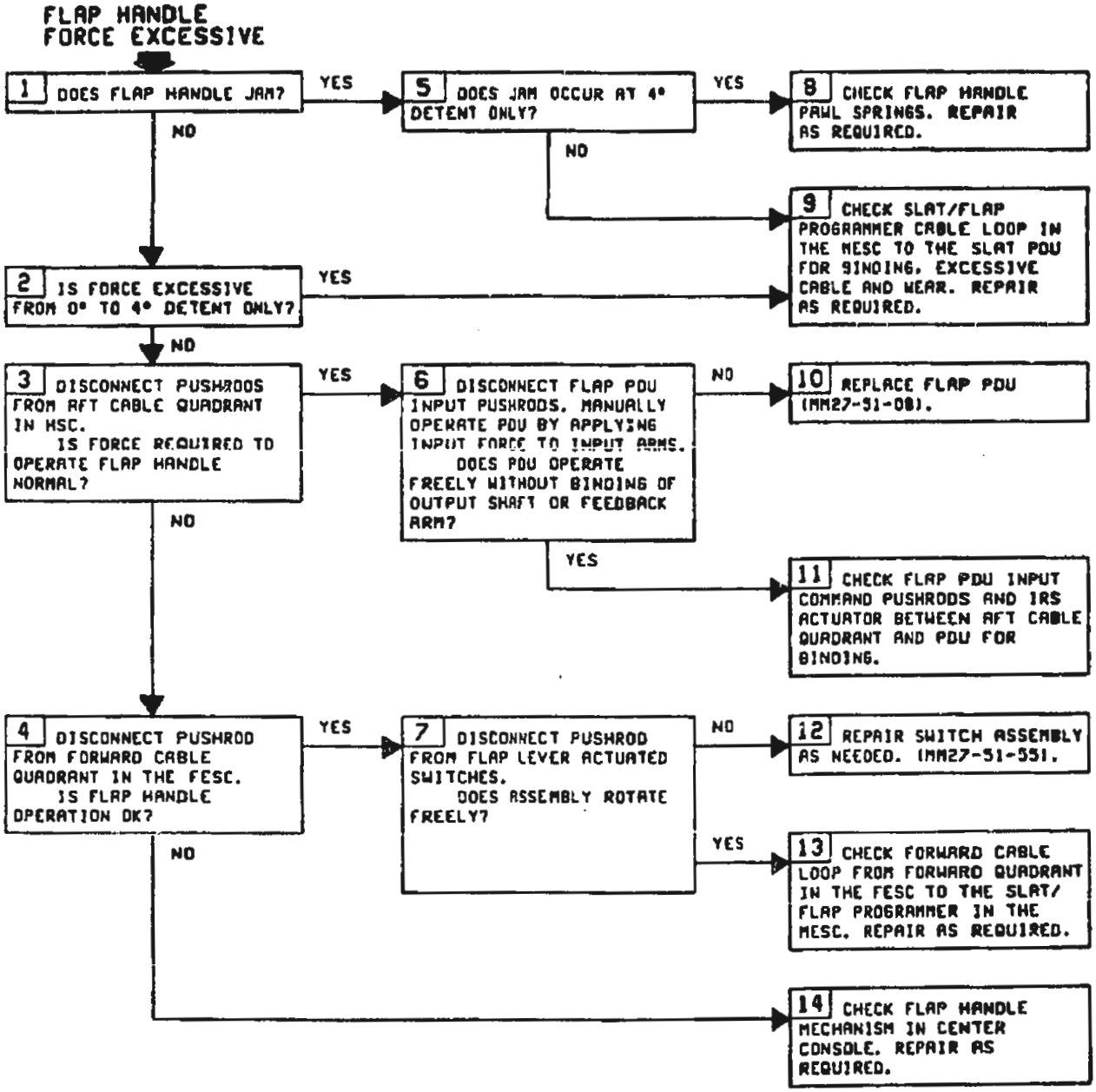
PREREQUISITES
HYDRAULIC POWER SYSTEM A OR C (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB'S: 1J10, 1J11, 1J13, 2H21, 2H22


1
WARNING
VERIFY THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS.
PRESSURIZE AFFECTED HYDRAULIC SYSTEM AND SET FLAP CONTROL HANDLE TO EXTEND FLAPS. CHECK FLAP PDU BRAKE RELEASE INDICATOR PIN.
IS BRAKE RELEASE INDICATOR PIN EXTENDED (BRAKE RELEASED) (1)?
YES
NO
2 REPLACE AFFECTED PDU HYDRAULIC MOTOR (MM27-51-14).
IF FAULT PERSISTS, REPLACE FLAP PDU (MM27-51-08).
3 REPLACE AFFECTED SOLENOID SHUTOFF VALVE (MM27-51-10).
IF FAULT PERSISTS, REPLACE FLAP PDU (MM27-51-08).

(1) **NOTE**
BRAKE INDICATOR PIN IS FLUSH WITH HEX HEAD WHEN BRAKE ACTUATED BY INTERNAL SPRING (HYDRO SHUT OFF). PIN EXTENDS WHEN BRAKE RELEASED (HYDRO APPLIED TO PDU HYDRAULIC MOTOR AND BRAKE).

M1-0104-27-508

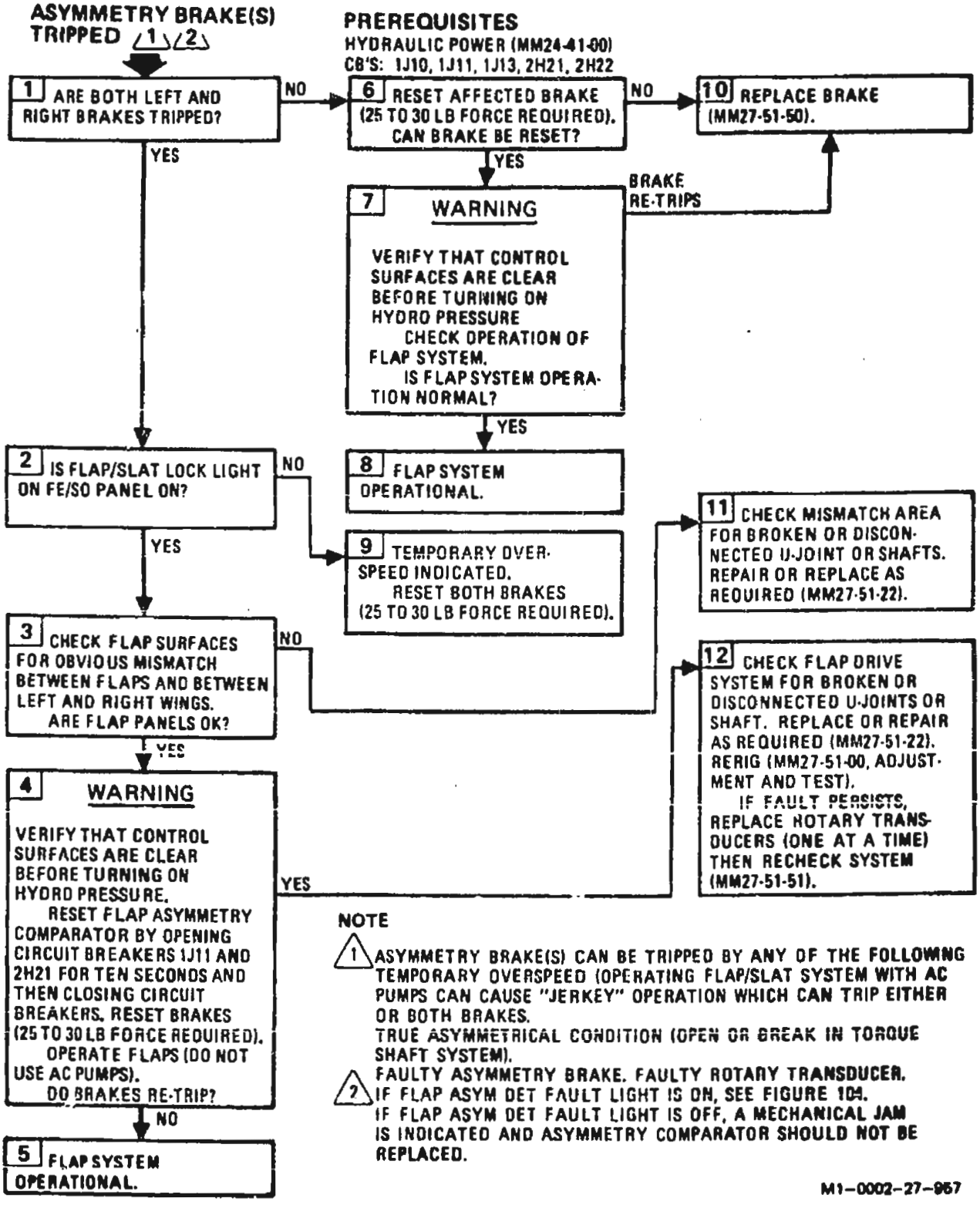
Flap PDU Inoperative on One Hydraulic System OK on Other
Figure 107


FLAP HANDLE FORCE EXCESSIVE
1 DOES FLAP HANDLE JAM?
YES
NO
5 DOES JAM OCCUR AT 4° DETENT ONLY?
YES
NO
8 CHECK FLAP HANDLE PAWL SPRINGS. REPAIR AS REQUIRED.
9 CHECK SLAT/FLAP PROGRAMMER CABLE LOOP IN THE MESC TO THE SLAT PDU FOR BINDING. EXCESSIVE CABLE AND WEAR. REPAIR AS REQUIRED.
2 IS FORCE EXCESSIVE FROM 0° TO 4° DETENT ONLY?
YES
NO
3 DISCONNECT PUSHRODS FROM AFT CABLE QUADRANT IN MSC. IS FORCE REQUIRED TO OPERATE FLAP HANDLE NORMAL?
YES
6 DISCONNECT FLAP PDU INPUT PUSHRODS. MANUALLY OPERATE PDU BY APPLYING INPUT FORCE TO INPUT ARMS. DOES PDU OPERATE FREELY WITHOUT BINDING OF OUTPUT SHAFT OR FEEDBACK ARM?
NO
10 REPLACE FLAP PDU (MM27-51-08).
YES
11 CHECK FLAP PDU INPUT COMMAND PUSHRODS AND IRS ACTUATOR BETWEEN AFT CABLE QUADRANT AND PDU FOR BINDING.
NO
4 DISCONNECT PUSHROD FROM FORWARD CABLE QUADRANT IN THE FESC. IS FLAP HANDLE OPERATION OK?
YES
7 DISCONNECT PUSHROD FROM FLAP LEVER ACTUATED SWITCHES. DOES ASSEMBLY ROTATE FREELY?
NO
12 REPAIR SWITCH ASSEMBLY AS NEEDED. (MM27-51-55).
YES
13 CHECK FORWARD CABLE LOOP FROM FORWARD QUADRANT IN THE FESC TO THE SLAT/FLAP PROGRAMMER IN THE MESC. REPAIR AS REQUIRED.
NO
14 CHECK FLAP HANDLE MECHANISM IN CENTER CONSOLE. REPAIR AS REQUIRED.

RI-0004-87-000

Flap Handle Force Excessive
Figure 108

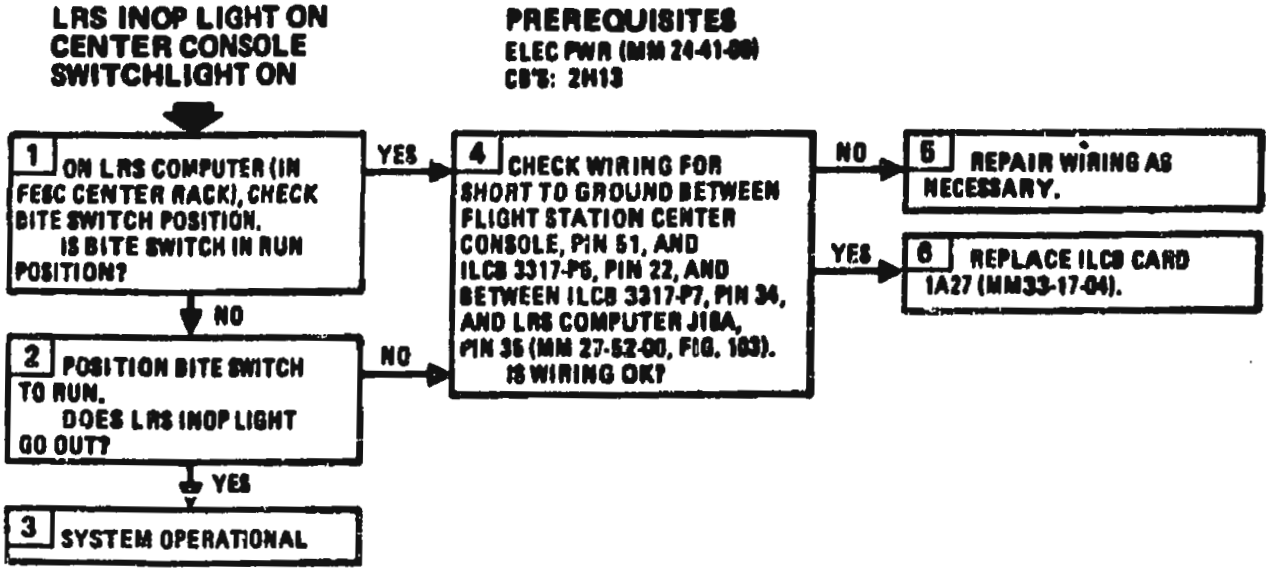
R EFFECTIVITY: ALL
R
001B

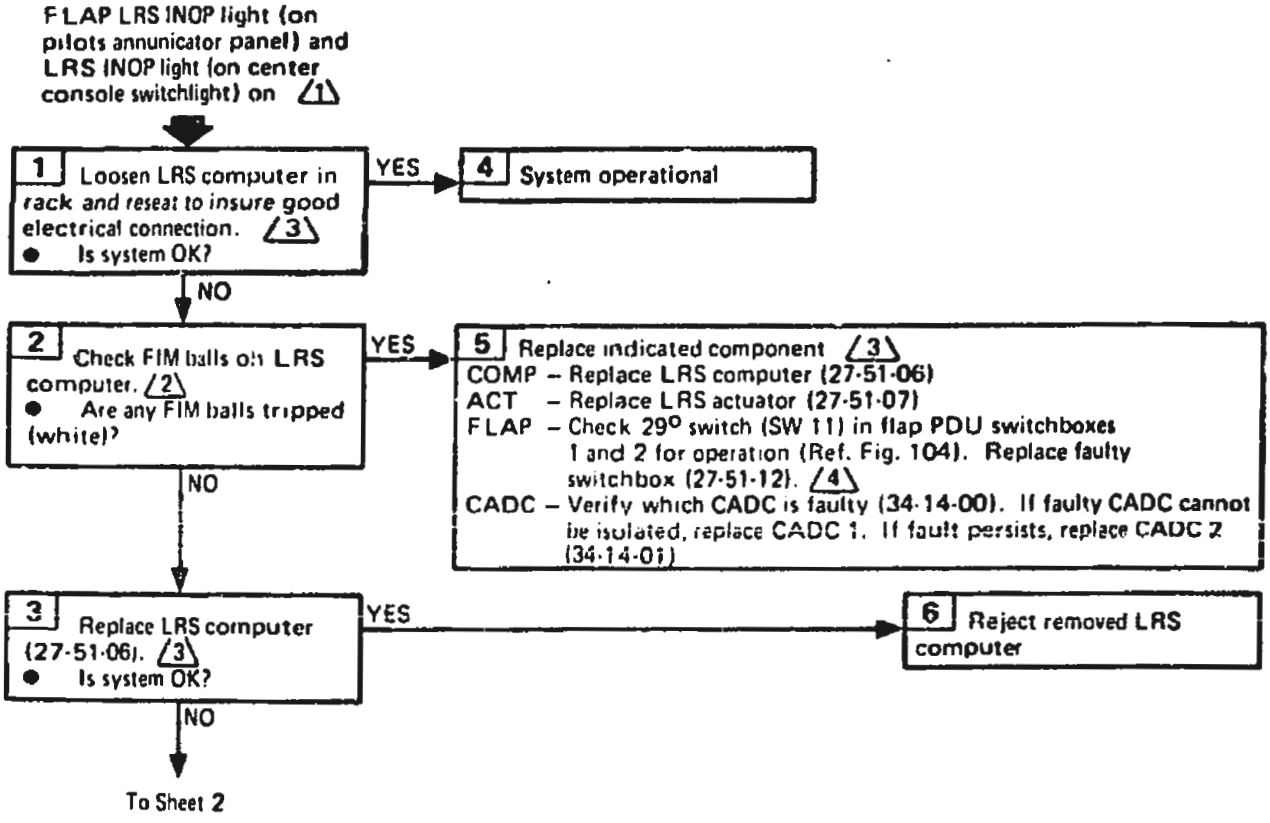

ASYMMETRY BRAKE(S) TRIPPED (1)(2)
PREREQUISITES
HYDRAULIC POWER (MM24-41-00)
CB'S: 1J10, 1J11, 1J13, 2H21, 2H22
1 ARE BOTH LEFT AND RIGHT BRAKES TRIPPED?
NO
YES
6 RESET AFFECTED BRAKE (25 TO 30 LB FORCE REQUIRED). CAN BRAKE BE RESET?
NO
YES
10 REPLACE BRAKE (MM27-51-50).
BRAKE RE-TRIPS
7 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE
CHECK OPERATION OF FLAP SYSTEM.
IS FLAP SYSTEM OPERATION NORMAL?
YES
2 IS FLAP/SLAT LOCK LIGHT ON FE/SO PANEL ON?
NO
YES
8 FLAP SYSTEM OPERATIONAL.
9 TEMPORARY OVERSPEED INDICATED.
RESET BOTH BRAKES (25 TO 30 LB FORCE REQUIRED).
11 CHECK MISMATCH AREA FOR BROKEN OR DISCONNECTED U-JOINT OR SHAFTS. REPAIR OR REPLACE AS REQUIRED (MM27-51-22).
3 CHECK FLAP SURFACES FOR OBVIOUS MISMATCH BETWEEN FLAPS AND BETWEEN LEFT AND RIGHT WINGS.
ARE FLAP PANELS OK?
NO
YES
12 CHECK FLAP DRIVE SYSTEM FOR BROKEN OR DISCONNECTED U-JOINTS OR SHAFT. REPLACE OR REPAIR AS REQUIRED (MM27-51-22). RERIG (MM27-51-00, ADJUSTMENT AND TEST).
IF FAULT PERSISTS, REPLACE ROTARY TRANSDUCERS (ONE AT A TIME) THEN RECHECK SYSTEM (MM27-51-51).
4 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE.
RESET FLAP ASYMMETRY COMPARATOR BY OPENING CIRCUIT BREAKERS 1J11 AND 2H21 FOR TEN SECONDS AND THEN CLOSING CIRCUIT BREAKERS. RESET BRAKES (25 TO 30 LB FORCE REQUIRED).
OPERATE FLAPS (DO NOT USE AC PUMPS).
DO BRAKES RE-TRIP?
YES
NO
5 FLAP SYSTEM OPERATIONAL.
NOTE
(1) ASYMMETRY BRAKE(S) CAN BE TRIPPED BY ANY OF THE FOLLOWING
TEMPORARY OVERSPEED (OPERATING FLAP/SLAT SYSTEM WITH AC PUMPS CAN CAUSE "JERKEY" OPERATION WHICH CAN TRIP EITHER OR BOTH BRAKES.
TRUE ASYMMETRICAL CONDITION (OPEN OR BREAK IN TORQUE SHAFT SYSTEM).
FAULTY ASYMMETRY BRAKE. FAULTY ROTARY TRANSDUCER.
(2) IF FLAP ASYM DET FAULT LIGHT IS ON, SEE FIGURE 104.
IF FLAP ASYM DET FAULT LIGHT IS OFF, A MECHANICAL JAM IS INDICATED AND ASYMMETRY COMPARATOR SHOULD NOT BE REPLACED.
M1-0002-27-967

R Asymmetry Brake Tripped
R Figure 109

EFFECTIVITY: ALL

001B


LRS INOP LIGHT ON
CENTER CONSOLE
SWITCHLIGHT ON
PREREQUISITES
ELEC PWR (MM 24-41-00)
CB'S: 2H13
1 ON LRS COMPUTER (IN FESC CENTER RACK), CHECK BITE SWITCH POSITION.
IS BITE SWITCH IN RUN POSITION?
YES
NO
2 POSITION BITE SWITCH TO RUN.
DOES LRS INOP LIGHT GO OUT?
YES
NO
3 SYSTEM OPERATIONAL
4 CHECK WIRING FOR SHORT TO GROUND BETWEEN FLIGHT STATION CENTER CONSOLE, PIN 51, AND ILCB 3317-P6, PIN 22, AND BETWEEN ILCB 3317-P7, PIN 34, AND LRS COMPUTER J18A, PIN 35 (MM 27-52-00, FIG. 103).
IS WIRING OK?
NO
5 REPAIR WIRING AS NECESSARY.
YES
6 REPLACE ILCB CARD 1A27 (MM33-17-04).


FLAP LRS INOP light (on pilots annunicator panel) and LRS INOP light (on center console switchlight) on /1\
1 Loosen LRS computer in rack and reseat to insure good electrical connection. /3\
● Is system OK?
YES
4 System operational
NO
2 Check FIM balls on LRS computer. /2\
● Are any FIM balls tripped (white)?
YES
5 Replace indicated component /3\
COMP – Replace LRS computer (27-51-06)
ACT – Replace LRS actuator (27-51-07)
FLAP – Check 29° switch (SW 11) in flap PDU switchboxes 1 and 2 for operation (Ref. Fig. 104). Replace faulty switchbox (27-51-12). /4\
CADC – Verify which CADC is faulty (34-14-00). If faulty CADC cannot be isolated, replace CADC 1. If fault persists, replace CADC 2 (34-14-01)
NO
3 Replace LRS computer (27-51-06). /3\
● Is system OK?
YES
6 Reject removed LRS computer
NO
To Sheet 2

PREREQUISITES

Hyd Pwr, Sys A and C (29-11-00)
Elec Pwr (24-41-00)
CB's: CB1-B7
CB2-H12, H13, H20, K12, K13, K14, K15, K16
CB3-G8, G9

NOTE

/1\ Warning horn will also sound if flaps not fully retracted

/2\ On-119 computer, actuate FIM SW on LRS computer to enable FIM balls

/3\ After replacing component, reset LRS computer by turning BITE switch on LRS computer to RESET for five seconds and then to RUN. All fault lights should go out and all LRS FIM balls should go black. Then check LRS system as follows:

A) Position flaps to full extend

B) Run airspeed above 164 knots by simultaneously depressing and holding both CADC self-test switches (FLAP LRS INOP light on annunciator panel will come on if self-test switches are not operated together. If FLAP LRS INOP light comes on, release CADC switches, reset LRS computer and repeat Step B)

C) When airspeed indicator exceeds 164 knots, flaps must retract to 28 degrees and no fault lights must come on

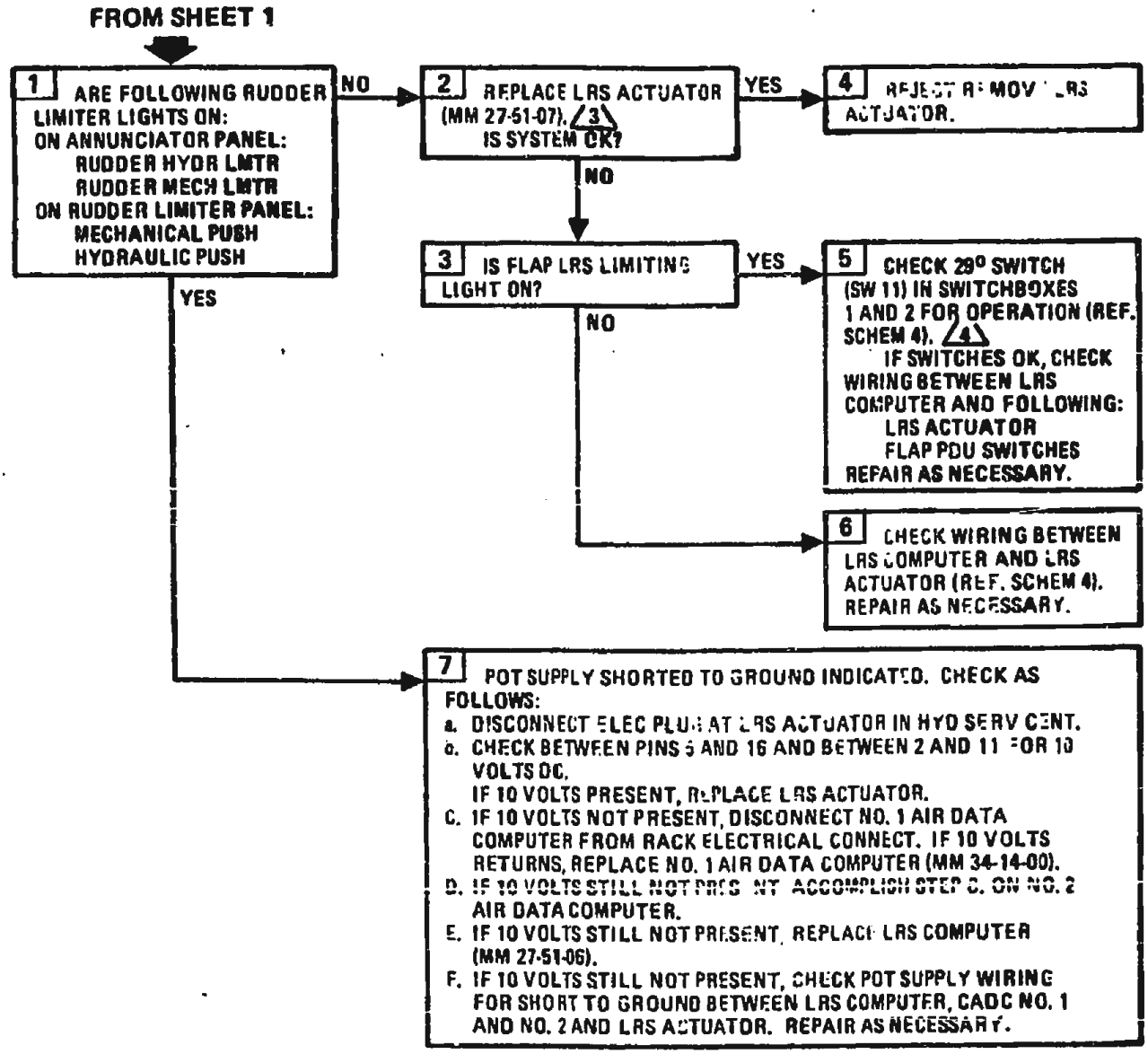
/4\ Flap PDU switches can be intermittent. Operate PDU and check switch continuity several times to ensure correct switch operation

M1-0107-27-526

R FLAP LRS INOP Light (Pilots Annunciator) and LRS INOP
R Light (Center Console FLAP LRS OVRD Switchlight) On
R Figure 111 (Sheet 1)

EFFECTIVITY: 001-031 WITHOUT SB27-118

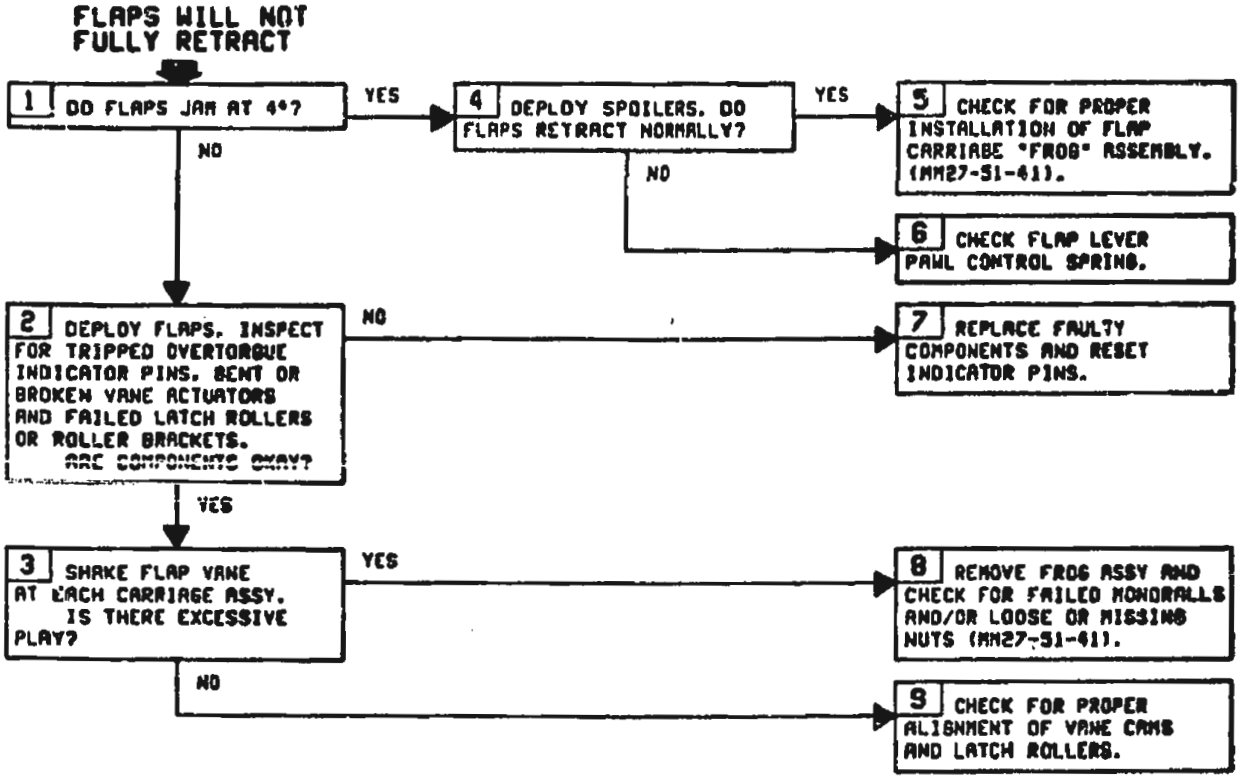
001B


FROM SHEET 1
1 ARE FOLLOWING RUDDER LIMITER LIGHTS ON:
ON ANNUNCIATOR PANEL:
RUDDER HYDR LMTR
RUDDER MECH LMTR
ON RUDDER LIMITER PANEL:
MECHANICAL PUSH
HYDRAULIC PUSH
NO
YES
2 REPLACE LRS ACTUATOR (MM 27-51-07). 3 IS SYSTEM OK?
YES
4 REJECT REMOVE LRS ACTUATOR.
NO
3 IS FLAP LRS LIMITING LIGHT ON?
YES
5 CHECK 29° SWITCH (SW 11) IN SWITCHBOXES 1 AND 2 FOR OPERATION (REF. SCHEM 4). 4
IF SWITCHES OK, CHECK WIRING BETWEEN LRS COMPUTER AND FOLLOWING:
LRS ACTUATOR
FLAP PDU SWITCHES
REPAIR AS NECESSARY.
NO
6 CHECK WIRING BETWEEN LRS COMPUTER AND LRS ACTUATOR (REF. SCHEM 4). REPAIR AS NECESSARY.
7 POT SUPPLY SHORTED TO GROUND INDICATED. CHECK AS FOLLOWS:
a. DISCONNECT ELEC PLUG AT LRS ACTUATOR IN HYD SERV CENT.
b. CHECK BETWEEN PINS 5 AND 16 AND BETWEEN 2 AND 11 FOR 10 VOLTS DC.
IF 10 VOLTS PRESENT, REPLACE LRS ACTUATOR.
C. IF 10 VOLTS NOT PRESENT, DISCONNECT NO. 1 AIR DATA COMPUTER FROM RACK ELECTRICAL CONNECT. IF 10 VOLTS RETURNS, REPLACE NO. 1 AIR DATA COMPUTER (MM 34-14-00).
D. IF 10 VOLTS STILL NOT PRESENT ACCOMPLISH STEP C. ON NO. 2 AIR DATA COMPUTER.
E. IF 10 VOLTS STILL NOT PRESENT, REPLACE LRS COMPUTER (MM 27-51-06).
F. IF 10 VOLTS STILL NOT PRESENT, CHECK POT SUPPLY WIRING FOR SHORT TO GROUND BETWEEN LRS COMPUTER, CADC NO. 1 AND NO. 2 AND LRS ACTUATOR. REPAIR AS NECESSARY.

M1-0101-27-000

FLAP LRS INOP Light (Pilots Annunciator) and LRS INOP Light (Center Console FLAP LRS OVRD Switchlight) On
Figure 111 (Sheet 2)

PREREQUISITES
HYDRAULIC POWER (MM29-11-001).

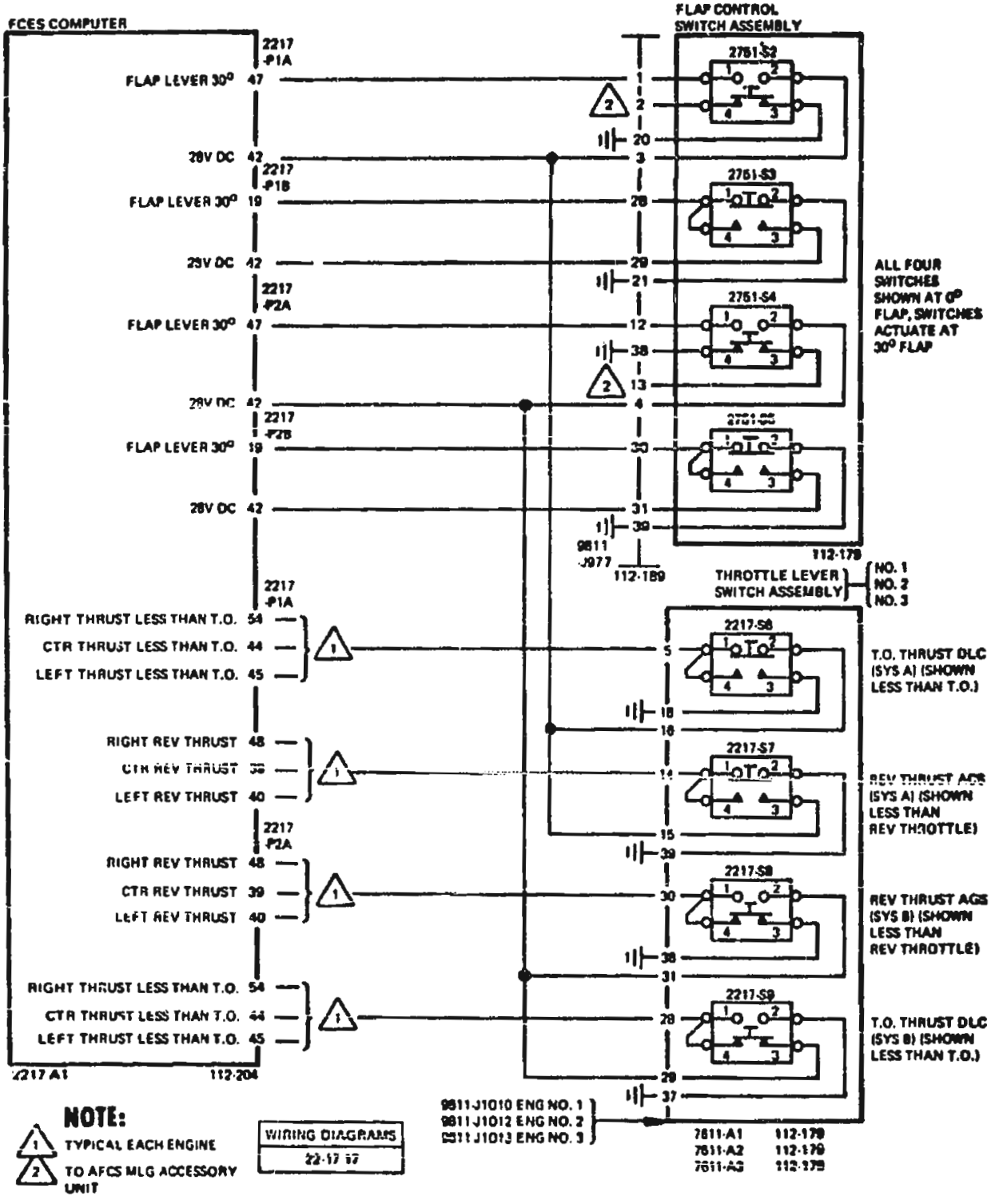

FLAPS WILL NOT FULLY RETRACT
1 DO FLAPS JAM AT 4°?
YES
NO
4 DEPLOY SPOILERS. DO FLAPS RETRACT NORMALLY?
YES
NO
5 CHECK FOR PROPER INSTALLATION OF FLAP CARRIAGE "FROG" ASSEMBLY. (MM27-51-41).
6 CHECK FLAP LEVER PAWL CONTROL SPRING.
2 DEPLOY FLAPS. INSPECT FOR TRIPPED OVERTORQUE INDICATOR PINS, BENT OR BROKEN VANE ACTUATORS AND FAILED LATCH ROLLERS OR ROLLER BRACKETS. ARE COMPONENTS OKAY?
NO
7 REPLACE FAULTY COMPONENTS AND RESET INDICATOR PINS.
YES
3 SHAKE FLAP VANE AT EACH CARRIAGE ASSY. IS THERE EXCESSIVE PLAY?
YES
8 REMOVE FROG ASSY AND CHECK FOR FAILED NONORALLS AND/OR LOOSE OR MISSING NUTS (MM27-51-41).
NO
9 CHECK FOR PROPER ALIGNMENT OF VANE CAMS AND LATCH ROLLERS.

M1-0000-27-0006

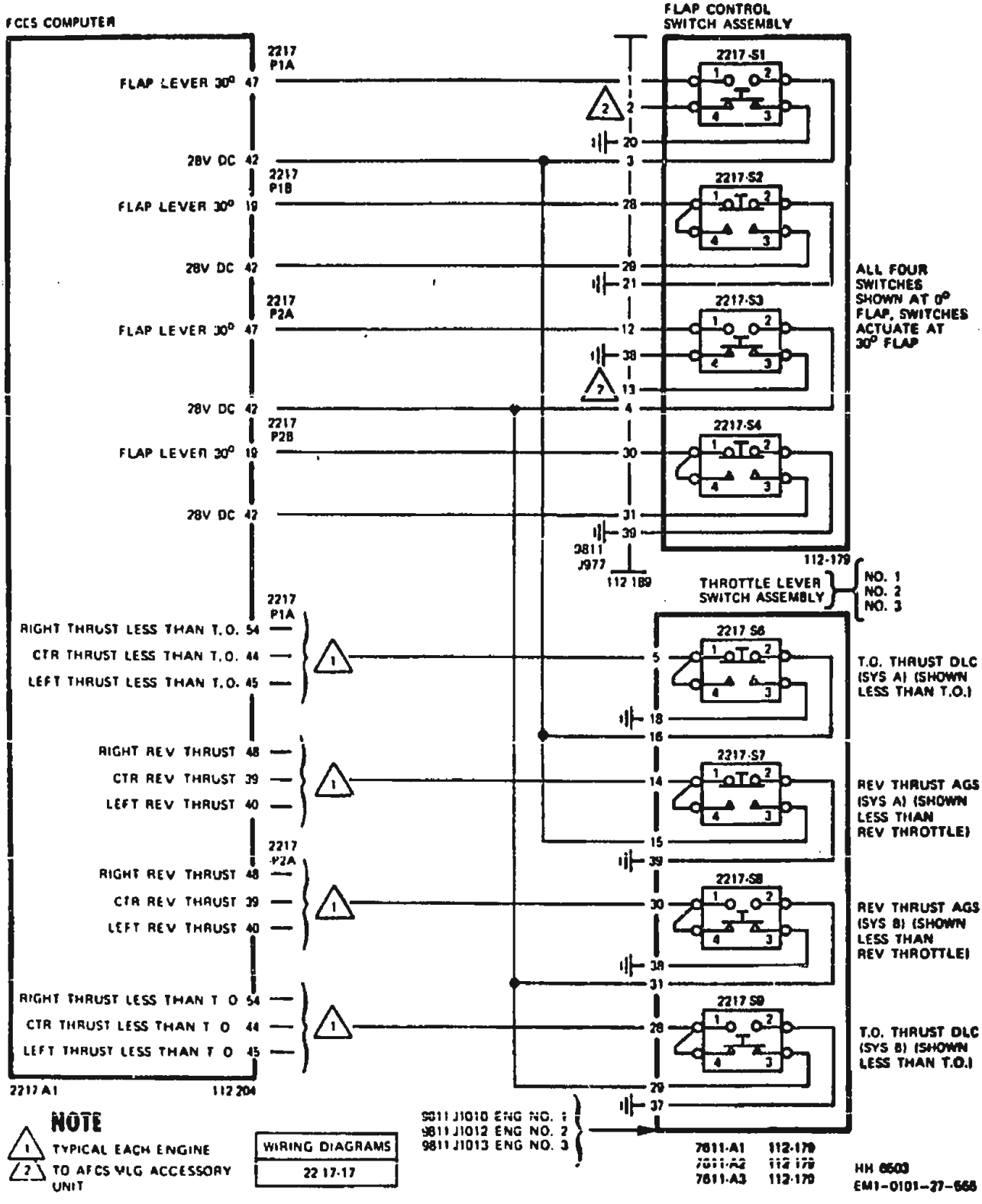
Flaps Will Not Fully Retract
Figure 112

R

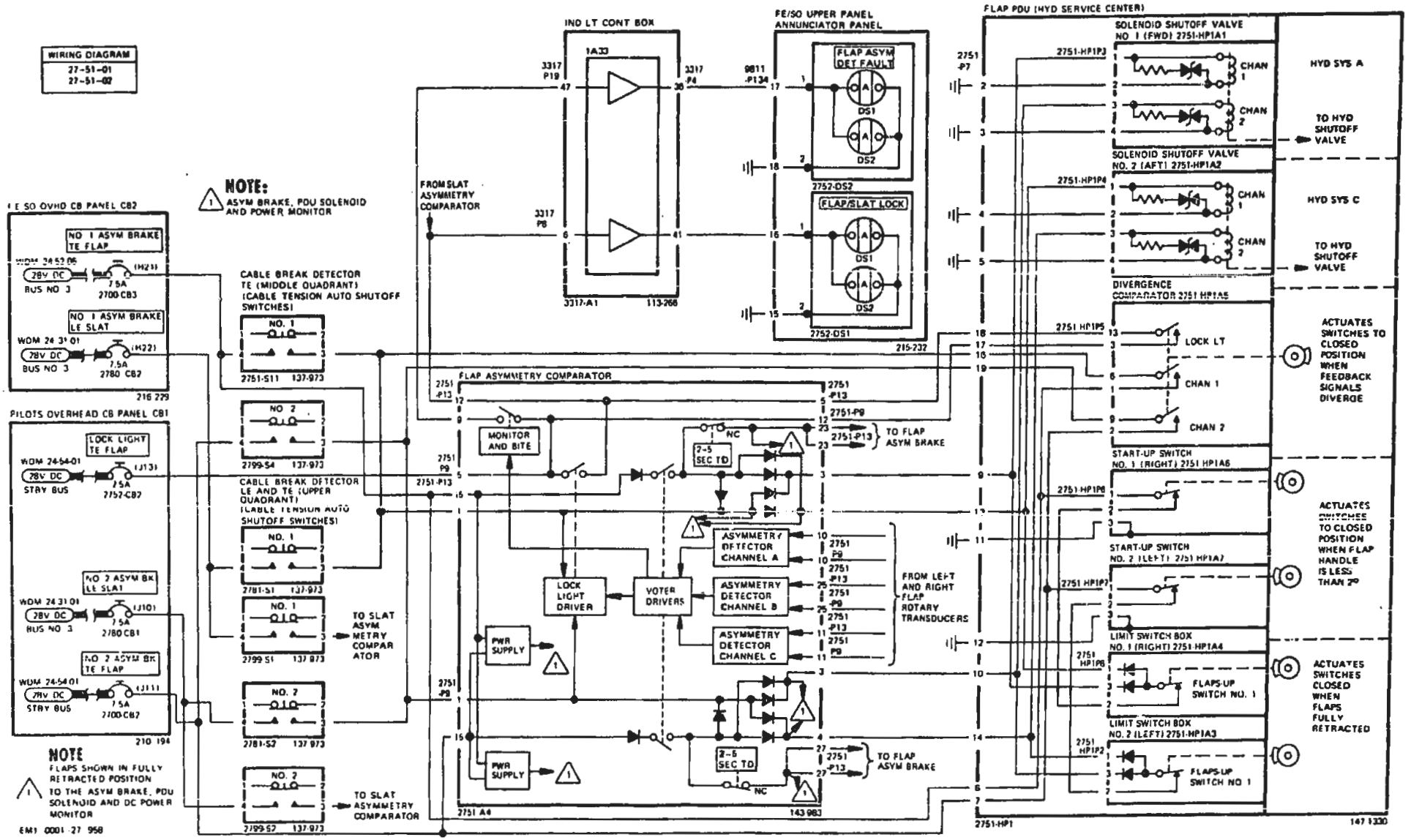
R EFFECTIVITY: ALL
R
001B



Flap Lever and Throttle Switches Electrical Schematic
SCHEM 1

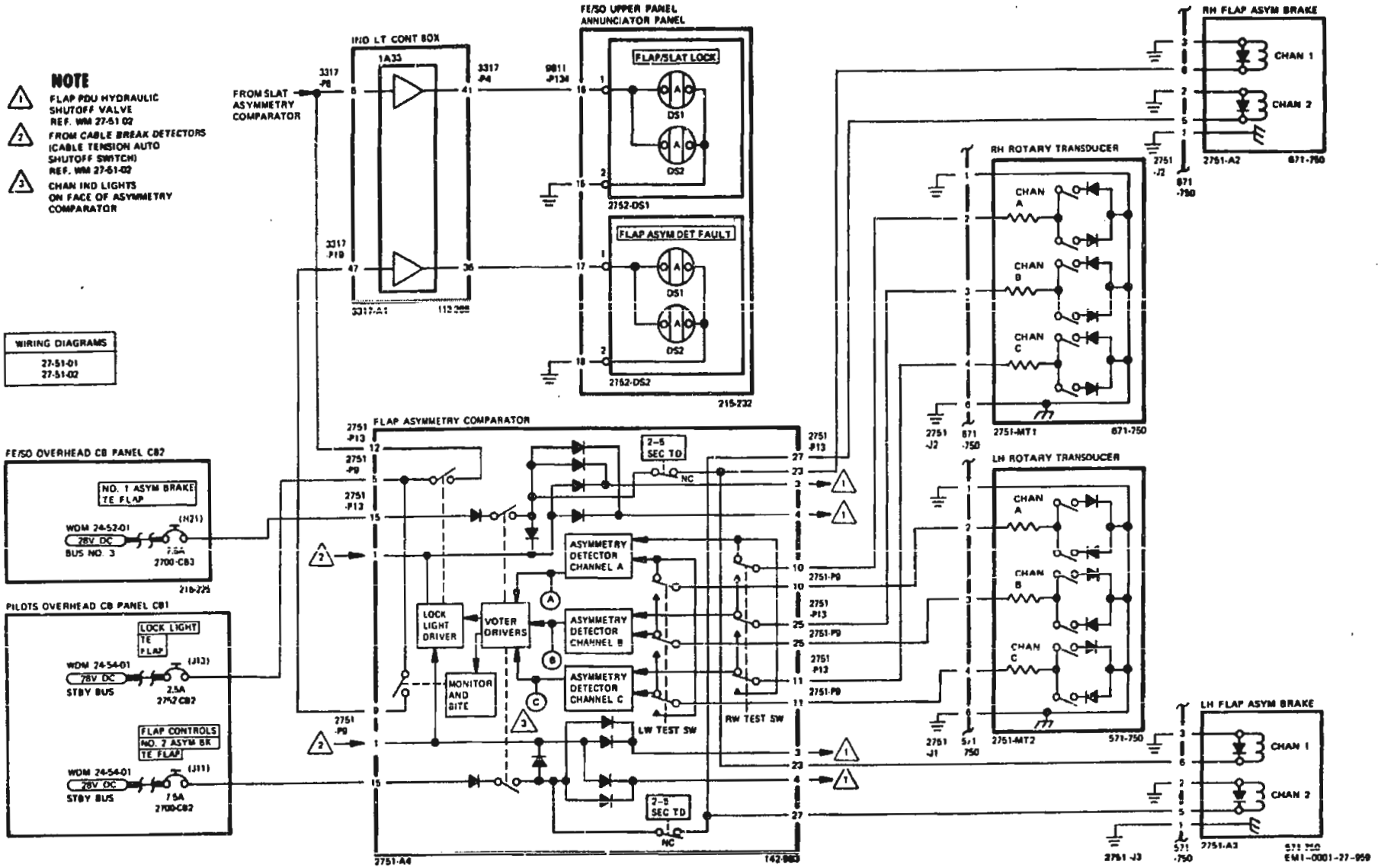


Flap Lever and Throttle Switches Electrical Schematic
SCHEM 1


WIRING DIAGRAM
27-51-01
27-51-02
NOTE:
ASYM BRAKE, PDU SOLENOID AND POWER MONITOR
FROM SLAT ASYMMETRY COMPARATOR
IND LT CONT BOX
FE/SO UPPER PANEL ANNUNCIATOR PANEL
FLAP PDU (HYD SERVICE CENTER)
SOLENOID SHUTOFF VALVE NO. 1 (FWD) 2751-HP1A1
SOLENOID SHUTOFF VALVE NO. 2 (AFT) 2751-HP1A2
DIVERGENCE COMPARATOR 2751 HP1A5
START-UP SWITCH NO. 1 (RIGHT) 2751 HP1A6
START-UP SWITCH NO. 2 (LEFT) 2751 HP1A7
LIMIT SWITCH BOX NO. 1 (RIGHT) 2751-HP1A4
LIMIT SWITCH BOX NO. 2 (LEFT) 2751-HP1A3
HYD SYS A
HYD SYS C
TO HYD SHUTOFF VALVE
ACTUATES SWITCHES TO CLOSED POSITION WHEN FEEDBACK SIGNALS DIVERGE
ACTUATES SWITCHES TO CLOSED POSITION WHEN FLAP HANDLE IS LESS THAN 7°
ACTUATES SWITCHES CLOSED WHEN FLAPS FULLY RETRACTED
FLAP ASYMMETRY COMPARATOR
MONITOR AND BITE
LOCK LIGHT DRIVER
VOTER DRIVERS
ASYMMETRY DETECTOR CHANNEL A
ASYMMETRY DETECTOR CHANNEL B
ASYMMETRY DETECTOR CHANNEL C
FROM LEFT AND RIGHT FLAP ROTARY TRANSDUCERS
TO FLAP ASYM BRAKE
TO SLAT ASYMMETRY COMPARATOR
CABLE BREAK DETECTOR TE (MIDDLE QUADRANT) (CABLE TENSION AUTO SHUTOFF SWITCHES)
CABLE BREAK DETECTOR LE AND TE (UPPER QUADRANT) (CABLE TENSION AUTO SHUTOFF SWITCHES)
PILOTS OVERHEAD CB PANEL CB1
F E SO OVHD CB PANEL CB2
NO 1 ASYM BRAKE TE FLAP
NO 1 ASYM BRAKE LE SLAT
LOCK LIGHT TE FLAP
NO 2 ASYM BK LE SLAT
NO 2 ASYM BK TE FLAP
NOTE
FLAPS SHOWN IN FULLY RETRACTED POSITION
TO THE ASYM BRAKE, PDU SOLENOID AND DC POWER MONITOR

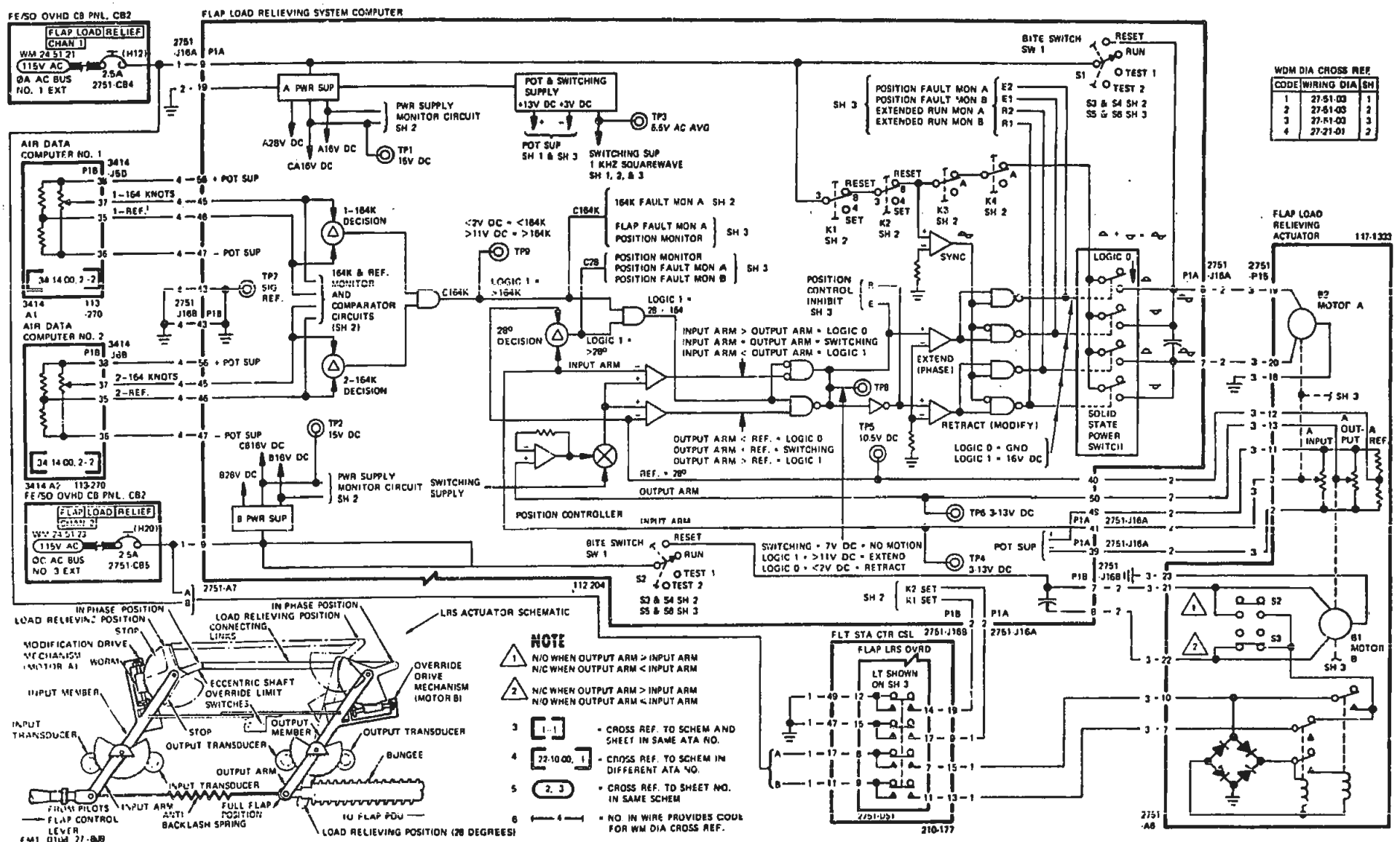
Flap PDU Control Schematic
SCHEM 2

EFFECTIVITY: ALL



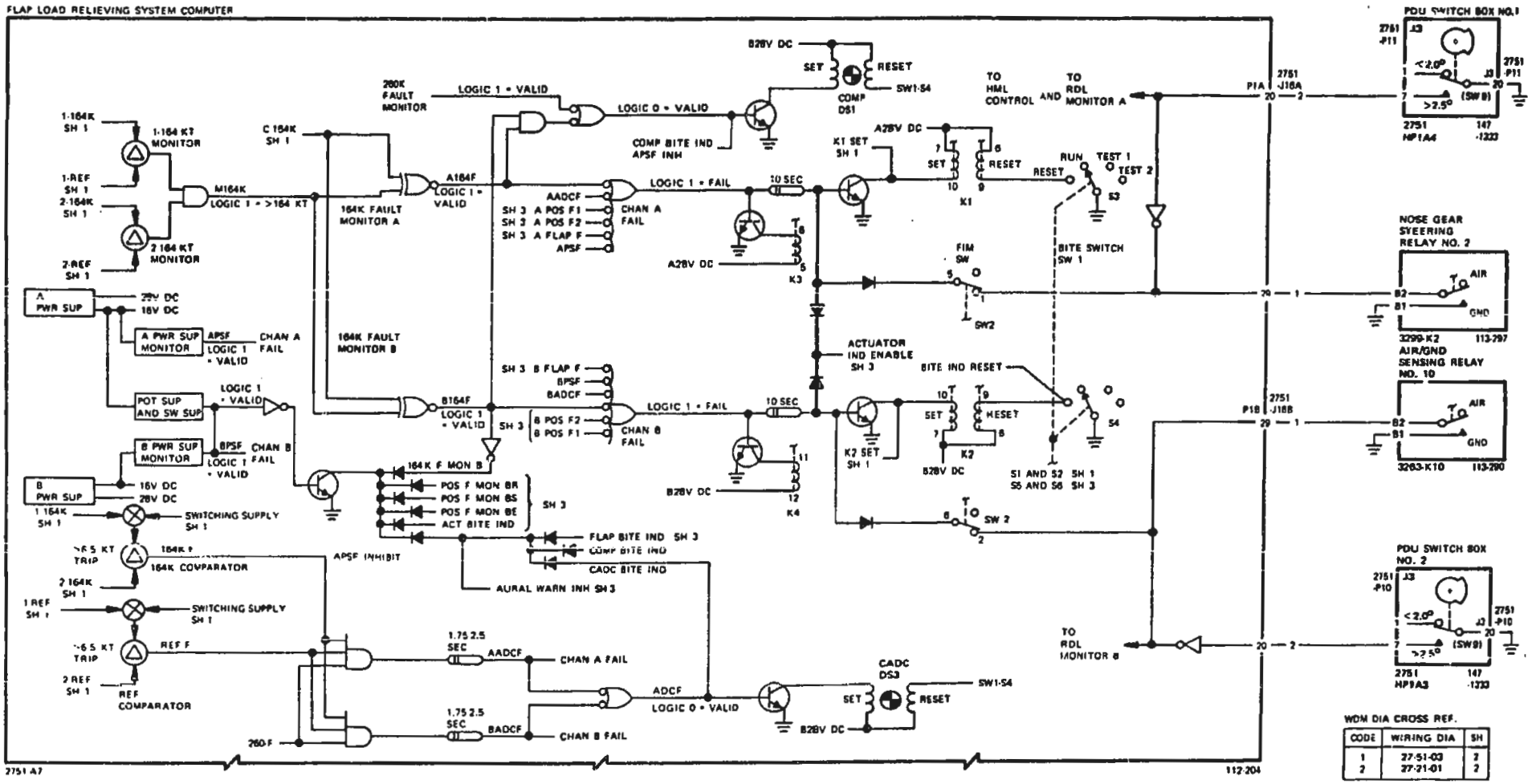
Flap Asymmetry System Electrical Schematic
SCHEM 3

EFFECTIVITY: ALL



Flap Load Relieving System (LRS) Electrical Schematic
(Normal System Operation)
SCHEM 4 (Sheet 1)

EFFECTIVITY: ALL



WDM DIA CROSS REF.

CODE	WIRING DIA	SH
1	27-51-03	2
2	27-21-01	2

NOTE

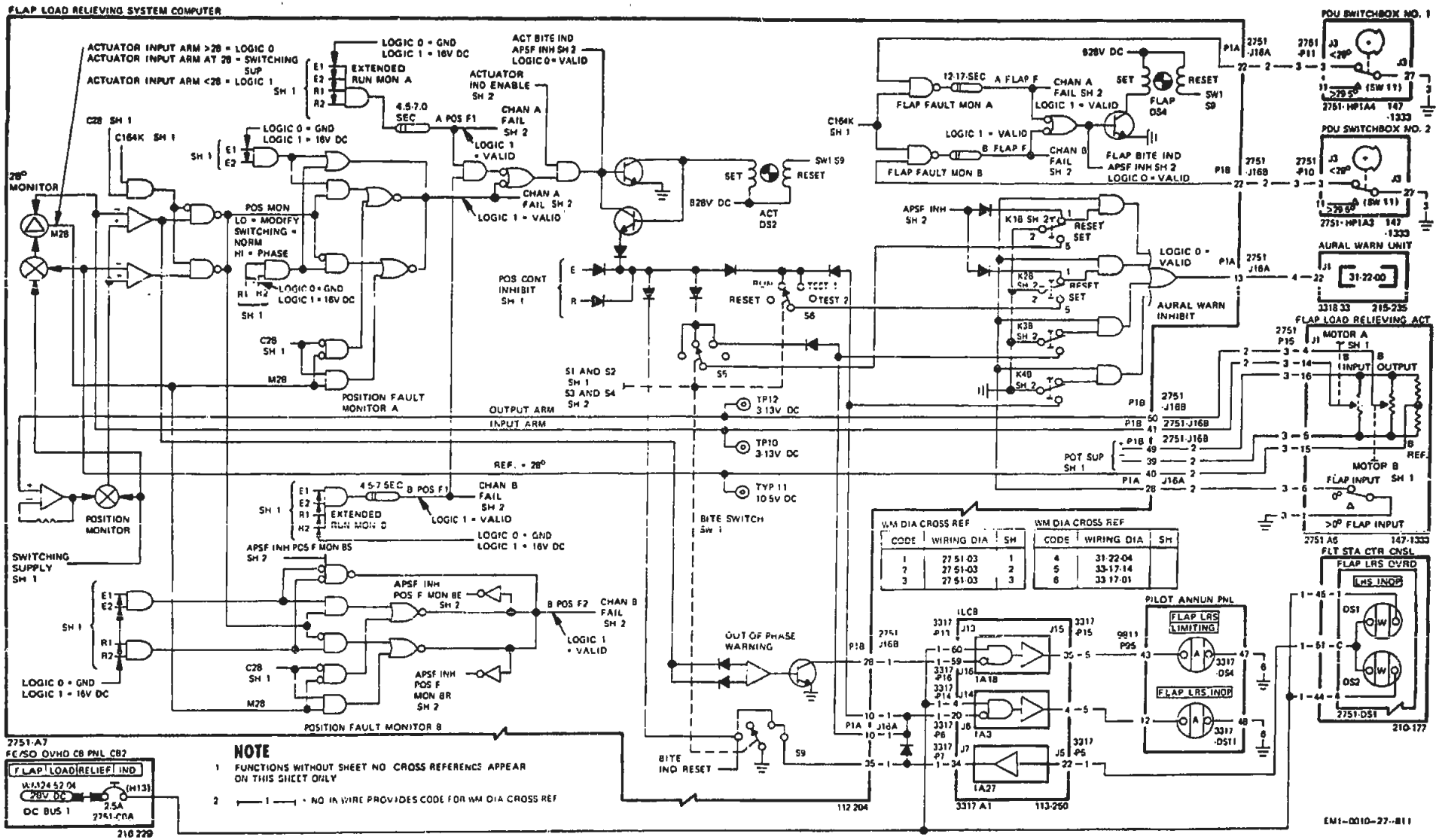
1 FUNCTIONS WITHOUT SHEET NO CROSS REFERENCE APPEAR ON THIS SHEET ONLY

2 } 1 { NO IN WIRE PROVIDES CODE FOR WDM DIA CROSS REF.

EM1-0102-27-278

R Flap Load Relieving System (LRS) Electrical Schematic
R (Fault Monitoring)
R SCHEM 4 (Sheet 2)

R EFFECTIVITY: ALL
R
0018



NOTE

1 FUNCTIONS WITHOUT SHEET NO. CROSS REFERENCE APPEAR ON THIS SHEET ONLY

2 —1— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF

R Flap Load Relieving System (LRS) Electrical Schematic
R (Fault Monitoring)
R SCHEM 4 (Sheet 3)

EFFECTIVITY: ALL

001B

FLAP CONTROL SYSTEM - ADJUSTMENT AND TEST

1. General

This section provides the procedures to perform operational and functional tests (Ref. Para. 4), and a rigging check and adjustment (Ref. Para. 5) of the wing trailing edge flap control system.

C NOTE: LRS System deactivated on TWA Airplanes - MO 98686.

2. Equipment and Materials

Rig pins: 5/16-inch diameter, 2-inches long (R2), 3-inches long (R3), and 6-inches long (R6), or equivalent (part of Rig Pin Kit, PN B735).

Air Data Tester, Milhard Engineering Co. PN 127, or equivalent (For Para. 4D test)

Tee (to connect air data tester to two pitot-static tubes)

Shutoff valve (to be installed in one pitot pressure line)

R Protractors (2 required)

Cable Tensiometer, Pacific Scientific Co., PN 1601009-03, or equivalent

Lock-wire, 0.032-inch diameter, Fed Spec QQ-W-423, Form I, Cond A, or equivalent

Camrol Driver (SNAP-ON drag link socket modified by G/ITEL 27-51-124), or equivalent (For Para. 5F rigging of vanes)

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
6-50-00	Interior Access Doors and Panels
20-00-08	Installation of Metal Foil Rub Strips, PB79-479B
24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-12	Flap PDU Switchbox - Removal and Installation

27-51-26	Flap Carriage Ballscrew Actuator - Removal and Installation
27-51-35	Wing Flap - Removal and Installation
27-51-42	Vane - Removal and Installation
27-51-47	Vane Carriage Assembly - Removal and Installation
27-51-48	Actuator Flap Vane - Approved Repairs
27-61-00	Spoiler and Speedbrake System - Adjustment and Test
27-61-17	Spoiler Servo Control - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Adjustment/Test

The following test procedures are provided in this section:

Flap Asymmetry Comparator BITE Test (Ref. Para. 4A)

Flap Control System Verification Test (Ref. Para. 4B)

Flap Asymmetry Detector System Operational Test (Ref. Para. 4C)

Flap Control System Operational Check (Ref. Para. 4D)

CAUTION: PRIOR TO GROUND OPERATION OF WING FLAPS, OBSERVE THE FOLLOWING TO PREVENT SPOILER SELECTOR DWELL ACTUATOR STALL:

AILERONS FAIRED WITHIN ±10 DEGREES.

SPEED BRAKE LEVER WITHIN 2 INCHES OF FULL FORWARD.

4A. Flap Asymmetry Comparator BITE Test

NOTE: The FLAP ASYM DET FAULT light on Flight Engineer/Second Officers panel will come on anytime a fault is sensed in the asymmetry detector and control system. The FLAP ASYM DET FAULT light may go off after resetting comparator (opening CB1-J11 and CB2-H21 for ten seconds and then closing circuit breakers) but will come on again when flaps are operated if a fault still exists in the asymmetry detector system. If a fault exists in the asymmetry detector system, the CHAN IND lights on asymmetry comparator will flash on and off while flaps are operating.

R Accomplish comparator BITE test only if CHAN IND lights
R on asymmetry comparator flash on and off while flaps are
R operating. The comparator BITE test isolates the problem
R to comparator or rotary transducer. If FLAP ASYM DET
R FAULT light is on but CHAN IND lights do not come on, see
R 27-51-00, Fault Isolation for additional fault isolation
R procedures.

(1) On pilots overhead circuit breaker panel CB1, zone 210,
R verify following circuit breakers are closed.

R FLAP CONTROLS

R NO. 2 ASYM BK TE FLAP (J11)

R LOCK LIGHT TE FLAP (J13)

R On Flight Engineer/Second Officers aft circuit breaker
R panel CB2, zone 215, verify following is closed.

R NO. 1 ASYM BK TE FLAP (H21)

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip the overspeed governor in either or both asymmetry brakes, and give invalid test results. To perform a valid test of flap and/or slat actuation system, pressurize the B and C hydraulic systems using ATM pumps, and the A hydraulic system using the PTU. Alternately, two ground sources, each capable of 25 GPM at 3000 psi, may be used to pressurize the A and C hydraulic systems.

(4) Enter mid-electrical service center and locate flap asymmetry comparator mounted on the rear bulkhead on the right side (BL 80R).

(5) Remove covers from left and right trouble test switches.

(6) Position flap handle to fully extend flaps.

(7) If PN 672835-109 comparator is installed: with flaps moving, depress the LEFT WING TROUBLE TEST SW and hold for at least five seconds then release. Repeat with the RIGHT WING TROUBLE TEST SW.

CAUTION: ON 672835-111 COMPARATOR, DEPRESSING OR RELEASING EITHER TROUBLE TEST SWITCH WHILE CHANNEL LIGHT IS ON WILL CAUSE ASYMMETRY LOCK-UP.

(7) If PN 672835-111 comparator is installed: with flaps moving, depress the LEFT WING TROUBLE TEST SW, while CHAN IND light is off, and hold for at least five seconds. Release only when CHAN IND light is off. Repeat with the RIGHT WING TROUBLE TEST SW.

NOTE: If extending flaps is not enough time to accomplish test, complete test while flaps are retracting.

(8) If the channel indicator lights change position between channels while wing test switch is depressed, replace rotary transducer associated with switch causing change (Ref. 27-51-51).

(9) If the channel indicator lights do not change position during test, replace comparator (Ref. 27-51-49).

R (10) If channel indicator lights do not come on during test but FLAP ASYM DET FAULT light on the FE/SO panel is on, see 27-51-00, Fault Isolation for additional fault isolation procedures.

(11) Replace covers on left and right trouble test switches.

(12) Retract flaps.

(13) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(14) Turn off electrical power if no longer required (Ref. 24-41-00).

4B. Flap Control System Verification Test

(1) On Pilots overhead circuit breaker panel CB1, zone 210, verify following circuit breakers are closed:

FLAP CONTROLS

NO. 2 ASYM BK LE SLAT (J10)

NO. 2 ASYM BK TE FLAP (J11)

LOCK LIGHT LE SLAT (J12)

LOCK LIGHT TE FLAP (J13)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify following circuit breakers are closed:

R DLC SERVO

R A (H14)

R B (H15)

NO. 1 ASYM BRAKE

TE FLAP (H21)

LE SLAT (H22)

FLAP LOAD RELIEF

CHAN 1 (H12)

IND (H13)

R CHAN 2 (H20)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify following circuit breakers are closed:

POSN IND

TE FLAP (K16)

LE SLAT (K17)

LE SLAT EXTEND LT (K18)

(2) Turn on electrical power (Ref. 24-41-00). Verify following lights are off:

(a) FLAP/SLAT LOCK annunciator light on FE/SO console.

(b) FLAP ASYM DET FAULT annunciator light on FE/SO console.

(c) SLAT ASYM DET FAULT annunciator light on FE/SO console.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic system A (Ref. 29-11-00). Verify hydraulic system C is off.

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip the overspeed governor in either or both asymmetry brakes, and give invalid test results. To perform a valid test of flap and/or slat actuation system, pressurize the B hydraulic systems using ATM pumps, and A hydraulic system using the PTU. Alternately a ground source capable of 25 GPM at 3000 PSI, may be used to pressurize the A hydraulic system.

(4) Verify flap handle is in the 0-degree detent and flaps are fully retracted.

(5) Verify both tapes of flap position indicator (on pilots center instrument panel) are within the 0-degree range mark limits.

(6) Install protractors on left and right No. 3 flaps at approximately mid-span parallel with rivet line. Zero protractors.

NOTE: On some aircraft the location for the protractor is marked on flap surface.

(7) Remove protractors from flaps.

NOTE: Maintain setting on protractors.

WARNING: VERIFY FLAP TRAVEL AREAS ARE CLEAR OF PERSONNAL AND EQUIPMENT BEFORE OPERATING FLAPS.

(8) Depress the finger-latch release under forward edge of flap control knob and move flap control handle to 4-degree position. The flaps (and slats) must start to extend.

(9) During transit, verify LE TRANS light on flap position indicator on the pilots center instrument panel is on and that flaps (and slats) move smoothly.

(10) When motion stops, verify following:

(a) LE TRANS light goes off and LE EXT light comes on.

(b) Both tapes of the flap position indicator have moved within the 4-degree range mark limits.

(c) Flap handle is held securely in the 4-degree detent position.

(11) Depress finger-latch on underside of flap control knob to raise the mechanical lock out of the detent. Move the control handle successively through each detent position (allow flaps to stop at each selected position), until the 22 degree detent is reached. Verify following at each position:

(a) Flaps and vanes operate smoothly and flaps position to selected angle.

(b) Both tapes of flap position indicator move to selected position and indicate flap position within the range mark limits.

(c) Flap handle is held securely at each detent position, and finger-latch must be depressed to move handle through each position.

(d) Flap control handle operates without excessive force.

(12) With flaps extended to 22 degrees, install protractors on left and right No. 3 flaps at approximately

mid-span, parallel with rivet line. Measure flap deflection. Verify flap angle is 22 (±1) degrees.

(13) Remove protractors from flaps.

NOTE: Maintain setting on protractors.

(14) Depress finger-latch on underside of flap control knob to raise the mechanical lock out of the detent. Move the control to full flaps position. Verify following:

(a) Flaps and vanes operate smoothly and flaps position to selected angle.

(b) Both tapes of flap position indicator move to selected position and indicate flap position within the range mark limits.

(c) Flap handle is held securely at each detent, and finger-latch must be depressed to move handle through each position.

(d) Flap control handle operates without excessive force.

(15) Turn off hydraulic system A and turn on hydraulic system C (Ref. 29-11-00).

(16) Depress finger latch on underside of flap control knob and move control handle forward to the 22 degree detent.

Verify following:

(a) Flaps retract smoothly and position to selected angle.

(b) Both tapes of the flap position indicator move to selected position and indicate flap position within the range mark limits.

(17) With flaps extended to 22 degrees, install protractors on left and right No. 3 flaps at approximately mid-span, parallel with rivet line. Measure flap deflection. Verify flap angle is 22 degrees ±1 degree.

(18) Remove protractors from flaps.

(19) Depress finger latch on underside of flap control knob and move handle forward through each detent position (allow flaps to stop at each position) until flaps are fully retracted. Verify the following:

(a) Flaps retract smoothly and position to selected angle.

(b) Both tapes of the flap position indicator move to the selected position and indicate flap position within the range mark limits.

(c) When flaps pass the 4-degree position, the slats also start to retract, the LE EXT light goes out, and the LE TRANS light comes on.

(d) When flaps (and slats) are fully retracted, the LE TRANS light on flap position indicator goes out, and flaps and slats are faired with wing surfaces.

NOTE: If the flap position indicator tape positions are out of tolerance, check adjustment of flap position transmitters (Ref. 27-52-01).

(20) Turn off hydraulic power (Ref. 29-11-00).

(21) Turn off electrical power (Ref. 24-41-00).

(22) Verify both tapes of the TE FLAPS indicator move to the OFF position.

4C. Flap Asymmetry Detector System Operational Test

(1) Remove wing access panels 571AB and 671AB to gain access to flap asymmetry brakes (Ref. 6-40-00).

(2) Verify following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

No. 2 ASYM BRAKE

LE SLAT (J10) and TE FLAP (J11)

LOCK LIGHT

LE SLAT (J12) and TE FLAP (J13)

(b) On Flight Engineer/Second Officers Overhead circuit breaker panel CB2, zone 215:

No. 1 ASYM BRAKE

LE SLAT (H22) and TE FLAP (H21)

(3) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(5) Position the flap handle to the 4-degree detent; the flaps will extend to 4 degrees and the slats will fully extend.

(6) Disconnect the electrical connector from either the left wing or right wing rotary transducer. (Rotary transducer is the shorter of two units mounted on inboard side of asymmetry brake; do not disconnect both rotary transducers.)

(7) Open circuit breaker CB1-J11. The FLAP ASYM DET FAULT light on FE/SO annunciator panel must come on.

(8) Move flap control handle to the 10-degree detent position and verify following:

(a) The flap asymmetry system actuates to lock both asymmetry brakes before the flaps have extended two inches (the brake reset knobs on both asymmetry brakes trip to the extended position).

NOTE: Flap lock-up may be immediate with no noticeable movement of flap.

(b) The brake indicator rod on the flap PDU brake is flush with the hex head, indicating the flap PDU was electrically shut off (Ref. 27-51-12, Fig. 401, View B).

(c) On the FE/SO annunciator panel the FLAP/SLAT LOCK light comes on and the FLAP ASYM DET FAULT light goes off.

(9) Reset both asymmetry brakes (push in reset knobs). (It requires 25 to 30 pound force to reset asymmetry brake).

(10) Open circuit breakers CB1-J13 and CB2-H21. Verify the FLAP/SLAT LOCK light goes out and flaps move to selected position.

(11) Reset asymmetry comparator by closing circuit breakers CB1-J11 and CB1-J13. Verify FLAP ASYM DET FAULT light comes on.

(12) Position flap handle to 22 degrees. Verify following:

(a) Flaps start to extend and then lock up.

(b) FLAP/SLAT LOCK light comes on and FLAP ASYM DET FAULT light goes off.

(c) Both right and left asymmetry brakes have tripped.

(d) Flap PDU brake has actuated (brake indicator rod is flush with hex head).

(13) Reset both asymmetry brakes (push in reset knobs).

(14) Open circuit breakers CB1-J11 and CB1-J13. Verify following:

(a) FLAP/SLAT LOCK light goes off.

(b) Flaps move to 22 degree position.

(15) Reset asymmetry comparator by closing circuit breakers CB1-J11 and CB1-J13. Verify FLAP ASYM DET FAULT light comes on.

(16) Position flap handle to 10 degrees. Verify following:

(a) Flaps start to retract and then lock up.

(b) FLAP/SLAT LOCK light comes on.

(c) FLAP ASYM DET FAULT light goes off.

(d) Both right and left asymmetry brakes have tripped.

(e) Flap PDU brake has actuated (the brake indicator rod is flush with hex head).

(17) Reset both asymmetry brakes (push in reset knobs).

(18) Open circuit breakers CB1-J11 and CB1-J13. Verify following:

(a) FLAP/SLAT LOCK light goes off.

(b) Flaps move to selected position.

(19) Reset asymmetry comparator by closing circuit breakers CB1-J13 and CB2-H21. Verify FLAP ASYM DET FAULT light comes on.

(20) Position flap handle to 4 degrees. Verify following:

(a) Flaps start to retract and then lock up.

(b) FLAP/SLAT LOCK light comes on.

(c) FLAP ASYM DET FAULT light goes off.

(d) Both right and left asymmetry brakes have tripped.

(e) Flap PDU brake has actuated (the brake indicator rod is flush with hex head).

(21) Reset both asymmetry brakes (push in reset knobs).

(22) Reconnect the rotary transducer electrical connector disconnected in Step 4 4C (6).

(23) Open circuit breakers CB1-J13 and CB2-H21. Verify following:

(a) FLAP/SLAT LOCK light goes out.

(b) flaps move to selected position.

(24) Reset asymmetry comparator by closing circuit breakers CB1-J11, CB1-J13 and CB2-H21. Verify FLAP/SLAT LOCK and FLAP ASYM DET FAULT lights remain off.

(25) Position flap handle to zero (full up). Verify the following:

(a) Flaps and slats fully retract.

(b) FLAP/SLAT LOCK and FLAP ASYM DET FAULT lights remain off.

(26) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(27) Turn off electrical power if no longer required (Ref. 24-41-00).

(28) Close access panels.

4D. Flap Control System Operational Check

(1) On Pilots overhead circuit breaker panel CB1, verify following circuit breakers are closed:

FLAP CONTROLS

NO. 2 ASYM BRAKE LE SLAT (J10)

NO. 2 ASYM BRAKE TE FLAP (J11)

LOCK LIGHT LE SLAT (J12)

LOCK LIGHT TE FLAP (J13)

(2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify following circuit breakers are closed:

NO. 1 ASYM BRAKE

TE FLAP (H21)

LE SLAT (H22)

FLAP LOAD RELIEF - CHAN 1 (H12)FLAP LOAD RELIEF - CHAN 2 (H20)

(3) On Flight Engineer/Second Officers aft circuit breaker panel CB3, verify following circuit breakers are closed:

POSN IND

TE FLAP (K16)

LE SLAT (K17)

LE SLAT EXTEND LT (K18)

(4) Turn on electrical power (Ref. 24-41-00). Verify FLAP/SLAT LOCK, FLAP ASYM DET FAULT and SLAT ASYM DET FAULT light on FE/SO annunciator panel are off.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip overspeed governor in either or both asymmetry brakes, and give invalid test results. To perform a valid test of flap and/or slat actuation system, pressurize the B and C hydraulic systems using ATM pumps, and the A hydraulic system using the PTU. Alternately, two ground sources, each capable of 25 gpm at 3000 psi, may be used to pressurize the A and C hydraulic systems.

(6) Verify flap handle is in the 0-degree detent and flaps are fully retracted.

(7) Verify both tapes on flap position indicator (pilots center instrument panel) are within the 0-degree range mark limits.

(8) Depress the finger-latch release under forward edge of flap control knob and move flap control handle to the 4-degree position; the flaps (and slats) must start to extend.

(9) During transit, verify LE TRANS light on the flap position indicator on the pilots center instrument panel is on and that flaps (and slats) move smoothly.

When motion stops, verify:

(a) LE TRANS light goes off and LE EXT light comes on.

(b) Flaps have extended 4 degrees (use flap position indicator).

(c) Both tapes of the TE FLAPS indicator have moved within the 4-degree range mark limits.

(d) Flap handle is held securely in the 4-degree detent position.

(10) Depress finger-latch on underside of the flap control knob to raise the mechanical lock-out of the detent. Move the control handle successively through each detent position (allow flaps to stop at each selected position); verify:

(a) Flaps and vanes operate smoothly and flaps position to selected angle (use flap position indicator).

(b) Both tapes of the TE FLAPS indicator move to the selected position and indicate flap position within the range mark limits.

(c) Flap handle is held securely at each detent position, and finger-latch must be depressed to move handle through each position.

(d) Flap control handle operates without excessive force.

(11) Return flap handle to UP position by moving the control handle successively through detent position (allow flaps to stop at each selected position); verify the following:

NOTE: This

(a) Flaps retract smoothly and position to selected angle.

(b) Both tapes of the TE FLAPS indicator move to the selected position and indicate flap position within the range mark limits.

(c) When flaps pass the 4-degree position, the slats also start to retract, the LE EXT light goes out, and the LE TRANS light comes on.

(d) When flaps (and slats) are fully retracted, the LE TRANS light goes out, and flaps and slats are faired with the wing surfaces.

NOTE: If the flap position indicator tape positions are out of tolerance, check adjustment of the flap position transmitters (Ref. 27-52-01).

The following steps check the flap asymmetry detector system.

(12) Remove wing access panels 571AB and 671AB to gain access to flap asymmetry brakes (Ref. 6-40-00).

(13) Position the flap handle to the 4-degree detent. The flaps will extend to 4 degrees and the slats will fully extend.

(14) Disconnect the electrical connector from either the left wing or right wing rotary trandsucer. (Rotary transducer is the shorter of two units mounted on inboard side of asymmetry brake. Do not disconnect both rotary transducers.)

(15) Open circuit breaker CB1-J11. Verify FLAP ASYM DET FAULT annunciator light comes on.

(16) Move flap control handle to the 10-degree detent and verify following:

(a) The flap asymmetry system actuates to lock both asymmetry brakes before the flaps have extended two inches (the brake reset knobs on both asymmetry brakes trip to the extended position).

NOTE: Flap lock-up may be immediate with no noticeable flap movement.

(b) The brake indicator rod on the flap PDU brake is flush with the hex head, indicating flap PDU was electrically shut off (Ref. 27-51-12, Figure 401, View B).

(c) The FLAP/SLAT LOCK light on FE/SO annunciator panel comes on.

(d) The FLAP ASYM DET FAULT light on FE/SO annunciator panel goes off.

(17) Reset both asymmetry brakes (push in reset knobs). (It requires 25 to 30 pounds force to reset asymmetry brake.)

(18) Open circuit breakers CB1-J13 and CB2-H21. Verify FLAP/SLAT LOCK light goes off and flaps move to selected position.

(19) Reset asymmetry comparator by closing circuit breakers CB1-J11 and CB1-J13. Verify FLAP ASYM DET FAULT light on FE/SO annunciator panel comes on.

(20) Position flap handle to 22 degrees and verify following:

(a) The flaps start to extend and then lock-up.

(b) FLAP/SLAT LOCK light comes on and the FLAP ASYM DET FAULT on FE/SO annunciator panel goes off.

(c) Both right and left asymmetry brakes have tripped.

(d) The flap PDU brake has actuated (the brake indicator rod is flush with hex head).

(21) Reset both asymmetry brakes (push in reset knobs).

(22) Open circuit breakers CB1-J11 and CB1-J13. Verify FLAP/SLAT LOCK light on FE/SO annunciator panel goes off and flaps move to selected position.

(23) Reset asymmetry comparator by closing circuit breakers CB1-J11 and CB1-J13. Verify FLAP ASYM DET FAULT light on FE/SO annunciator panel comes on.

(24) Position flap handle to 10 degrees and verify following:

(a) The flaps start to retract and then lock-up.

(b) FLAP/SLAT LOCK light comes on and FLAP ASYM DET FAULT light goes off.

(c) Both right and left asymmetry brakes have tripped.

(d) The flap PDU brake has actuated (the brake indicator rod is flush with hex head).

(25) Reset both asymmetry brakes (push in reset knobs).

(26) Open circuit breakers CB1-J11 and CB1-J13. Verify FLAP/SLAT LOCK light goes off and flaps move to selected position.

(27) Reset asymmetry comparator by closing circuit breakers CB1-J13 and CB2-H21. Verify FLAP ASYM DET FAULT light on FE/SO annunciator panel comes on.

(28) Position flap handle to 4 degrees and verify following:

(a) The flaps start to retract and then lock-up.

(b) FLAP/SLAT LOCK light comes on and FLAP ASYM DET FAULT light goes off.

(c) Both right and left asymmetry brakes have tripped.

(d) The flap PDU brake has tripped (the brake indicator rod is flush with hex head).

(29) Reset both asymmetry brakes (push in reset knobs).

(30) Reconnect transducer electrical connector opened in Step 4D(14).

(31) Open circuit breakers CB1-J13 and CB2-H21. Verify FLAP/SLAT LOCK light goes off and flaps move toward selected position.

(32) Reset asymmetry comparator by closing circuit breakers CB1-J11, CB1-J13 and CB2-H21. Verify FLAP/SLAT LOCK and FLAP ASYM DET FAULT lights remain off.

(33) Position flap handle to zero (full up). The flaps and slats will fully retract.

(34) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(35) Turn off electrical power if no longer required (Ref. 24-41-00). If electrical power is turned off, verify that both tapes on the TE FLAP indicator move to the OFF position.

(36) Close access panel opened in Step 4D(12).

5. Rigging Check and Adjustment

Rigging check and adjustment procedures are presented separately for each part of the flap system. The preparation and completion check procedures must be performed before and after

any rigging check and adjustment. The individual procedures are listed below.

PARAGRAPH	PROCEDURE
5A	Preparation
5B	Flap Control Handle to Flap-and-Slat Programmer (Forward Cable Loop)
5C	Flap-and-Slat Programmer to Flap Aft Cable Quadrant (Aft Cable Loop)
5D	Flap Aft Cable Quadrant Output to Flap Power Drive Unit
5E	Flap Panels
5F	Vanes
5G	Flap Vane-to-Spoiler Contact Check
5H	Outboard Flap Vane-to-Flap Contact Check
5I	Completion Check

CAUTION: WHEN WORKING IN FLAP AREA, VERIFY VANE ACTUATOR IS FULLY EXTENDED (STRAIGHT) BEFORE RETRACTING FLAPS. RETRACTING FLAPS WITH A FOLDED VANE ACTUATOR WILL DAMAGE VANE ACTUATOR CAM AND ROLLER.

NOTE: Aircraft structure and cable temperatures must be stabilized when adjusting cable tension. Do not operate air conditioning equipment immediately before or during cable rigging and/or adjustment.

After making a turnbuckle adjustment, check for minimum thread engagement by verifying that no more than three threads are exposed on cable terminal.

Also verify cable terminals are not threaded more than a maximum .25 of an inch into turnbarrel and prevent proper engagement of locking clips.

To measure the maximum thread engagement insert a small piece of .020 safety wire between cable and inside surface of turnbarrel and mark where safety wire and outside surface contacts. Remove safety wire and measure distance of mark (Ref. Fig. 501, View B).

After making pushrod adjustment, check for minimum thread

engagement by verifying rod end thread is visible at inspection hole.

The flap swing link carriage frogs and the vane carriage frogs (roller crosses) are safetied with special tab washers. If a tab washer is found with the tab broken off (the tab engages a hole in the frog), the tab washer need not be replaced as long as the lock-wire is intact. The tab is for alignment only. A broken tab washer should be replaced when the frog or carriage is removed. It should be noted that a broken tab washer indicates a lack of lubrication of the carriage body monoball bearing.

5A. Preparation - Rigging Check and Adjustment

(1) Shut off all four hydraulic systems (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

5B. Flap Control Handle to Flap-and-Slat Programmer (Forward Cable Loop) - Rigging Check and Adjustment

NOTE: The flap/slat control system consists of three cable loops: the forward (flap/slat) loop, the aft (flap) loop, and the center (slat) loop. To rig the flap control system, the forward and aft cable loops must be rigged. Rigging of the center (slat) cable loop is covered in 27-81-00, 501, Adjustment and Test.

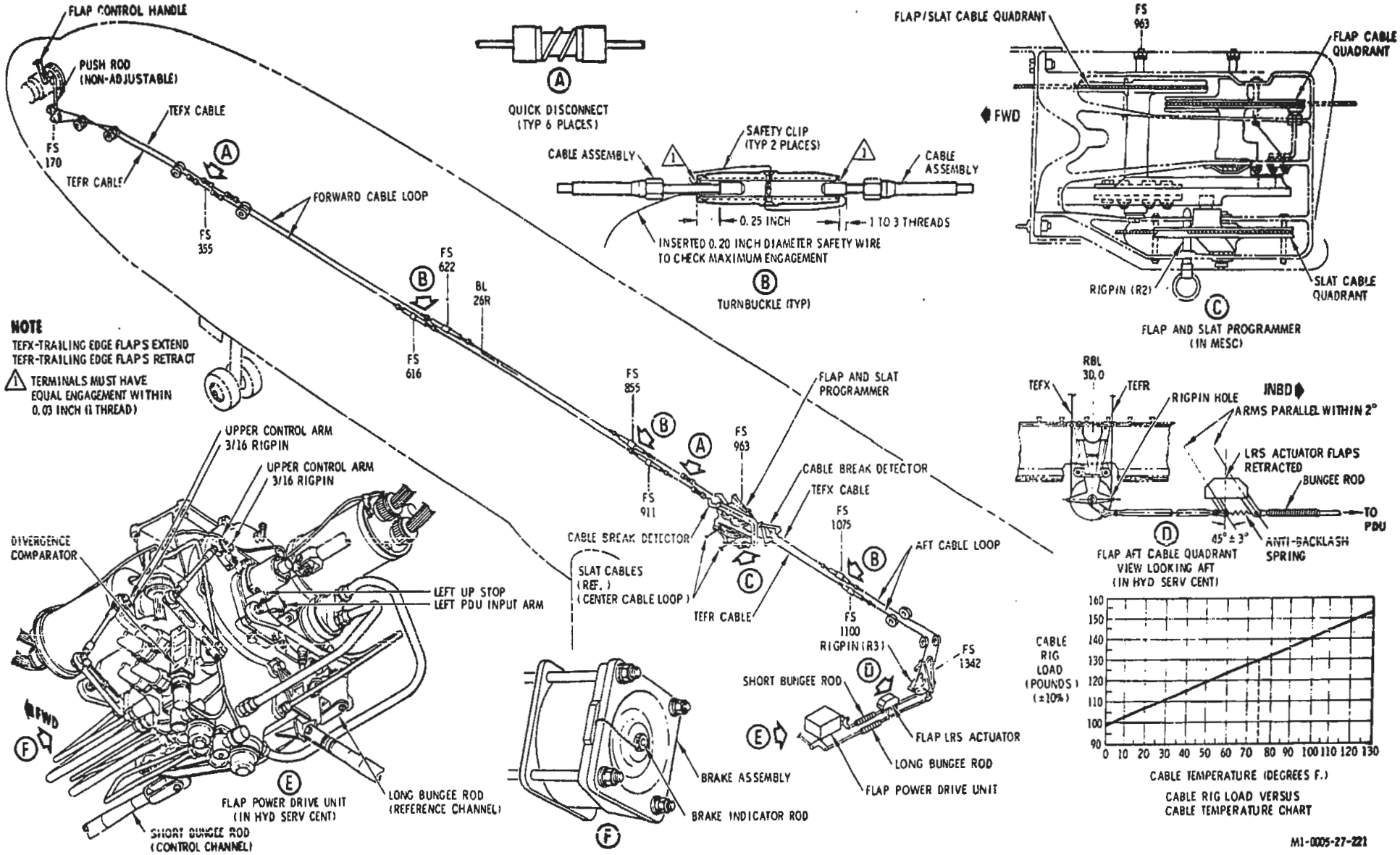
(1) Turn off all hydraulic power and tag hydraulic control panels.

(2) For rigging of forward cable loop, accomplish following:

(a) Verify that flap handle is in the 0-degree detent position.

(b) Verify rig pin R2 can be inserted in the lower cable quadrant of the flap-and-slat programmer and that cable tension conforms to chart (Ref. Fig. 501). If not, adjust turnbarrels.

NOTE: Flap and slat cables are accessible in the forward electronic service center for checking cable tension. Turnbuckles are accessible through the forward cargo compartment ceiling access panels 125HR, 125KR (Ref. 6-50-00).



R Flap Input Control System Rigging
R Figure 501

EFFECTIVITY: ALL

001B

(3) Install safety clips on turnbuckles.

(4) Perform completion check (Ref. Para. 5I).

5C. Flap-and-Slat Programmer to Flap Aft Cable Quadrant (Aft Cable Loop) - Rigging Check and Adjustment

(1) Open hydraulic service center access door 147AB or 147BB.

(2) Verify flap control handle is in the 0-degree detent position.

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(3) Insert rig pin (R2) through support bracket and lower cable quadrant of flap-and-slat programmer (Ref. Fig. 501) Verify following:

(a) Cable tension conforms to temperature compensation chart on Fig. 501.

(b) Rig pin (R3) fits freely through bracket and aft cable quadrant (in hydraulic service center).

(4) If both requirements are not met, adjust the cable turnbuckles.

NOTE: Turnbuckles are located below passenger cabin floor access panel 252FB (Ref. 6-50-00).

(5) If cable adjustment was required, remove rig pins and move flap control handle from the retracted position to the fully extended position, and back to the retracted position. Repeat three times to exercise and stabilize cable runs. Recheck cable rigging in accordance with Steps 5, 5C(3) and 5, 5C(4).

(6) Install safety clips on turnbuckles.

(7) If aft cable loop is adjusted, check forward cable loop. Accomplish Para. 5B (Flap Control Handle to Flap-and-Slat Programmer).

(8) If no further rigging of the flap system is required, perform completion check (Ref. Para. 5I).

5D. Flap Aft Cable Quadrant to Flap Power Drive Unit (PDU) - Rigging Check and Adjustment

(1) Verify that flap control handle is in 0-degree detent position.

(2) Open hydraulic service center access door 147AB or 147BB (Ref. 6-40-00).

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(3) Insert rig pin (R3) through flap aft cable quadrant and its support bracket (Ref. Fig. 501).

(4) Verify the two input control arms on the PDU are against the fixed external UP stops (forward stops) with no backlash in either control system between the PDU input arm and LRS actuator output arms. If not, perform following:

NOTE: A very small amount of backlash can be tolerated in the long bungee rod (reference channel); no backlash is acceptable in the short bungee rod (control channel).

(a) Install two 3/16-inch rig pins in PDU upper control arms to prevent actuation of the PDU divergence comparator when the flap PDU input bungee rods are disconnected.

CAUTION: IF COMPARATOR TRIPS (INPUT ARMS DO NOT SYNCHRONIZE), DO NOT MOVE INPUT ARMS WITHOUT RESETTING COMPARATOR (REF. 27-51-08, PARA. 5) OR INTERNAL DAMAGE MAY RESULT.

NOTE: On later PDU's, rig pin holes have been eliminated. On these PDU's, lock-wire input arms against up-stops.

(b) Disconnect the control rods from the load relieving system (LRS) actuator input arms and the bungee rods from the output arms. Note the anti-backlash spring attaching hardware.

(c) Verify LRS actuator arms are at between 42 degrees and 48 degrees with vertical centerline and are parallel within 2 degrees. If not replace flap LRS actuator.

(d) Position LRS actuator input arms against the internal flaps-up stop (input arms pointing to left side of aircraft); adjust input control rods to minimum backlash and connect to LRS actuator.

(e) Adjust bungee (output) control rods to zero backlash and connect to PDU.

(f) Remove rig pins from PDU upper control arms (or remove lock-wire holding input arms against up-stops) and recheck for backlash. If backlash exists, reinstall rig pins in PDU upper control arms (or lock-wire input arms against up-stops) and readjust bungees to remove the backlash.

NOTE: The bungees are in correct adjustment when no backlash exists in either input linkage with the rig pins or lock-wire removed from PDU input arms. A small amount of backlash can be tolerated in the long bungee reference channel; no backlash is acceptable in the short bungee control channel. Bungee preload in either channel must not exceed 1/2 turn.

(g) Safety bungee rods.

(h) Verify anti-backlash springs are properly installed between LRS actuator input and output arms.

(i) Turn off electrical power if no longer required (Ref. 24-41-00).

(5) Remove rig pin from flap aft cable quadrant and rig pins from PDU upper control arms or lock-wire from input arms.

(6) If the flap aft cable quadrant to flap PDU control system is adjusted, check the forward cable loop. Accomplish Para. 5B (Flap Control Handle to Flap-and-Slat Programmer).

(7) If no further rigging of the flap system is required, perform the completion check (Ref. Para. 5I). Move control arms against stops to remove backlash.

5E. Flap Panels - Rigging Check and Adjustment

(1) Position flaps to the retracted 0-degree rig position as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) Verify circuit breakers No. 1 ASYM BRAKE, TE FLAP (CB2-H21) and NO. 2 ASYM BK, TE FLAP (CB1-J11) are closed.

(c) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(d) Position flap handle to the 4° detent. When flaps stop, position flap handle to the 0-degree detent. The flaps will retract to the 0-degree rig position. [As confirmation, verify brake indicator rod on the flap PDU break is flush with the hex head on the brake, indicating electrical shutoff of the PDU and application of the PDU brake (Ref. Fig. 501, View F).]

NOTE: Electrical shutoff of the flap PDU (flaps retract rig position), is controlled by a switch in each PDU switchbox. Correct switchbox rigging can be verified by opening circuit breaker CB2-H21 and CB1-J11. With hydraulic power on, the flap torque shaft must rotate 1 to 4 turns in the retract direction until hydraulic shutoff by the flap PDU. If flap torque shafts do not rotate 1 to 4 turns, check flap PDU switchbox and reducer coupling rigging in accordance with procedures in 27-51-12. After above check, close circuit breaker CB2-H21 and CB1-J11, position flaps to four degrees and then back to zero degrees to position flaps to the retract rig position.

C

C

(2) Remove wing access panels. Table 501 lists the access panels on the underside of the wings which provide access to the flap drive system.

Wing Access Panels
Table 501

LEFT WING	RIGHT WING	FLAP PANEL
541BB	641BB	1

Wing Access Panels (Cont)
Table 501

LEFT WING	RIGHT WING	FLAP PANEL
541CB	641DB	1
541FB	641FB	2
541GB	641GB	2
561AB	661AB	3
561BB	661BB	3
561CB	661CB	4
571AB	671AB	Asymmetry Brake

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(3) Verify the fore and aft location of each flap by checking the clearance between the flat on the forward face of the ballscrew carriage and the flat on the aft face of the ballscrew stop. Clearance must be 0.54 (±0.06) inch (0.48 to 0.60 inch) (Ref. Fig. 502).

(a) Pull flap asymmetry brake reset knob.

(b) Support aft end of flap panel.

NOTE: All carriages on all ballscrew actuator shafts are rigged to the same relative position. However, the method of rigging differs between the carriages for tracks 1,4,5 and 8 and the back-to-back carriages 2 and 3, and 6 and 7 (Ref. Fig. 502).

Care must be taken to avoid twisting the flap and binding the eccentric adjusting pins. The pins must turn freely at the final position. Adjust carriages at both

ends of flap panel, if required, to free pins.

(c) On track number 1,4,5 or 8, disconnect wing torque shafting at each side of gearbox. Rotate gearbox input shaft to adjust clearance.

(c) On tracks numbers 2 and 3 or 6 and 7, disconnect wing torque shafting at each side of the pair of gearboxes. Rotate inboard gearbox input shaft to position one carriage against its stop. Disconnect quill shaft on adjacent actuator shaft and rotate actuator shaft to move carriage against its stop. Reconnect quill shaft and rotate gearbox input shaft to adjust clearance of both carriages.

CAUTION: QUILL SHAFT CAN BE INSTALLED IN BALLSCREW TO ALIGN BOLT HOLES IN TWO POSITIONS, 180 DEGREES APART. IN WRONG POSITION, BOLT WILL BE A PUSH FIT AND QUILL SHAFT MAY EVENTUALLY FAIL. IN CORRECT POSITION, BOLT FITS FREELY THROUGH BALLSCREW AND QUILL SHAFT AND QUILL SHAFT CAN BE MOVED FORE AND AFT AT LEAST 0.040 INCH AFTER BOLT INSTALLATION.

(d) Reconnect torque shafts to gearboxes.

(e) Push in asymmetry brake reset knob.

(f) Remove support from aft end of flap panels.

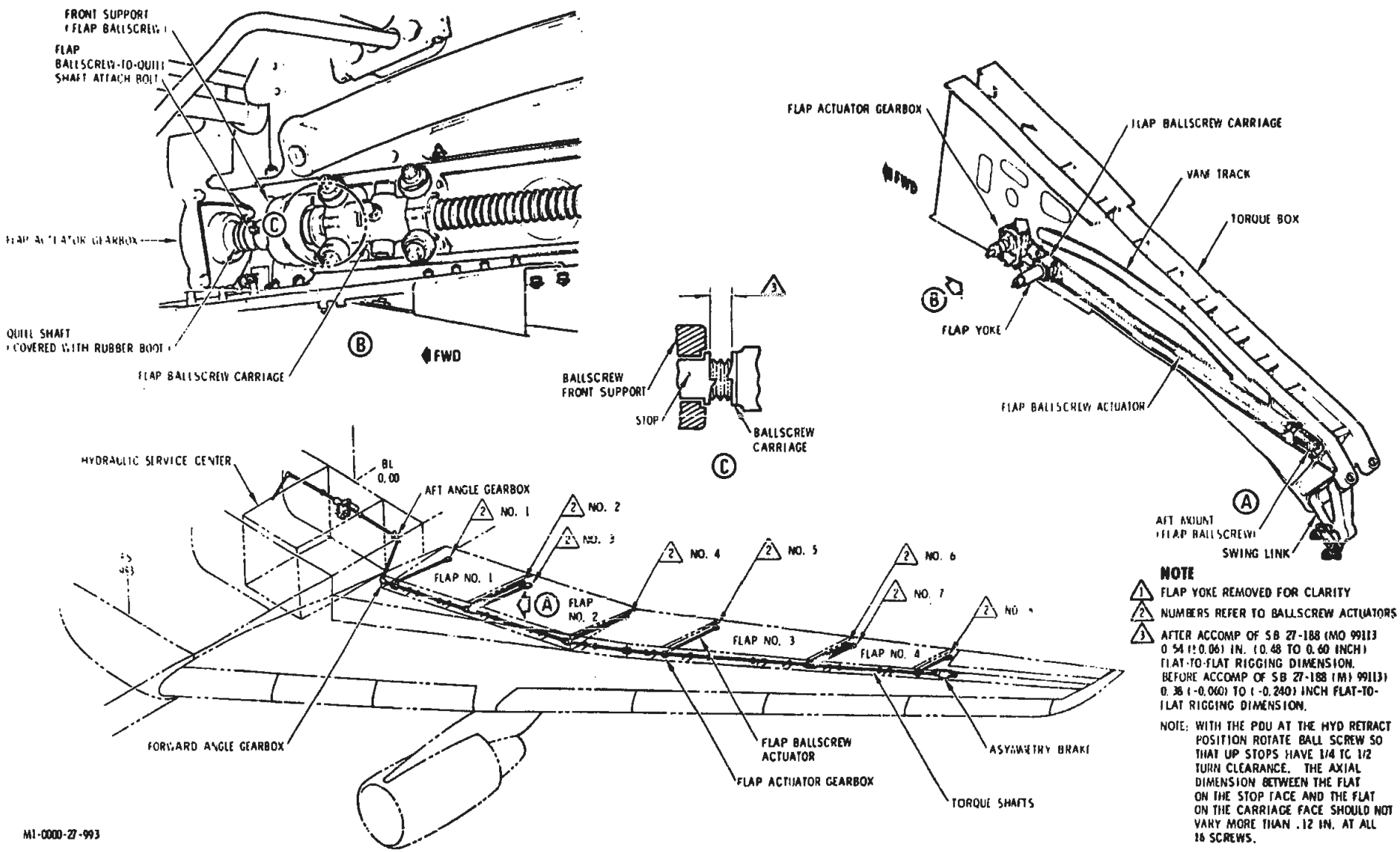
(4) With flaps fully retracted, verify the gap between the upper surfaces of each flap and adjacent torque box is no less than 0.20 inch (Ref. Fig. 503). If not, extend flaps and shift flap spanwise position as follows:

(a) Block inboard end of flap and support flap aft end.

(b) Remove flap attach (outboard) fitting and transfer shims from one side of yoke to the other.

CAUTION: VERIFY THAT FLAP ATTACH FITTING ROTATES FREELY ON YOKE; IF NECESSARY, OMIT ONE SHIM FROM RETAINER FITTING END OF YOKE.

(c) Remove flap attach swing (inboard) fitting and transfer same number of shims from one side of yoke to the other as were transferred on the outboard fitting.



NOTE

1. FLAP YOKE REMOVED FOR CLARITY
2. NUMBERS REFER TO BALLSCREW ACTUATORS
3. AFTER ACCOMP OF SB 27-188 (MO 99113 0.54 (±0.06) IN. (0.48 TO 0.60 INCH) FLAT-TO-FLAT RIGGING DIMENSION. BEFORE ACCOMP OF SB 27-188 (M) 99113) 0.36 (-0.060) TO (-0.240) INCH FLAT-TO-FLAT RIGGING DIMENSION.

NOTE: WITH THE PDU AT THE HYD RETRACT POSITION ROTATE BALL SCREW SO THAT UP STOPS HAVE 1/4 TO 1/2 TURN CLEARANCE. THE AXIAL DIMENSION BETWEEN THE FLAT ON THE STOP FACE AND THE FLAT ON THE CARRIAGE FACE SHOULD NOT VARY MORE THAN .12 IN. AT ALL 16 SCREWS.

C C Ballscrew Actuator Carriage Adjustment
Figure 502

R R 0018 EFFECTIVITY: ALL

NOTE: The number of shims on the inboard and outboard sides of yoke should be identical for both inboard and outboard yokes.

(5) With flaps fully retracted, verify following (Ref. Fig. 503):

(a) The flap upper surface is in contour with the torque box upper surface (±0.15 inch mismatch). If not, adjust flap aft carriage eccentric pin (on swing link).

(b) The flap lower surface is in contour with the wing lower trailing edge access panels (+0.25, - 0.50 inch mismatch). C

NOTE: Mismatch between the flap and wing lower access panels can be affected by contour irregularities in the access panels. To properly check mismatch, use the flat (wide) surface of a flexible steel 24 to 36 inch scale (a piece of 0.015 to 0.020 spring steel 0.50 inch wide can also be used). Lay flat side of steel scale across flap-to-wing gap to eliminate contour irregularities and measure mismatch.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

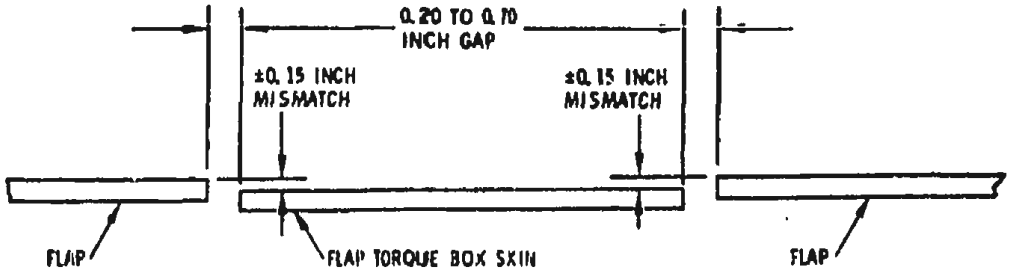
PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on hydraulic system A and C (Ref. 29-11-00).

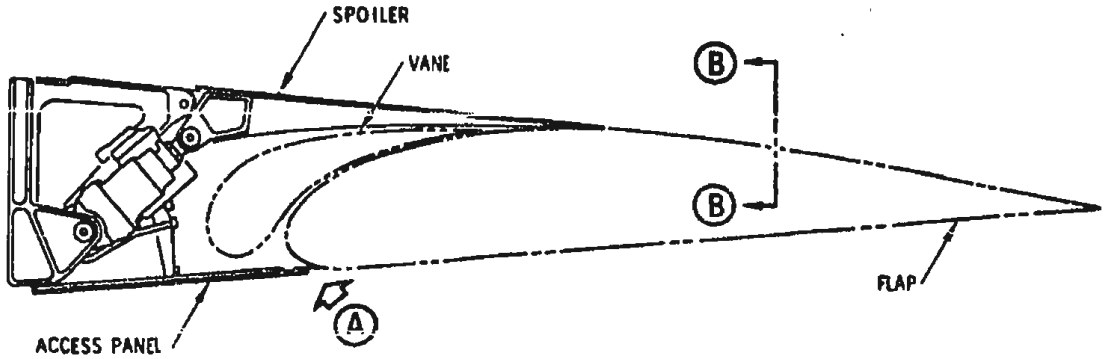
CAUTION: VERIFY VANE ACTUATORS ARE FULLY EXTENDED (STRAIGHT). RETRACTING FLAPS WITH A FOLDED VANE ACTUATOR WILL DAMAGE THE VANE ACTUATOR CAM AND ROLLER.

NOTE: If using AC pumps, improve hydraulic operation of flaps by deactivating the slats. Depress slat lock switchlight on SLAT MONITOR panel on

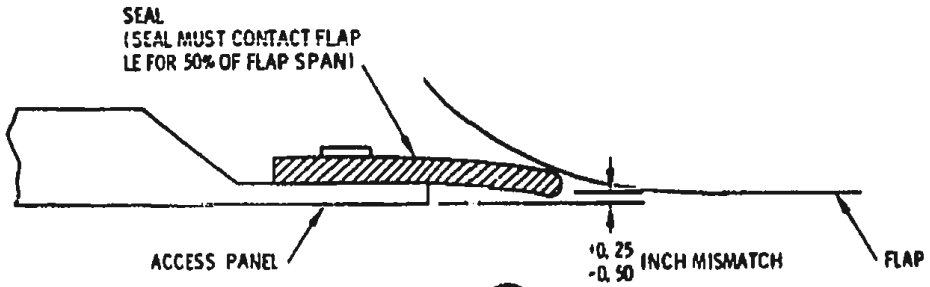


(B)

FLAP-TO-TORQUE BOX CONTOUR REQUIREMENT



FLAP-TO-WING CONTOUR REQUIREMENT



(A)

M1-0001-27-1225

CR
CR

Flap Requirement
Figure 503

EFFECTIVITY: ALL

001B

FE/SO upper instrument panel. Switchlight 1 LOCK and 2 LOCK lights must come on.

(7) Cycle flaps from full up through full extend and back to full up. Observe the seals on the bottom of adjacent flap fairing on the outboard flaps. If the seals tend to protrude and pinch, readjust aft carriage eccentric pins to the maximum allowable out of contour for the flap to torque box upper surface (±0.15 inch). While cycling flaps, note operation of ballscrew and swing link carriage rollers. Flaps should operate smoothly without binding.

NOTE: Carriage rollers are adjusted to fit tightest position in track with only a slight drag. The maximum allowable roller-to-track clearance at any travel position is 0.030 inch, measured at one roller of each frog with other rollers against track. If roller-to-track clearance exceeds 0.030 inch, adjust rollers to a maximum clearance of 0.025 inch in accordance with 27-51-26 (Flap Carriage Ballscrew Actuator - Removal and Installation) for ballscrew carriage, and 27-51-35 (Wing Flap - Removal and Installation) for swing link carriage.

(8) After adjustments are made, verify all locking and safety devices are properly installed.

(9) Verify flaps are full up.

(10) Install protractors on left and right No. 3 flap panels at approximately mid span, parallel with rivet line.

(11) Zero protractors. Remove protractors from aircraft. Maintain zero setting for following Steps.

(12) Position flap handle to 22 degrees.

(13) Measure flap angle with protractors installed on left and right No. 3 flap panels at approximately mid span, parallel with rivet line. Verify flap angle is 22 (±1) degrees.

(14) If flaps are out of tolerance, adjust as follows:

(a) Open access panels 135BL-3 and 135DL-3 in forward cargo compartment ceiling to gain access to Trailing Edge Flaps Extend and Trailing Edge Flaps Retract control cable turnbuckles (FS855 and 911).

(b) If flap angle was greater than 23 degrees, loosen Trailing Edge Flap Extend cable turnbuckle and one full turn for every one half degree greater than 22 degrees.

(c) Tighten Trailing Edge Flap Retract cable turnbuckle the same number of turns Trailing Edge Flap Extend cable turnbuckle was loosened.

(d) If flap angle was less than 21 degrees, loosen Trailing Edge Flap Retract cable turnbuckle one full turn for every one half degree less than 22 degrees.

(e) Tighten Trailing Edge Flap Extend cable turnbuckle the same number of turns Trailing Edge Flap Retract cable turnbuckle was loosened.

NOTE: One full turn of turnbuckle will equal one half degree of flap angle at this flap position only.

(15) Cycle flaps full up, full down, full up and to 22 degree position. With protractors verify flap angle is 22 (±1) degrees. If not readjust turnbuckles.

(16) Verify minimum and maximum turnbuckle engagement and install safety clips.

(17) Close access panels in forward cargo compartment ceiling.

(18) If no further rigging of the flap system is required, perform completion check (Ref. Para. 5I).

NOTE: If slat lock switchlight was released, depress (in) switchlight. Verify that 1 LOCK and 2 LOCK lights go off.

5F. Vanes - Rigging Check and Adjustment

NOTE: The flaps and spoilers must be fully rigged before vane panels are adjusted.

C (1) Check for proper contact between inboard flap vanes and
C spoilers (Ref. Para. 5G) and clearance between outboard flap vanes and flaps (Ref. Para. 5H).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

THE PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on all four hydraulic systems (Ref. 29-11-00).

(3) Cycle flaps and vanes from full up through full extend and back to 10 degrees, note operation of vane carriage rollers. Vane should operate smoothly without binding.

(a) Carriage rollers are to be adjusted to fit tightest position in track with only slight drag (20 pounds maximum per carriage assembly). When carriage rollers are adjusted, torque retaining nut to 40-60 pound-inches and lockwire. The maximum allowable roller to track clearance at any travel position is 0.060 inch measured at one roller of each frog with the other three rollers against track.

(b) If clearance is exceeded, replace the carriage (Ref. 27-51-47,401).

(4) Check that vane actuators operate freely by alternately flexing each vane actuatory slightly overcenter by hand (approximately 0.50 inch from locked position) at both the 10- and 18-degree flap positions. The actuator must spring back to the fully extended (locked) position when released. IF not, readjust vane eccentrics to remove vane twist while maintaining proper contact with flap (Ref. Para. 5H). R

CAUTION: VERIFY VANE ACTUATORS ARE FULLY EXTENDED (STRAIGHT). RETRACTING FLAPS WITH A FOLDED VANE ACTUATOR WILL DAMAGE THE VANE ACTUATOR CAM AND ROLLER.

(5) Position flaps and vanes so the forward surface of vane actuator cam is directly under cam roller (Ref. Fig. 504).

(a) Verify clearance of flap vane carriage rollers measured at one roller of each roller cross with other rollers resting on track does not exceed 0.060 inches.

(b) If clearance is exceeded replace the carriage (Ref. 27-51-47, 401).

(c) On vane 1 and 2 installations: visually verify a minimum of half of the vane actuator cam aligns with the cam roller. If not, shim roller bracket to allow a minimum of 0.22 inch of cam to align with roller and there is 0.12 inch minimum clearance between cam and roller bracket.

(d) On vane 3 and 4 installations: visually verify clearance between vane actuator cam and cam roller bracket and a minimum of 0.31 inch of cam aligns with cam roller. If not, shim roller bracket to dimensions shown in Figure 505, View A.

NOTE: The flap and vane panels must be fully rigged before vane actuator cam roller is adjusted.

(6) Verify clearance between cam and roller is between 0.02 and 0.06 inch. If not, adjust cam roller as follows:

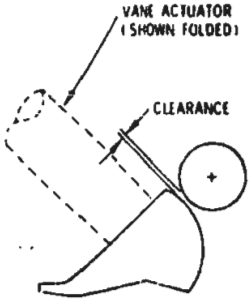
C NOTE: If cam spindle has excessive rotational freedom,
C add shims between spindle and vane actuator
C attach clevis to limit total clearance to 0.010
C inch (Ref. 27-51-48).

(a) Loosen cam roller using a Camrol driver.

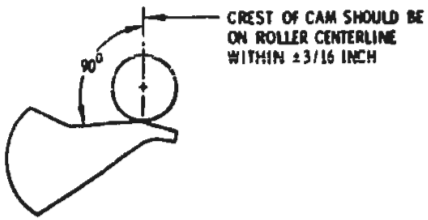
(b) Remove locking plate. Rotate serrated bushing for adjustment (locking plate may be used to rotate bushing).

NOTE: If insufficient adjustment exists on No. 3 or No. 4 vane rollers, shim roller bracket with appropriate shim. The inboard bracket uses a laminated shim (Ref. Fig. 504). The outboard roller bracket uses a tapered shim (Ref. Fig. 505). Tapered shim is installed to cause roller bracket to rotate slightly upward or downward. After installing tapered shim, verify full face contact of cam with roller surface.

(c) Reinstall locking plate.



STOWED POSITION CLEARANCE
(FLAPS FULL UP)

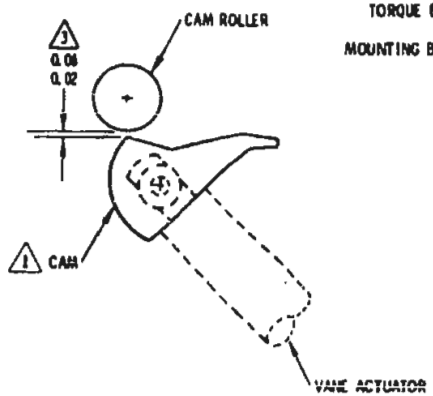


2 CAM-TO-ROLLER OVERLAP
(VANE CARRIAGES
CONTACTING
BOTH FORWARD
STOPS)

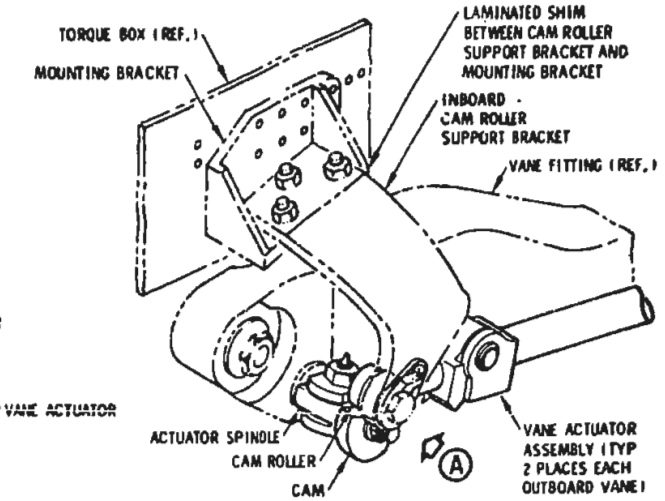
FWD

Ⓐ

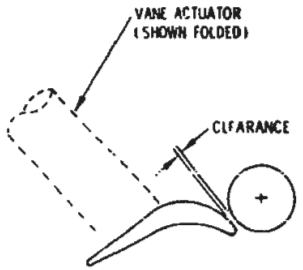
OUTBOARD VANES (VANES 3 AND 4)



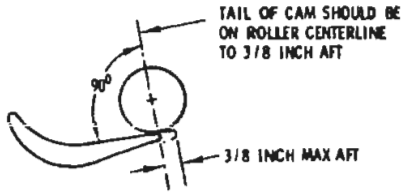
CAM-TO-ROLLER CLEARANCE
(FLAP APPROXIMATELY 8°)



OUTBOARD VANE CAM ACTUATOR INSTALLATION
(SIMILAR FOUR PLACES EACH WING)



STOWED POSITION CLEARANCE
(FLAPS FULL UP)

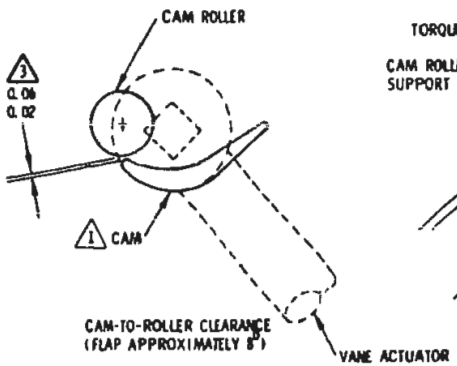


2 CAM-TO-ROLLER OVERLAP
(VANE CARRIAGES
CONTACTING
BOTH FORWARD
STOPS)

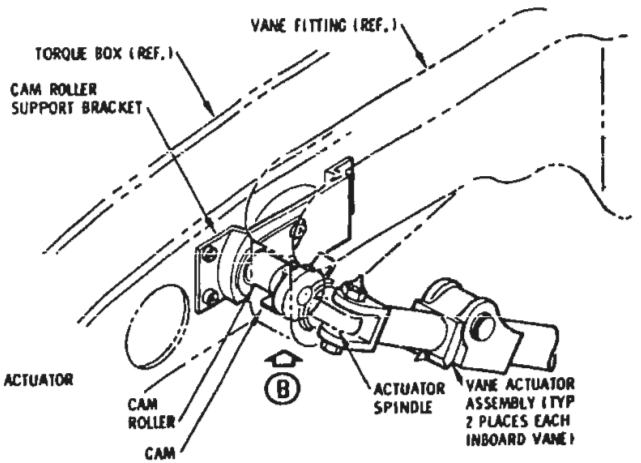
FWD

Ⓑ

INBOARD VANES (VANES 1 AND 2)



CAM-TO-ROLLER CLEARANCE
(FLAP APPROXIMATELY 8°)



INBOARD VANE CAM ACTUATOR INSTALLATION
(SIMILAR FOUR PLACES EACH WING)

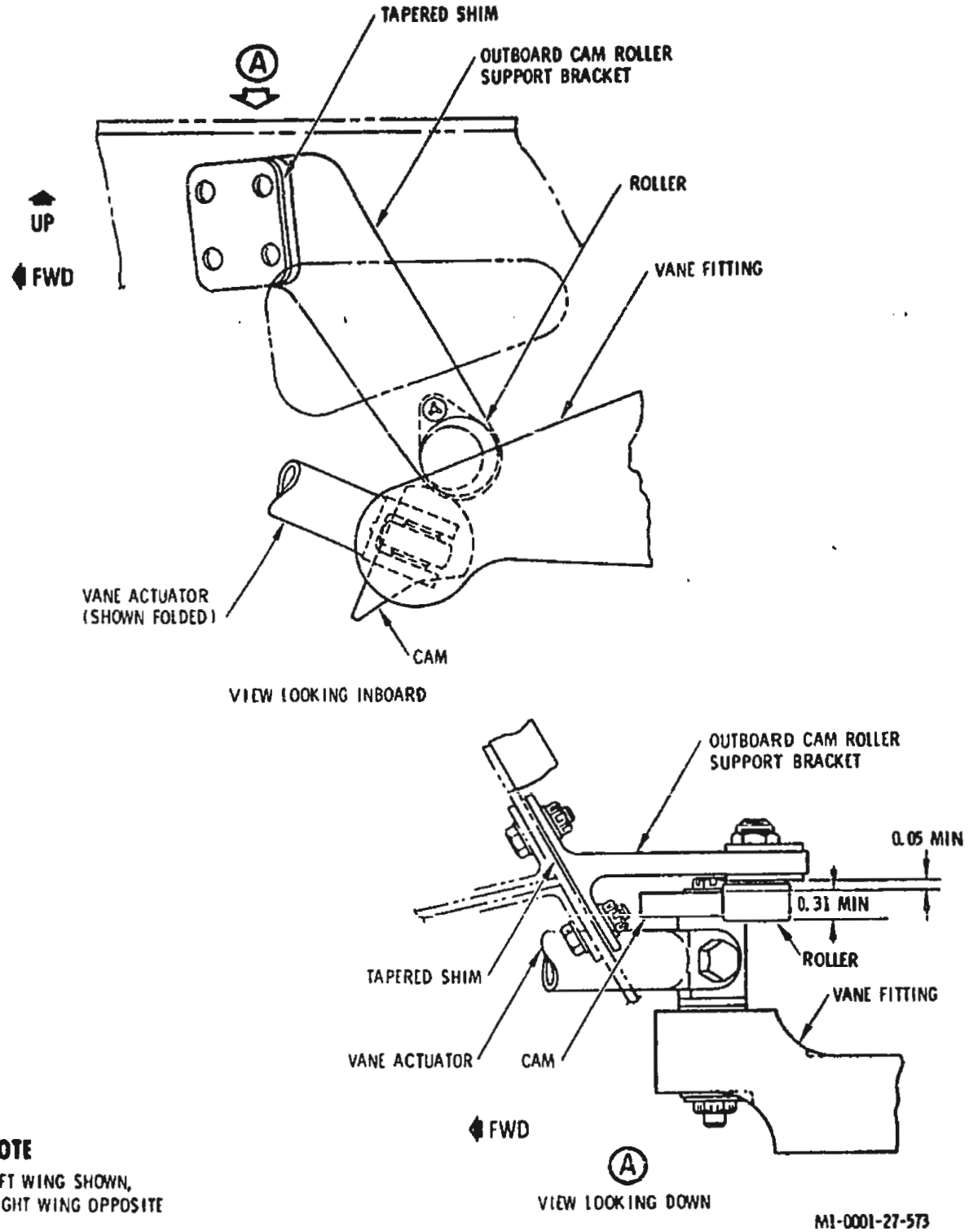
NOTE

1. POSITION OF CAM WITH VANE ACTUATOR FULLY EXTENDED.
2. CAM AND VANE ACTUATOR DETAILS OMITTED FOR CLARITY.
3. SHIMS MAY BE REQUIRED, REF. TO FIG. 401 27-51-26

M1-0000-27-994

C C Vane Actuator - Rigging and Adjustment
Figure 504

R R 001B EFFECTIVITY: ALL



NOTE
LEFT WING SHOWN,
RIGHT WING OPPOSITE

R Shimming of No. 3 and No. 4 Vane Outboard Cam Roller Bracket
R Figure 505

R (d) As an alternative to shimming, elongate the cam roller support bracket mounting holes and shift bracket to attain proper clearance.

R (e) Repeat Step 5F(5) following roller adjustment.

NOTE: On vanes 1 and 2 it may be necessary to shave top of cam roller support to maintain torque box contour.

(7) Disconnect aft end of the vane actuators from the flap fittings (2 per vane). Manually position the vane full forward against both carriage stops. Apply light forward pressure against the vane actuators and verify cam-to-roller overlap is within tolerance (Ref. Fig. 504).

NOTE: If insufficient cam overlap exists at vanes 3 and 4, adjust the vane carriage stops aft. Use AN970 washers and longer attaching screws as necessary. At vanes 1 and 2, add AN960-416 washers under the head of vane carriage frog attach bolts and install longer bolt as necessary. Safety the bolt head to the locking device.

(8) With the vane carriages resting against both forward stops, fold the vane actuator into the stowed position. Verify there is clearance between the cam surface and the roller (Ref. Fig. 504). If an interference exists, adjust the cam roller aft or adjust the carriage stops forward to provide clearance and repeat Steps 5F(5) thru 5F(7).

(9) When cam roller is properly adjusted, torque 50 to 80 lb in. and safety.

(10) Reconnect vane actuator to flap fitting. Install cotter pin.

(11) Slowly retract the flaps using the A system powered by the B system A/C pumps and the B to A PTU to minimize pressure. Check that the cam rollers trip the vane actuators before the carriage stops are contacted and that the actuators fold smoothly into the stowed (full up) position.

NOTE: Retract the flaps to the full up position. Verify a clearance exists between the flap and vane by manually driving the vane forward and aft at each end. A slight movement is to be obtained (inboard flaps only).

(12) Cycle flaps from 0 to 22 degrees several times to verify normal vane actuator operation. Verify positive clearance between inboard and outboard vane carriage fitting and spoiler lower surface.

(13) If no further rigging of the flap system is required, perform completion check [Ref. Steps 5I(1), 5I(2), 5I(3)].

5G. Flap Vane-to-Spoiler Contact Check - Rigging Check and Adjustment procedure applies only to flaps and spoilers No. 1 and 2, and checks for proper contact between the flap vane and the spoiler rub strips.

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on all four hydraulic systems (Ref. 29-11-00). Verify 2700 p.s.i. minimum pressure for all four systems.

(3) Position flaps to 10 degrees.

(4) Extend spoilers by positioning speedbrake lever partially aft.

(5) Place a test strip of plastic or metal sheet (approximately 0.004 inch thick by 3 inches wide) on the vane upper surface where the spoiler rub strips will contact. The strips must be long enough to provide a gripping surface from either end when spoilers are lowered.

C NOTE: On spoiler Nbr. 1, the inboard rubstrip may be
C moved inboard 8 inches from the original
C position to facilitate establishment of the
C spoiler-to-flap clearance and to raise the
C spoiler inboard trailing edge.

WARNING: STAY CLEAR OF SPOILERS.

(6) Position speedbrake lever full forward to retract spoilers.

CAUTION: DO NOT RELEASE (OUT) SPOILER SWITCHLIGHTS ON PFCS PANEL WITH SPOILERS EXTENDED. RAPID RETRACTION OF UNLOADED SPOILER CAN DAMAGE SPOILER SERVO.

(7) Release (out) SPOILER switchlight on PFCS panel to ensure spoiler servo pistons are bottomed.

NOTE: All readings must be taken with flaps positioned at 10 degrees.

C (8) Pull on test strip to determine degree of contact
C between vanes and spoiler rubstrip. The drag on No. 1
C and 2 inboard vane test strip must be between 25 and 40
C pounds with a maximum allowed 60 pounds permitted on
C the inboard rubstrip.

(a) On aircraft 001-031,
if drag is more than specified in Step 5G(8),
raise spoiler by adjusting spoiler servo length
within rigging tolerances of 27-61-17, or lower
vane by adjusting eccentric pins on both ends of
CR vane; or removing shims placed between spoiler and
C rubstrip.

C Bond with fuel tank sealant.

(a) On aircraft 032-036,
if drag is more than specified in Step 5G(8),
raise spoiler by adjusting spoiler servo length
within rigging tolerances of 27-61-17; or lower
vane by adjusting eccentric pins on both ends of
vane; or removing shims placed between spoiler and
rubstrip.

NOTE: Adjust vane eccentric pins by removing nut and lock plate from aft vane carriage eccentric pin, then adjusting eccentric pin and reinstalling lock plate and nut. Adjusting vane eccentric pins affects the vane actuator cam-to-roller rigging. When adjusting the vane carriage eccentric pins rotate freely at the vane rigged position. If either eccentric pin resists normal rotation, it is probably twisting the vane. If the vane rests freely on both forward stops, there will be no induced twist in

the vane. If vane eccentric pins are adjusted, accomplish Paragraph 5F.

(b) On aircraft 001-031, if drag is less than specified in Step 5G(8), lower spoiler by adjusting spoiler servo length within rigging tolerance of 27-61-17, or raise vane by adjusting eccentric pins on both ends of
R vane; or add shims to be placed between spoiler
R and rubstrip. (If vane eccentric pins are adjusted, accomplish Paragraph 5F.)

R (b) On aircraft 032-036, if drag is less than specified in Step 5G(8), lower spoiler by adjusting spoiler servo length within rigging tolerance of 27-61-17; or raise vane by adjusting eccentric pins on both ends of vane; or add shims to be placed between spoiler and rubstrip. (If vane eccentric pins are adjusted, accomplish Paragraph 5F.)

(9) Depress (in) SPOILER switchlight released in Step 5G(7).

(10) Remove test strip from between spoiler and vanes.

(11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(12) Turn off electrical power if no longer required (Ref. 24-41-00).

C 5H. Outboard Flap VANE-TO-FLAP Contact Check - Rigging Check and adjustment.

R NOTE: This procedure checks for proper contact/clearance between outboard flap vanes (No. 3 and 4) and flaps.

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL SET AT ZERO DEGREES.

LAND GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on all four hydraulic systems (Ref. 29-11-00). Verify 2700 p.s.i. minimum pressure for all four systems.

(3) Extend flaps for access.

C (4) Disconnect vane actuators at aft end from flap (Ref. 27-51-42).

(5) Move vane forward to fully retracted position.

(6) Adjust vane to full down position by rotating vane carriage eccentric pins, at both ends of vane.

NOTE: Both carriage assemblies must be in contact with their respective forward stops. If this cannot be accomplished, readjust one or both eccentric carriage pins to relieve induced twist on vane.

CR (6A) Reconnect vane actuators (Ref. 27-51-42).

(7) Place two test strips of plastic or sheet metal (approximately 0.004 inch thick by 3 inches wide and 30 inches long) cord wise, on upper forward surface of flap, approximately 6 inches from each end of flap.

(8) Retract flaps to 0 degrees.

(9) Pull on test strips, to determine degree of contact between vane and flap. The drag on both test strips must not exceed 25 pounds. A working clearance is preferred.

NOTE: It is acceptable to place the two test strips at other points on the flap leading edge where contact between flap and vane is observed. However, at positions closer to the centerline

of the vane, heavy (25 pound) contact pressures are not considered so critical, as the allowable deflections increase as the pressure points move away from the flap and vane tracks.

(10) If drag is more than specified in Step 5H(9), proceed with one of the following adjustments:

(a) Raise vane by adjusting eccentric carriage pins on both ends of vane.

(b) Remove the 1565815-101 vane carriage forward stops (0.375 inch thick) and install the 1565815-103 vane carriage forward stops (0.25 inch thick) to allow the vane to move forward.

C (11) Deleted

C (12) If adjustment is required in Steps 5F(9) thru 5F(10),
C repeat rigging check and adjustment procedure of Steps
C 5F(5) through 5F(8).

WARNING: STAY CLEAR OF SPOILERS.

(13) Position speedbrake lever full forward to retract spoilers.

CAUTION: DO NOT RELEASE (OUT) SPOILER SWITCHLIGHTS ON PFCS PANEL WITH SPOILERS EXTENDED. RAPID RETRACTION OF UNLOADED SPOILER CAN DAMAGE SPOILER SERVO.

(14) Release (out) SPOILER switchlight on PFCS panel to ensure that spoiler servo pistons are bottomed.

C (15) Cycle flap and vane several times with spoiler in full
C down position.

C (16) With flaps extended (approximately 7°) for access and
C vanes resting against their forward stops, verify
C vane-to-spoiler clearance of 0.20 inch minimum at a
C point on each spoiler adjacent to the respective
C interfaces of spoilers 3 to 4 and spoilers 5 to 6.

C NOTE: Spoilers may be up-rigged above the "0.12 below
C torque box" position in order to maintain a 0.20
C inch gap between the spoiler and vane.

C With the flaps retracted and the spoiler down,
C the spoiler trailing edge is to be bent down to
C contact the flap skin and may have up to 1/16

C inch springback.

C AD 90-03-15 applies.

C (17) Inspect links and fittings and replace any faulty
C assemblies (Ref. Service Bulletin 093-57-129).

C (18) Torque all pins and studs and safety (Ref. Structural
C Repair Manual 51-40-01 and Maintenance Manual
C 20-00-06).

(19) Depress (in) SPOILER switchlight released in Step 5H(11).

(20) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(21) Turn off electrical power if no longer required (Ref. 24-41-00).

5I. Completion Check

(1) Verify all rig pins are removed.

(2) Verify all tags are removed.

(3) Verify all access doors are closed and all access panels are installed.

(4) Perform verification test of the flap system (Ref. Para. 4B).

TRAILING EDGE FLAP SYSTEM - INSPECTION AND CHECK

1. General

A Flap/Slat Comparator Test Box (G/ITEL 27-51-167) may be used to check out and fault isolate flap asymmetry detection system. This test box connects in series with the asymmetry comparator.

R Wear limits are provided for some flap components to assist in
R determining serviceability of worn parts.

2. Equipment and materials

FLAP/SLAT Comparator Test Box, G/ITEL 27-51-167

3. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Flap Asymmetry System Inspection/Check

A. Installation

(1) Remove both electrical connectors from asymmetry comparator.

NOTE: Do not remove asymmetry comparator from aircraft.

(2) Install two electrical connectors from test box to asymmetry comparator and two connectors from test box to aircraft wiring that was disconnected from asymmetry comparator in Step 4A(1).

B. Test

(1) Verify following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel, CB1, zone 210:

NO. 2 ASYM BK - TE FLAP (J11)

LOCK LIGHT - TE FLAP (J13)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel, CB2, zone 215:

NO. 1 ASYM BRAKE - TE FLAP (H21)

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation and trip overspeed governor in the asymmetry brakes. To provide normal flap and slat operation, pressurize B and C hydraulic systems using ATM pumps and A system using PTU. Alternately, two ground sources, each capable of 25 gpm at 3000 psi may be used to pressurize A and C systems.

(4) Press and release LAMP TEST button and verify all lights on comparator test box are on (Ref. Fig. 601).

(5) Press and release LAMP RESET button on comparator test box.

(6) Verify all three POWER REQUIREMENTS lights are on, if not trouble-shoot power supply between indicated circuit breaker and comparator.

(7) Verify all four ASYMMETRY BRAKE COILS - OPEN COIL and all four PDU SHUTOFF - OPEN COIL lights are off, if not replace indicated component.

(8) Verify COMPARATOR FAULT DETECTION - DIVERGENCE COMPARATOR light is off, if not check PDU feedback assembly.

NOTE: COMPARATOR FAULT DETECTION - LOCK light is normally on when DIVERGENCE COMPARATOR light is on.

(9) Verify CABLE BREAK DETECTOR OR FLAP DIVERGENCE COMPARATOR CHECK lights are off. Three lights on indicate a failed cable break detector switch. All six lights on indicate a failed cable.

NOTE: COMPARATOR FAULT DETECTION - LOCK light is normally on when CABLE BREAK DETECTOR OR FLAP DIVERGENCE COMPARATOR CHECK lights are on.

(10) Position flaps full up.

(11) Verify PDU SWITCHES CH 1 or CH 2 lights are on.

NOTE: PDU SWITCHES lights on indicate PDU shutoff valves are closed.

(12) Position flap handle full down.

R (13) While flaps are in transit, verify 2 OUT OF 3 VOTER lights remain off. One light on indicates a failed channel in indicated rotary transducer or in that channel wiring.

NOTE: A true asymmetry condition will cause following lights on test box to come on: COMPARATOR FAULT DETECTION-LOCK, PDU SWITCHES - CH-1 and CH-2 and multiple 2 OUT OF 3 VOTER lights come on; and ASYMMETRY BRAKE COILS - RIGHT WING and LEFT WING lights come on for 5 seconds and then go off.

C. Removal

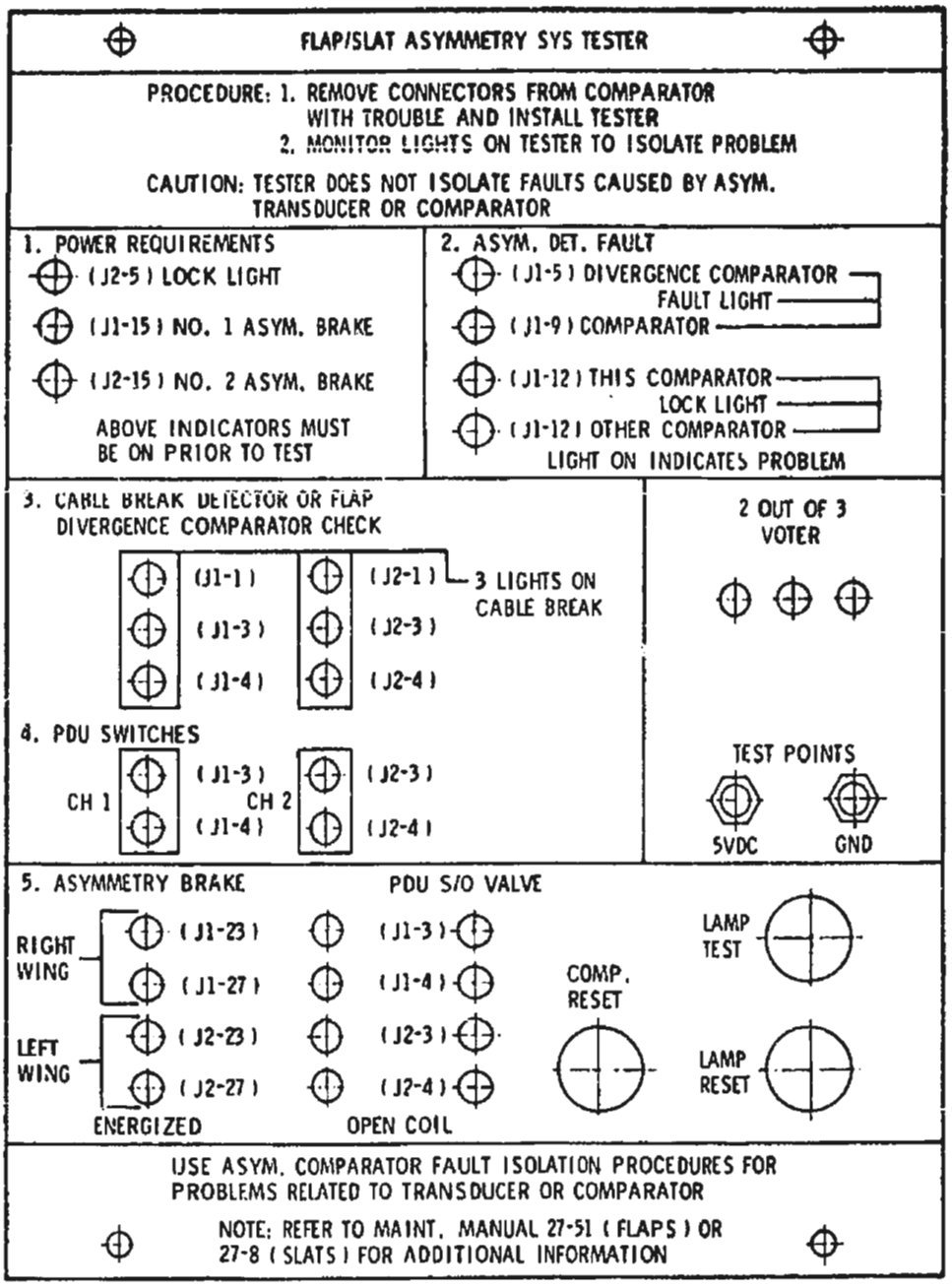
(1) Disconnect two electrical connectors from test box to aircraft wiring and two connectors from test box to asymmetry comparator.

(2) Connect two aircraft wiring electrical connectors to asymmetry comparator.

(3) Operate flaps through at lease one up-down cycle. Verify FLAP ASYM DET FAULT and FLAP/SLAT LOCK lights on FE/SO annunciator panel remain off.

(4) Turn off hydraulic power (Ref. 29-11-00).

(5) Turn off electrical power (Ref. 24-41-00).



M1-0001-27-1029

R
R

Flap/Slat Comparator Test Set
Figure 601

EFFECTIVITY: ALL

003B

5. Flap Component Wear Limits

The following wear limits have been established so that worn components (at limit or beyond) may be removed and repaired. The limits also will provide guidelines for acceptable and unacceptable conditions and allow continued service of serviceable parts.

	LOCATION	LIMIT	CORRECTIVE ACTION
R R R R	Vane - Carriage Roller to Track	.060 inch Clearance to 20 lb. drag	Adjust rollers or replace track
R R	Vane - Carriage Fitting to Vane Fitting	.045 inch	Shim
R R R	Flap - Actuator Ballscrew Carriage Roller to Track	.030 inch clearance	Adjust rollers or replace track
R R R	Flap - Carriage Roller to Track	.060 inch	Adjust rollers or replace track
R	Flap - Swinglink to Torque Box	.030 inch	Shim
	Flap - Total Free Play-Inbd (extended)	2.3°	Replace worn components
	Flap - Total Free Play-O.B.	1.50°	Replace worn components
R R	Flap - Ballnut to Ballscrew	.030 inch	Replace actuator
R R R	Flap - Ballscrew Front Mount Bearing to Housing (Flaps Extended)	.075 inch (Radial)	Replace front mount
R		.060 inch Minimum (Axial)	Replace front mount
CR CR CR CR	Flap - Outboard clevis assy.	.150 inch (Minimum arm thickness)	Replace assy.

	LOCATION	LIMIT	CORRECTIVE ACTION
CR		.080X1.00 inch (oval slot wear)	
CR	Flap - Inboard Clevis Assy.	.144 inch (minimum arm thickness)	Repair assy Per Lockheed SRM (57-54-00, Page 816)
CR		.050X1.50 inch (oval slot wear)	
CR C C	Flap - Trailing Edge Clevis Assy. Bushing holes	.8125 inch Maximum (Oversize)	Replace Clevis Assy.
	Torque Tube - PDU to Asymm Brake	70°	Replace worn component
	Torque Tube - Spline	1.5°	Replace torque tube
	Torque Tube - U Joint	2.0°	Replace Torque Tube
R	Torque Tube - Support Bearing	.030 inch (Radial)	Replace Worn Component
	Torque Tube - Support Bearing	(Axial) Shall not expose more than 1/2 of Bearing Sleeve Retainer Pin	
	Gearbox (all)	1.5°	Replace gearbox

LOCATION	LIMIT	CORRECTIVE ACTION
NOTE: To check Flap - Total Free Play-Inbd (extended) and Flap - Total Free Play-O.B. lift trailing edge flap and measure angle with Clinometer.		

R R # FLAP AND SLAT CONTROL SYSTEM CABLE BREAK DETECTOR REMOVAL AND INSTALLATION

R 1. General

R The flap and slat control system consists of three cable loops. R Each cable loop incorporates a cable break detector. This R procedure covers the removal and installation of all three cable R break detectors.

R 2. Referenced Procedure

R 24-41-00 External Power/Ground Service System - Maintenance R Practices

R 3. Removal/Installation

R A. Removal (Ref. Fig. 401)

R (1) Turn off hydraulic systems A and C and tag hydraulic R control panel.

R (2) Open and tag the following circuit breakers:

R (a) On pilots overhead circuit breaker panel CB1, zone R 210: No. 2 ASYM BK LE SLAT (J10) and NO. 2 ASYM R BK TE FLAP (J11).

R (b) On Flight Engineer/Second Officers overhead R circuit breaker panel CB2, zone 215: NO. 1 ASYM R BRAKE, TE FLAP (H21) and NO. 1 ASYM BRAKE LE SLAT R (H22).

R (3) Gain access to the mid electrical service center R (MESC).

R (4) At cable break detector, tag and remove wires from R switch. (If switch wires are soldered, disconnect R switch wires at terminal block.)

R (5) Remove the cable guard pin from each detector arm.

R (6) Remove the detector attaching pivot bolt. Disengage R cables from the detector arms and remove the detector R assembly.

R B. Installation (Ref. Fig. 401)

(1) Verify that hydraulic systems A and C are turned off.

(2) On replacement detector assembly, remove the cable guard pins.

(3) Position detector assembly in the installed position with the cables engaged in the arm pulleys. Install the detector attaching pivot bolt, washers, bushing and nut. Install cotter pin.

NOTE: On the flap detector, the pivot bolt is installed from the bottom and a bolt retainer is used.

(4) Install cable guard pin in each arm.

(5) Connect switch wires (Ref. WDM 27-51-02 for flap/slat and flap detector; 27-81-02 for slat detector).

(6) Remove tag from hydraulic control panels.

(7) Remove tags and close circuit breakers opened in Step A(2).

C. Switch Checkout (Ref. Fig. 401)

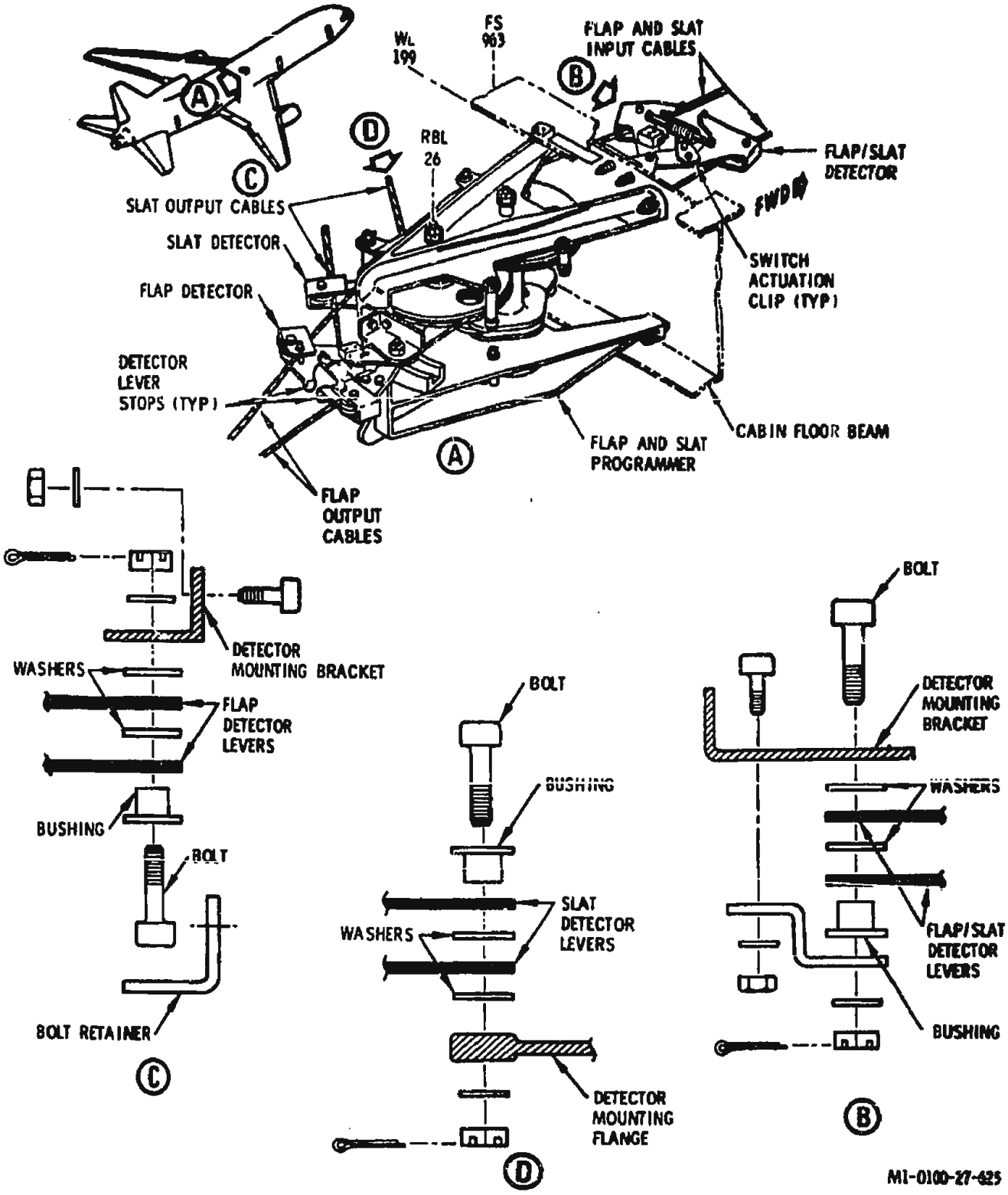
(1) Turn on electrical power (Ref. 24-41-00).

(2) Position a 0.010 (±0.005)-inch shim between the detector lever stops and squeeze the cables together so that the detector levers contact the shim; the switch must be actuated closed. If not, loosen bolts and adjust the switch actuation clip as necessary. Tighten the actuation clip bolts.

R NOTE: When flap/slat detector switch closes, the FLAP/SLAT LOCK light on the FE/SO annunciator panel will come on. When the flap detector switch closes, the FLAP/SLAT LOCK light will come on. When the slat detector switch closes, the FLAP/SLAT LOCK light will come on.

(3) Release squeeze force on cables after checking switch adjustment.

(4) Turn off electrical power if no longer required (Ref. 24-41-00).



Flap and Slat Control System Cable Break Detectors
Removal and Installation
Figure 401

FLAP AND SLAT CONTROL SYSTEM CABLE BREAK DETECTOR

1. General

The flap and slat control system consists of three cable loops; the forward and aft cable loops control flaps, the forward and center cable loops control slats.

This procedure must be used to perform an operational test of the three cable loop break detectors.

NOTE: In performing this procedure, flaps and slats are tested together. However, any flap or slat movement or FE/SO annunciator panel lighting condition change is affected only by the respective systems circuit breakers.

2. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power Systems - Maintenance Practices

3. Adjustment/Test

A. Operational Test

R (1) On FE/SO overhead circuit breaker panel CB2, open
R circuit breaker No. 1 ASYM BRAKE - LE SLAT (H22).

R (2) Remove electrical connector from Slat Isolation Valve
R located on the lower forward bulkhead of the hydraulic
R service center (Ref. Fig. 502). Apply 28V dc to pin 1
R and ground pin 2.

R NOTE: When circuit breaker CB2-H22 is open the slat
R isolation valve shuts off system C hydraulic
R pressure to the slat PDU. Application of 28V dc
R to the isolation valve electrical connector will
R keep the valve open.

R (3) Verify the following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:
No. 2 ASYM BK - TE FLAP (J11) and LE SLAT (J10),

LOCK LIGHT - TE FLAP (J13) and LE SLAT (J12)

(b) On FE/SO overhead circuit breaker panel CB2, zone 215:
No. 1 ASYM BRAKE - TE FLAP (H21) and LE SLAT (H22)

R (4) Turn on electrical power (Ref. 24-41-00).

CAUTION: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEMS:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (5) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test, pressurize B and C hydraulic systems using ATM pumps and A hydraulic system using PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize A and C hydraulic systems.

R (6) Verify flap handle is at 0 degrees.

R (7) Test flap/slat cable break detector on forward control cables (forward cable loop) as follows:

(a) Move flap handle to 4 degree position. Flaps and slats must extend. Observe the slat torque shaft in Mid-Electrical Service Center (MESC) to verify that when shaft stops rotating, it stops
R immediately and does not coast to a stop. Verify
R the following:

R • FLAP ASYM DET FAULT, SLAT ASYM DET FAULT and
R FLAP/SLAT LOCK lights on FE/SO annunciator panel
R are off.

(b) On pilots overhead circuit breaker panel CB1, open No. 2 ASYM BK - TE FLAP (J11) and LE SLAT (J10). Verify the following:

• FLAP ASYM DET FAULT light on FE/SO annunciator panel comes on.

• SLAT ASYM DET FAULT light on FE/SO annunciator panel comes on.

R • FLAP/SLAT LOCK light remains off.

WARNING: FLAP/SLAT CABLES WILL MOVE. KEEP HANDS CLEAR OF CABLES AS INJURY MAY RESULT.

R R R R (c) Simulate slack in flaps/slat cable loop located in the MESC (forward cable loop) (Ref. Fig. 501) by compressing the flap/slat cable break detector assembly together. Maintain pressure on break detector assembly. Verify the following:

• FLAP/SLAT LOCK light on FE/SO annunciator panel comes on.

• FLAP ASYM DET FAULT light remains on.

• SLAT ASYM DET FAULT light remains on.

R R R (d) Maintain pressure on break detector. Move flap handle to 0 degree flap position. Verify the following:

R • Flaps and slats do not move.

R • FLAP/SLAT LOCK light remains on.

R • FLAP ASYM DET FAULT light remains on.

R • SLAT ASYM DET FAULT light remains on.

R R R R (e) Maintain pressure on break detector. On FE/SO overhead circuit breaker panel CB2, open No. 1 ASYM BRAKE - TE FLAP (H21) and LE SLAT (H22). Verify the following:

R • Flaps and Slats retract.

• FLAP/SLAT LOCK light goes off.

• FLAP ASYM DET FAULT light remains on.

• SLAT ASYM DET FAULT light remains on.

R R R (f) Maintain pressure on break detector. On pilots overhead circuit breaker panel CB1, close No. 2 ASYM BK - TE FLAP (J11) and LAT (J10). Position

flap handle to 4 degree position. Verify the following:

- Flaps and Slats do not move.
- FLAP/SLAT LOCK light comes on.
- FLAP ASYM DET FAULT light remains on.
- SLAT ASYM DET FAULT light remains on.

(g) Release pressure on flap/slat cable break detector assembly and verify the following:

- Flaps and slats extend.
- FLAP/SLAT LOCK light goes off.
- FLAP ASYM DET FAULT light remains on.
- SLAT ASYM DET FAULT light remains on.

(h) On FE/SO overhead circuit breaker panel CB2, close No. 1 ASYM BRAKE - TE FLAP (H21) and LE SLAT (H22). Position flap handle to 0 degree position. Verify the following:

- Flap and slats retract.
- FLAP ASYM DET FAULT light goes off.
- SLAT ASYM DET FAULT light goes off.

(i) Turn off hydraulic system C (Ref. 29-11-00).

(j) Repeat Steps 3A(7)(a) through 3A(7)(h).

(k) Turn off hydraulic system A and turn on hydraulic system C (Ref. 29-11-00).

(l) Repeat Steps 3A(7)(a) through 3A(7)(h).

R (m) Turn on hydraulic system A (Ref. 29-11-00).

(8) Test slat cable break detector on center cable loop as follows:

(a) Move flap handle to 4 degree position. Verify the following:

- Slats must extend.

• SLAT ASYM DET FAULT and FLAP/SLAT LOCK lights are off.

(b) On pilots overhead circuit breaker panel CB1, open No. 2 ASYM BK - LE SLAT (J10). Verify the following:

• SLAT ASYM DET FAULT light comes on.

• FLAP/SLAT LOCK light remains off.

WARNING: SLAT CABLE WILL MOVE. KEEP HANDS CLEAR OF CABLE AS INJURY MAY RESULT.

(c) Simulate slack in slat cable loop by compressing slat cable break detector assembly. Verify the following:

• FLAP/SLAT LOCK light comes on.

• SLAT ASYM DET FAULT light remains on.

(d) Maintain pressure on break detector. Move flap handle to 0 degree position. Verify the following:

• Slats do not move.

• FLAP/SLAT LOCK light remains on.

• SLAT ASYM DET FAULT light remains on.

(e) Maintain pressure on break detector. On FE/SO overhead circuit breaker panel CB2, open No. 1 ASYM BRAKE - LE SLAT (H22). Verify the following:

• Slats retract.

• FLAP/SLAT LOCK light goes off.

• SLAT ASYM DET FAULT light remains on.

(f) Maintain pressure on break detector. On Pilots overhead circuit breaker panel CB1, close No. 2 ASYM BK - LE SLAT (J10). Position flap handle to the 4 degree position. Verify the following:

• Slats do not move.

• FLAP/SLAT LOCK light comes on.

• SLAT ASYM DET FAULT light remains on.

(g) Release pressure on slat cable break detector assembly and verify the following:

- Slats extend.
- FLAP/SLAT LOCK light goes off.
- SLAT ASYM DET FAULT light remains on.

(h) On FE/SO overhead circuit breaker panel CB2, close No. 1 ASYM BRAKE - LE SLAT (H22) and verify the following:

- SLAT ASYM DET FAULT light goes off.

(i) Move flap handle to 0 degree position and verify the following:

- Slats retract.

R (j) Turn off hydraulic system C (Ref. 29-11-00).

R (k) Repeat Steps 3A(8)(a) through 3A(8)(i).

R (l) Turn off hydraulic system A and turn on hydraulic
R system C (Ref. 29-11-00).

R (m) Repeat Steps 3A(8)(a) through 3A(8)(i).

R (n) Turn on hydraulic system A (Ref. 29-11-00).

(9) Test flap cable break detector on aft cable loop as follows:

(a) Move flap handle to 4 degree position. Verify the following:

- Flaps extend to 4 degrees.
- FLAP ASYM DET FAULT and FLAP/SLAT LOCK lights are off.

(b) On Pilots overhead circuit breaker panel CB1, open No. 2 ASYM BK - TE FLAP (J11). Verify the following:

- FLAP ASYM DET FAULT light comes on.
- FLAP/SLAT LOCK light remains off.

WARNING: FLAP CABLE WILL MOVE. KEEP HANDS CLEAR OF CABLE AS INJURY MAY RESULT.

(c) Simulate slack in flap cable loop by compressing flap cable break detector assembly. Verify the following:

- FLAP/SLAT LOCK light comes on.
- FLAP ASYM DET FAULT light remains on.

(d) Maintain pressure on break detector and move the flap handle to 0 degree position. Verify the following:

R

- Flaps do not move.
- FLAP/SLAT LOCK light remains on.
- FLAP ASYM DET FAULT light remains on.

(e) Maintain pressure on break detector. On FE/SO overhead circuit breaker panel CB2, open No. 1 ASYM BRAKE - TE FLAP (H21). Verify the following:

- Flaps retract.
- FLAP/SLAT LOCK light goes off.
- FLAP ASYM DET FAULT light remains on.

(f) Maintain pressure on break detector. On Pilots overhead circuit breaker panel CB1, close No. 2 ASYM BK - TE FLAP (J11). Move flap handle to 4 degree position. Verify the following:

- Flaps do not move.
- FLAP/SLAT LOCK light comes on.
- FLAP ASYM DET FAULT light remains on.

(g) Release pressure on flap break cable detector assembly and verify the following:

- Flaps extend to 4 degrees.
- FLAP/SLAT LOCK light goes off.
- FLAP ASYM DET FAULT light remains on.

(h) On FE/SO overhead circuit breaker panel CB2, close No. 1 ASYM BRAKE - TE FLAP (H21) and verify the following:

- FLAP ASYM DET FAULT light goes off.

(i) Move flap handle to 0 degree position. Verify the following:

- Flaps retract.

R (j) Turn off hydraulic system C (Ref. 29-11-00).

R (k) Repeat Steps 3A(9)(a) through 3A(9)(i).

R (l) Turn off hydraulic system A and turn on hydraulic
R system C (Ref. 29-11-00).

R (m) Repeat Steps 3A(9)(a) through 3A(9)(i).

(10) In hydraulic service center, remove 28V dc and ground from slat isolation valve electrical connector and reconnect connector to valve.

B. Switch Adjustment

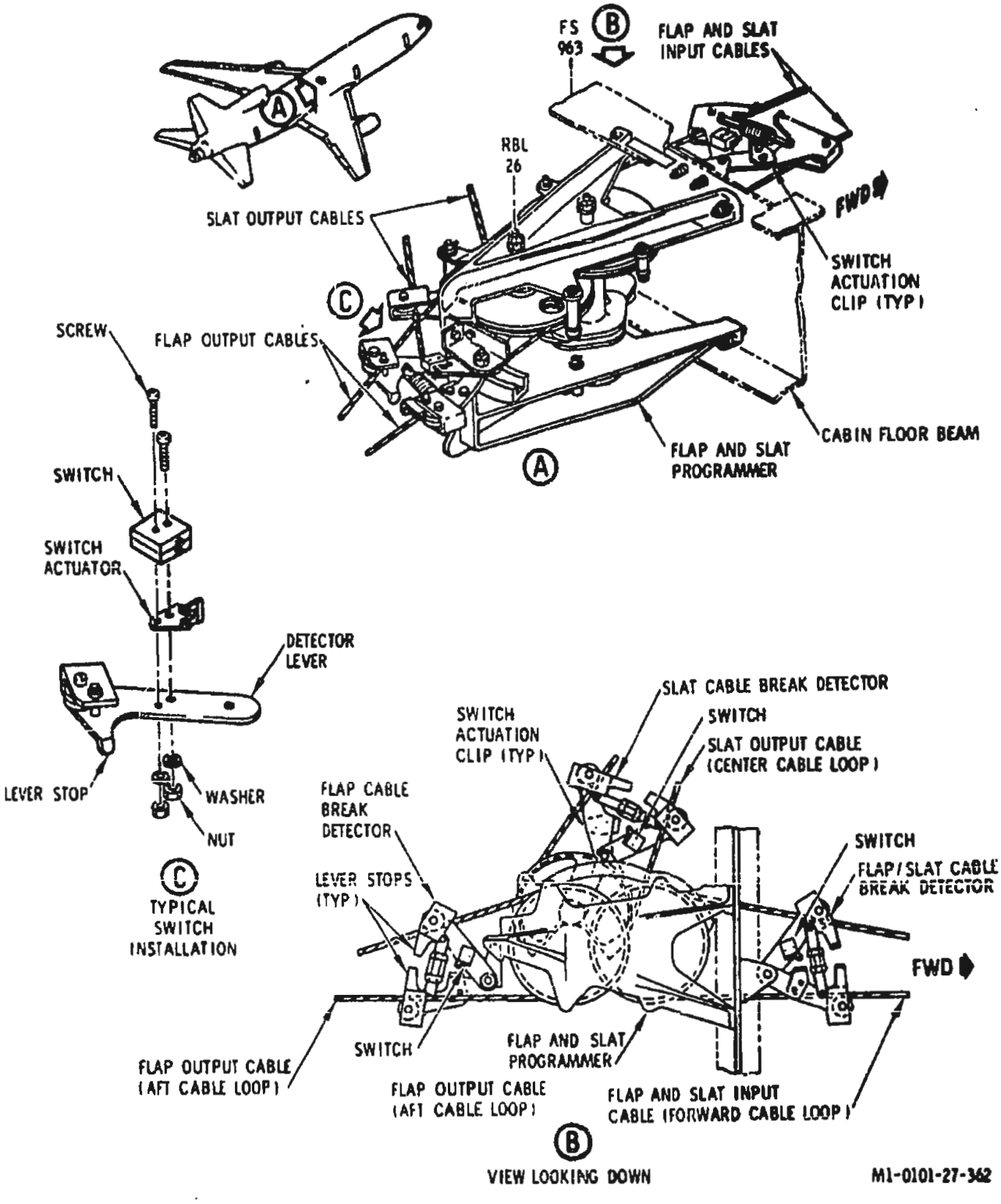
(1) Turn on electrical power (Ref. 24-41-00).

(2) Position a 0.010 (±0.005) inch shim between the detector lever stops and squeeze the cable together so that the detector levers contact the shim. The switch must now be in an actuated position. (FLAP/SLAT LOCK light on). If not, loosen bolts and adjust the switch actuation clip as necessary.

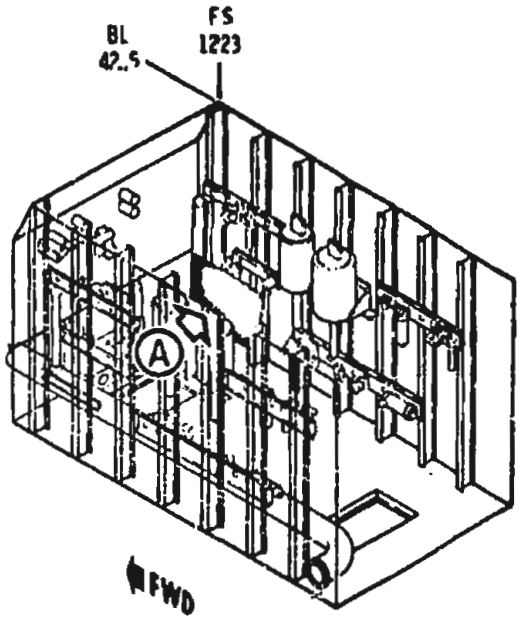
(3) Release squeeze pressure on the cables after checking adjustments.

(4) Turn off electrical power if no longer required (Ref. 24-41-00).

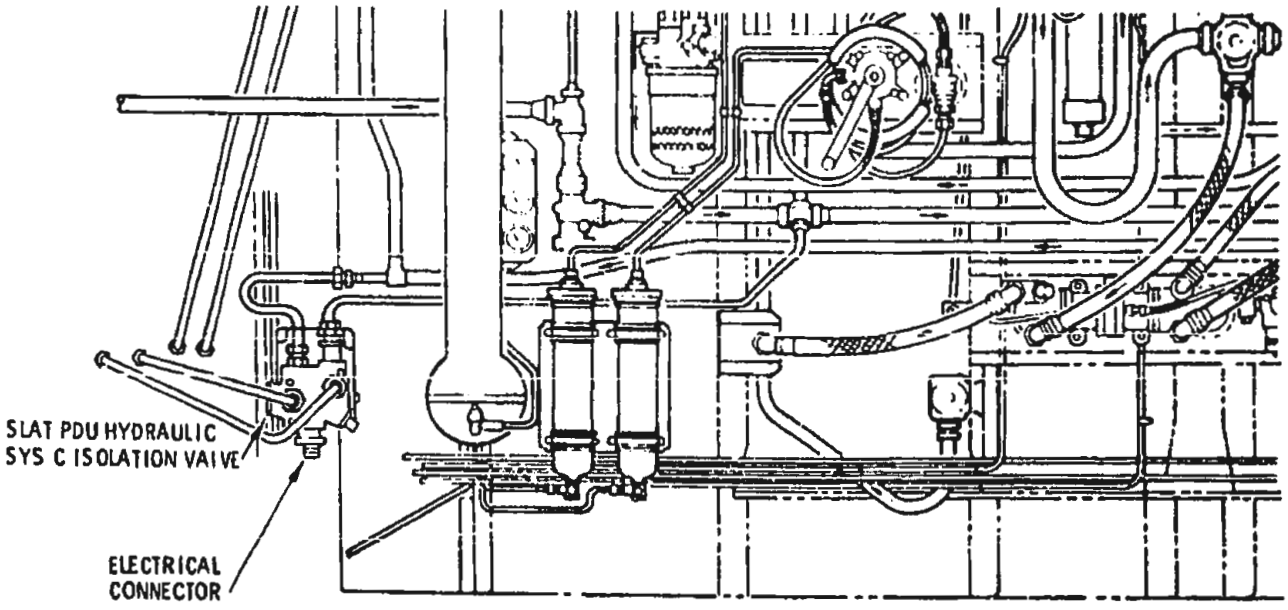
(5) Turn off hydraulic power if no longer required (Ref. 29-11-00).



Flap and Slat Cable Break Detector
Figure 501



HYDRAULIC SERVICE CENTER



M1-0000-27-1102

R R Slat PDU Hydraulic System C Isolation Valve
Figure 502

R R 002B EFFECTIVITY: ALL

LOAD-RELIEVING SYSTEM COMPUTER - REMOVAL AND INSTALLATION

1. Removal/Installation

A. Removal

R (1) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, open and tag the following
R circuit breakers:

R FLAP LOAD RELIEF - CHAN 1 (H12)

R FLAP LOAD RELIEF - CHAN 2 (H20)

R RUDDER MECH LMTR - A and B (K15, K16) (aircraft
R 001-017)

R RUDDER SERVO - A, B, and C (K12, K13, K14)

(2) Open access door 112AB and enter forward electronic service center. Locate load relieving system computer in center rack.

(3) Release holddown on computer front panel.

(4) Pull computer handle to release computer from mount.

(5) Slide computer out of mount.

B. Installation

(1) Verify circuit breakers opened in Step A(1) are open and tagged.

(2) Slide computer into mount until computer electrical connectors mate with mount connectors.

(3) Secure computer with holddown.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Perform Operational Test (Ref. 27-51-06, Adjustment and Test).

R LOAD RELIEVING SYSTEM (LRS) COMPUTER - ADJUSTMENT AND TEST

R 1. General

R This section contains procedures for performing the following
R tests:

R LRS Computer BITE Test (Para. 4A)

R LRS Computer Operational Test (Para. 4B)

R LRS Computer Monitor Circuits Functional Test (Para. 4C)

R This Configuration is for aircraft with two analog Central Air
R Data Computers (CADC) or one CADC and one Digital Air Data
R Computer (DADC).

R Procedures for aircraft with two DADC's are found in
R Configuration 2.

R When one CADC and one DADC is installed in an aircraft, the Air
R Data Computer PUSH TO TEST switches cannot be used to simulate
R airspeed for the LRS Computer BITE or Operational Tests. On
R these aircraft an Air Data Tester must be installed on aircraft
R pitot tubes to simulate airspeed for these tests.

R The following Acronyms (abbreviations) are used in this
R procedure:

R	FCAU	Flight Control Auxiliary Unit
R	FESC	Forward Electronic Service Center
R	LRS	Load Relieving System
R	CAWP	Caution And Warning Panel
R	CADC	Central Air Data Computer (Analog)
R	DADC	Digital Air Data Computer
R	IAS	Indicated Air Speed
R	FE/SO	Flight Engineer/Second Officer

R To improve flap load relieving system operation, SB 27-084 has
R been issued. The SB consists of two parts; one part modifies
R aircraft wiring and the other part replaces the -117 computer
R with the latest (-119) computer. Either part of the SB may be
R accomplished separately. The SB applies to aircraft 001-018.

EFFECTIVITY: WITH TWO ANALOG OR ONE ANALOG AND ONE DIGITAL AIR DATA COMPUTER

R All other aircraft have the intent of SB 27-084 accomplished in
R production.

R 2. Equipment and Materials

R Air Data Tester, Milhard Engineering Co. PN 127, or equivalent

R Resistors: 150 ohm, 1 watt

R 3. Referenced Procedures

R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-21-00	Rudder Control System - Fault Isolation
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	31-22-00	Proximity Switch System/Aural Warning System
R	34-14-00	Central/Digital Air Data Computer - Fault Isolation

R 4. Adjustment/Test

R A. LRS Computer BITE Test

R (1) Verify following circuit breakers are closed:

R (a) On Pilots overhead circuit breaker panel CB1, zone
R 210:

R SPOILER DWELL - DC (B7)

R NO. 1 NAVIGATION - AIR DATA CMPTR (G8)

R NO. 2 NAVIGATION - AIR DATA CMPTR (G27)

R NO. 1 INSTRUMENT - CAPT - IAS/MACH (F1)

R NO. 2 INSTRUMENT - F/O - IAS/MACH (F19)

R (b) On Flight Engineer/Second Officers overhead
R circuit breaker panel CB2, Zone 215:

R FLAP LOAD RELIEF - CHAN 1 (H12), and IND (H13)

R FLAP LOAD RELIEF - CHAN 2 (H20)

NOTE: FLAP LOAD RELIEF circuit breaker may be labeled RUD HYD LMTR.

RUDDER SERVO - A(K12), B(K13), and C(K14)

INDICATOR - T/O AURAL WRNG (H7)

CR On aircraft 001-018, 022,

RUDDER MECH LMTR - A(K15) and B(K16)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

IND LT - PFCS/ADS/DH (G8)

FLT CONT ALT ALERT (G9)

(2) Verify following circuit breakers are opened and tagged.

WARNING: IT IS ESSENTIAL RAT AUTO DEPLOY CIRCUIT BREAKER IS OPENED BEFORE OPENING MLG GND SENSE CIRCUIT BREAKER.

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

RAT AUTO DEPLOY (L3)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

MLG GND SENSE (L8)

WARNING: PRIOR TO MAINTENANCE PROCEDURES IN OR NEAR HYDRAULIC SERVICE CENTER, VERIFY RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED UNDER THE RAT DOOR.

(3) Turn on electrical power (Ref. 24-41-00).

(4) Verify RUDDER HYDRAULIC LIMITER A, B, C and C-REG lights on the Flight Control Auxiliary Unit (FCAU) are on. The FCAU is located in the Forward Electronic Service Center (FESC), center rack, below the bottom shelf.

(a) If any lights are off, depress LAMP TEST to check bulb.

R (b) If lights that were off, come on when LAMP TEST is
R depressed, check for servo pressure switch failing
R in high pressure state (Ref. 27-21-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (5) Turn on hydraulic systems A, B, C and D (Ref.
R 29-11-00).

R NOTE: It is not essential that Hydraulic System D be
R on, but some hydraulic fluid may transfer to
R System D if it is off.

R Test results will be invalid unless normal
R hydraulic power is supplied to the flap system
R (25 gpm at 3000 psi). Do not use AC pumps; use
R ATMs or ground hydraulic sources.

R (6) Position flaps to full up.

R (7) On Pilots overhead PFCS panel, verify RUDDER
R switchlight is depressed (latched in) and OFF light is
R off.

R (8) In FESC, locate Load Relieving System (LRS) computer on
R center rack, shelf 1. (LRS compter may be identified
R as LOAD LIMITER COMPUTER.) On LRS computer, place
R switch in RESET position for 5 seconds, then back to
R RUN.

R (9) On Pilots overhead panel, operate TEST switchlight on
R LIGHTS panel; verify all lights listed below are on.
R Turn off TEST switchlight, then operate the RESET
R pushbutton on the Pilots center panel; verify lights
R listed below are off.

R (a) On Caution and Warning panel (CAWP):

R RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

C On aircraft 001-018, 022,

MECHANICAL - MNL/PUSH

MECHANICAL - ±8°/±30°

C (10) On aircraft 001-018, 022, on Pilots Overhead Flight Control panel, verify MECHANICAL and HYDRAULIC switchlights are depressed (latched in) and only the ±30° light is on.

C (10) On aircraft 019-021, 023-999, on Pilots Overhead Flight Control panel, verify HYDRAULIC switchlight is depressed (latched in).

NOTE: The indications on CAWP and Pilots Overhead Flight Control Panels should not change unless noted in this procedure. Disregard changes of FLT CONT PANELS light on CAWP unless specifically noted.

The following steps will require a man in the FESC to operate air data computers (ADC) self test, and/or LRS computer BITE switch.

(11) On aircraft with two CADC's installed, in the forward electronic service center, locate CADC 1 and 2 on rear avionics rack, shelf 5. Simultaneously depress self-test button on both CADCs and hold.

(11) On aircraft with one CADC and one DADC installed, connect Air Data Tester to Captains and First Officers pitot ports on the upper left and upper right pitot-static tubes. Install a shutoff valve in the pressure line to each pitot-static tube. Leave both
R shutoff valves open. Adjust IAS to 180 knots.

(12) As IAS passes 164 knots, verify following:

C (a) On aircraft 001-018, 022, on Flight Control panel, MECHANICAL ±8°/±30° switchlight indication changes from ±30° to ±8°.

C (b) On aircraft 001-018, 022, on FCAU panel, located in FESC, RUDDER A and B lights come on.

C (b) On aircraft 019-021, 023-999, on FCAU panel, located in FESC, RUDDER A and C-REG lights come on.

(13) On aircraft with one CADC and one DADC installed, increase IAS beyond 260 knots, verify on FCAU following light comes on:

C On aircraft 001-018, 022,

RUDDER C-REG

C On aircraft 019-021, 023-999,

RUDDER B

(14) Position flaps to four degrees.

(15) On aircraft with two CADC's installed, release one CADC self-test button and verify following occurs within two minutes.

(a) On CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(15) On aircraft with one CADC and one DADC installed, close one pitot tube shutoff valve and verify following:

(a) On CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(16) On aircraft with two CADC's installed, release second CADC self test button.

(16) On aircraft with one CADC and one DADC installed, on Air Data Tester, reduce IAS to zero knots and open the closed shutoff valve (both should be open).

R (17) Verify following lights go off within two minutes.

(a) On CAWP:

FLT CONT PANELS (May go off)

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

C (c) On aircraft 001-018, 022, on FCAU panel:

RUDDER A and B

C (c) On aircraft 019-021, 023-999, on FCAU panel:

RUDDER A and C-REG

(18) On LRS computer face position BITE switch to RESET for 5 seconds and then to RUN to reset LRS computer.

(19) On FE/SO overhead circuit breaker panel CB2, pull FLAP LOAD RELIEF - CHAN 1 (H12) circuit breaker. Verify following lights come on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(20) On LRS computer face turn BITE switch to TEST 1. Verify following lights remain on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(21) On LRS computer face, turn BITE switch to TEST 2. Verify following lights remain on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(22) On LRS computer face, turn BITE switch to RUN. Verify following lights remain on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(23) On FE/SO overhead circuit breaker panel, close FLAP LOAD RELIEF - CHAN 1 (H-12) circuit breaker. On LRS computer face turn BITE switch to RESET for at least 2 seconds and then to RUN. Verify following lights go off:

(a) RUDDER HYDR LMTR

R FLT CONT PANELS (May go off)

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

NOTE: This completes LRS Computer Operational Test (Para. 4B). The following steps continue the LRS computer BITE TEST (Para. 4A).

(24) On FE/SO overhead circuit breaker panel, verify MLG GND SENSE circuit breaker (L8) is open.

(25) On FE/SO overhead circuit breaker panel, open FLAP LOAD RELIEF CHAN 2 circuit breaker (H20). Verify following lights come on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

NOTE: Keep circuit breaker CB2-H20 open a minimum of 20 seconds after lights come on before it is closed in Step 4A(30).

(26) On LRS computer face, turn BITE switch to TEST 1. Verify following lights remain on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(27) On LRS computer face, turn BITE switch to TEST 2. Verify following lights remain on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(28) On LRS computer face, turn BITE switch to RUN. Verify following lights remain on:

(a) On CAWP:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(29) On FE/SO overhead circuit breaker panel CB2, close FLAP LOAD RELIEF CHAN 2 circuit breaker (H20).

(30) On LRS computer face, rotate LRS computer BITE switch to RESET for 5 seconds then to RUN. Verify following lights are off:

(a) On CAWP:

R FLT CONT PANELS (May go off)

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

NOTE: Lights may go off in either Step 4A(29) or 4A(30).

(31) Verify IAS is 0 knots.

(32) On aircraft with two CADC's installed, in FESC, locate CADC 1 and 2 on rear avionics rack, shelf 5. Simultaneously depress self-test button on both CADC's and hold.

(32) On aircraft with one CADC and one DADC installed, with Air Data Tester, increase IAS to 180 knots.

(33) On LRS computer face, momentarily (3 seconds maximum) place 150-Ohm resistor between pins 7 and 9. Verify following:

R (a) On CAWP following lights come on:

R FLT CONT PANELS

R RUDDER HYDR LMTR

CR On aircraft 001-018, 022,

R RUDDER MECH LMTR

R (b) On Pilots Overhead Flight Control panel following
R lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

R (c) On aircraft with -117 computer, COMP fault indicator on LRS computer comes on. fault indicator on LRS computer must not come on.

R (c) On aircraft with -119 computer, COMP fault indicator on LRS computer must not come on.

(34) On aircraft with -117 computer, on LRS computer face turn BITE switch to TEST 1. Verify following:

(a) On CAWP following lights remain on:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On RUDDER LIMITER panel following lights remain on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) Comp fault indicator on LRS computer remains on.

(34) On aircraft with -119 computer, on LRS computer face remove resistor. Turn BITE switch to TEST 1. Momentarily (3 seconds maximum) place resistor between pins 7 and 9. Verify following:

(a) On CAWP following lights come on:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) COMP fault indicator on LRS computer remains off.

(35) On aircraft with -117 computer, on LRS computer face turn BITE switch to TEST 2. Verify following:

On CAWP following lights remain on:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On RUDDER LIMITER panel following lights remain on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) COMP fault indicator on LRS computer remains on.

(35) On aircraft with -119 computer, on LRS computer face remove resistor. Turn BITE switch to TEST 2. Momentarily (3 seconds maximum) place resistor between pins 7 and 9. Verify following:

(a) On CAWP following lights come on:

R FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) COMP fault indicator on LRS computer remains off.

(36) On LRS computer face remove resistor.

(37) On aircraft with two CADC's installed, release both CADC self-test buttons.

(37) On aircraft with one CADC and one DADC installed, reduce IAS to zero on Air Data Tester.

(38) Reset LRS computer by positioning BITE switch to RESET for 5 seconds and then to RUN.

(39) Turn off hydraulic power if no longer required (Ref 29-11-00).

(40) Turn off electrical power if no longer required (Ref. 24-41-00).

(41) Remove tags and close following circuit breakers in sequence shown:

(a) MLG GND SENSE (CB2-L8).

(b) RAT AUTO DEPLOY (CB1-L3).

B. LRS Computer Operational Test

NOTE: The following is a list of troubleshooting references if a fault occurs during the LRS Computer Operational Test:

- RUDDER HYDR LMTR annunciator light on, 27-21-00, Fault Isolation
- RUDDER MECH LMTR annunciator light on, 27-21-00, Fault Isolation
- Rudder limiting system electrical schematic, 27-21-00, Fault Isolation
- Aural Warning System, 31-22-00
- Air Data Computer (ADC), 34-14-00

(1) Verify following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

SPOILER DWELL - DC (B7)

NO. 1 NAVIGATION - AIR DATA CMPTR (G8)

NO. 2 NAVIGATION - AIR DATA CMPTR (G27)

NO. 1 INSTRUMENT - CAPT - IAS/MACH (F1)

NO. 2 INSTRUMENT - F/O - IAS/MACH (F19)

AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS (A5)

AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS (A23)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

FLAP LOAD RELIEF - CHAN 1 (H12), and IND (H13)

FLAP LOAD RELIEF - CHAN 2 (H20)

NOTE: FLAP LOAD RELIEF circuit breaker may be labeled RUD HYD LMTR.

RUDDER SERVO - A(K12), B(K13), and C(K14)

INDICATOR - T/O AURAL WRNG (H7)

C On aircraft 001-018, 022,

RUDDER MECH LMTR - A(K15) and B(K16)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

IND LT - PFCS/ADS/DH (G8)

FLT CONT ALT ALERT (G9)

(2) Accomplish Steps 4A(2) thru 4A(23) to complete the LRS Computer Operational Test:

(3) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(4) Turn off electrical power if no longer required (Ref. 24-41-00).

(5) Remove tags and close following circuit breakers in sequence shown:

(a) MLG GND SENSE (CB2-L8).

(b) RAT AUTO DEPLOY (CB1-L3).

C. LRS Computer Monitor Circuits Functional Test

(1) Connect Air Data Tester to Captains and First Officers pitot ports on upper left and upper right pitot-static tubes. Install a shutoff valve in the pressure line to each pitot-static tube. Leave both shutoff valves open.

(2) Verify following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

SPOILER DWELL - DC (B7)

NO. 1 NAVIGATION - AIR DATA CMPTR (G8)

NO. 2 NAVIGATION - AIR DATA CMPTR (G27)

NO. 1 INSTRUMENT - CAPT - IAS/MACH (F1)

NO. 2 INSTRUMENT - F/O - IAS/MACH (F19)

AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS (A5)

AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS (A23)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

FLAP LOAD RELIEF - CHAN 1 (H12), and IND (H13)

FLAP LOAD RELIEF - CHAN 2 (H20)

NOTE: FLAP LOAD RELIEF circuit breaker may be labled RUD HYD LMTR.

RUDDER SERVO - A(K12), B(K13), and C(K14)

C On aircraft 001-018, 022,

RUDDER MECH LMTR - A(K15) and B(K16)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

IND LT - PFCS/ADS/DH (G8), and FLT CONT ALT ALERT (G9)

(3) Verify following circuit breakers are opened and tagged:

WARNING: IT IS ESSENTIAL THAT RAT DEPLOY CIRCUIT BREAKER IS OPENED BEFORE OPENING MLG GND SENSE CIRCUIT BREAKER.

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

RAT AUTO DEPLOY (L3)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel, CB2, zone 215:

MLG GND SENSE (L8)

WARNING: PRIOR TO MAINTENANCE PROCEDURES IN OR NEAR HYDRAULIC SERVICE CENTER, VERIFY RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED UNDER THE RAT DOOR.

(4) Turn on electrical power (Ref. 24-41-00).

(5) Check status lights on Flight Control Auxiliary Unit (FCAU) (the FCAU is located in the Forward Electronic Service Center (FESC), center rack, below the bottom shelf). Verify RUDDER HYDRAULIC LIMITER A, B, C, and C REG lights are on.

(a) If any lights are off, depress LAMP TEST to check bulb.

(b) If lights that were off, come on when LAMP TEST is depressed, check for servo pressure switch failing in high pressure state (Ref. 27-21-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on hydraulic systems A, B, C and D (Ref. 29-11-00). Verify flaps are fully retracted.

NOTE: Test results will be invalid unless normal hydraulic power is supplied to flaps (25 gpm at 3000 psi). Do not use AC pumps; use ATMs or ground hydraulic sources.

(7) On pilots overhead PFCS panel, verify RUDDER switchlight is depressed (latched in) and OFF light is off.

(8) In FESC, locate flap Load Relieving System (LRS) computer on center rack, shelf 1. (LRS computer may be identified as LOAD LIMITER COMPUTER.)On LRS computer, place switch in RESET position for 5 seconds, then back to RUN.

(9) On Pilots overhead panel, operate TEST switchlight on LIGHTS panel; verify all lights listed below are on. Turn off TEST switchlight, then operate RESET pushbutton on the center panel verify all lights listed below are off.

(a) On Caution and Warning Panel (CAWP):

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

On aircraft without SB27-169,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH/OVRD

C On aircraft 001-018, 022,

MECHANICAL - MNL/PUSH

MECHANICAL - ±8°/±30°

C (10) On aircraft 001-018, 022, on Pilots Overhead Flight Control panel, verify MECHANICAL switchlight and HYDRAULIC switchlight are depressed (latched in) and only ±30° light is on.

C (10) On aircraft 019-021, 023-999, on Pilots Overhead Flight Control panel, verify HYDRAULIC switchlight is depressed (latched in).

(11) Verify pitot pressure indicates 0 knots and flaps are at 0 degrees.

(12) On FCAU (located in FESC, center rack, below bottom shelf), verify all lights are off. Press and hold RUDDER HYDRAULIC LIMITER C pushbutton. Verify following:

(a) On CAWP following light comes on:

RUDDER HYDR LMTR

NOTE: Anytime RUDDER HYDR LMTR light on CAWP comes on, the HYD LMTR FAULT light on FCAU will also come on.

(b) On Pilots Overhead Flight Control panel following light remains off:

HYDRAULIC - PUSH

(c) On FCAU:

R HYD LMTR FAULT - on

R C - on

R C-REG - off

(13) Keeping C pushbutton depressed, depress and hold A pushbutton. Verify following lights are on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

(c) On FCAU:

HYD LMTR FAULT

A

R C

(14) Release C and A pushbuttons. Verify following lights go off:

(a) On CAWP:

FLT CONT PANELS (May go off)

RUDDER HYDR LMTR

(b) On Pilots Overhead Flight Control panels:

HYDRAULIC - PUSH

(c) On FCAU:

HYD LMTR FAULT

A

R C

(15) Adjust pitot pressure to indicate 180 knots. Verify following:

C (a) On aircraft 001-018, 022, on RUDDER LIMITER panel, ±30° light goes off; ±8° light comes on.

C (b) On aircraft 001-018, 022, on FCAU, A and B lights come on.

C (b) On aircraft 019-021, 023-999, on FCAU, A and C-REG lights come on.

(16) On FCAU, depress and hold C button. Verify following:

(a) On CAWP following light comes on:

RUDDER HYDR LMTR

(b) On FCAU, A light goes off and C light comes on.

C (17) On aircraft 001-018, 022, on FCAU, release C button and depress C-REG button. Verify the following:

(a) On CAWP following light remains on:

RUDDER HYDR LMTR

(b) On FCAU, C light goes off and C-REG light comes on.

C (17) On aircraft 019-021, 023-999, on FCAU, release C button and depress B button. Verify following:

(a) On CAWP following light remains on:

RUDDER HYDR LMTR

R R (b) On FCAU, C light goes off and A and B lights come on.

C (18) On aircraft 001-018, 022, on FCAU, release C-REG button. Verify following:

(a) On CAWP following light remains on:

RUDDER HYDR LMTR

(b) On FCAU, C-REG light goes off.

C (18) On aircraft 019-021, 023-999, on FCAU, release B button. Verify following:

(a) On CAWP following light goes off:

RUDDER HYDR LMTR

(b) On FCAU, B light goes off.

C R (19) On aircraft 001-018, 022, on Pilots Overhead Flight Control panel, depress MNL/PUSH and the ±8°/±30° pushlights. Verify following:

(a) MNL light goes off.

(b) ±8° light goes off and the ±30° light comes on.

(20) Extend flaps to 4 degrees and verify pitot-static pressure indicates 180 knots.

(21) Close shutoff valve in left pitot-static pressure line. Leave shutoff valve in right pitot-static pressure line open. Verify following lights come on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(22) On LRS computer face turn BITE switch to TEST 1. Verify following lights remain on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(23) On LRS computer face turn BITE switch to TEST 2. Verify following lights remain on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(24) Slowly open shutoff valve in left pitot-static pressure line to equalize pressure. Adjust pitot-static pressure to indicate 0 knots.

(25) On LRS computer turn BITE switch to RESET for 5 seconds and then to RUN. Verify following lights are off:

(a) On CAWP:

FLT CONT PANELS (May go off)

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(26) Adjust pitot-static pressure to indicate 180 knots.

(27) On LRS computer face, momentarily (3 seconds maximum) place 150-ohm resistor between pins 7 and 9. Verify following:

(a) On CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On -117 computer,
COMP fault indicator on LRS computer comes on.

(c) On -119 computer,
COMP fault indicator on LRS computer must not come on.

(d) On LRS computer, operate FIM switch, CADC FIM ball must trip to white.

(28) On aircraft with -117 computer,
On LRS computer face turn BITE switch to TEST 1.
Verify following:

(a) On CAWP following lights remain on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights remain on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) COMP fault indicator on LRS computer remains on.

(28) On aircraft with -119 computer,
on LRS computer face remove resistor. Turn BITE switch to TEST 1. Momentarily (3 seconds maximum) place resistor between pins 7 and 9. Verify following:

(a) On CAWP following lights remain on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights remain on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) COMP fault indicator on LRS computer remains off.

(29) On aircraft with -117 computer, On LRS computer face turn BITE switch to TEST 2. Verify following:

(a) On CAWP following lights remain on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights remain on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) COMP fault indicator on LRS computer remains on.

(29) On aircraft with -119 computer, on LRS computer face remove resistor. Turn BITE switch to TEST 2. Momentarily (3 seconds maximum) place resistor between pins 7 and 9. Verify following:

(a) On CAWP following lights remain on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights remain on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) COMP fault indicator on LRS computer remains off.

(30) On LRS computer face remove resistor.

(31) Adjust pitot-static pressure to indicate 0 knots.

(32) On LRS computer face turn BITE switch to RESET for 5 seconds and then to RUN.

(33) Verify following lights are off:

(a) On CAWP:

FLT CONT PANELS (MAY REMAIN ON)

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(34) On FE/SO overhead circuit breaker panel CB2, pull FLAP LOAD RELIEF CHAN 1 circuit breaker (H12). Verify following:

(a) On CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(35) On FE/SO Overhead circuit breaker panel CB2close FLAP LOAD RELIEF CHAN 1 CIRCUIT BREAKER (H12).

(36) On LRS computer face turn BITE switch to RESET for 5 seconds and then to RUN. Verify following lights are off:

(a) On CAWP:

FLT CONT PANELS (may remain on)

RUDDER HYDR LMTR

C On aircraft 001-018, 22,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 22,

MECHANICAL - PUSH

(37) On FE/SO overhead circuit breaker panel CB2, pull FLAP LOAD RELIEF CHAN 2 circuit breaker (H20). Verify following:

(a) On CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(38) On FE/SO overhead circuit breaker panel CB2, close FLAP LOAD RELIEF CHAN 2 circuit breaker (H20).

(39) On LRS computer face turn BITE switch to RESET for 5 seconds and then to RUN. Verify following lights are off:

(a) On CAWP:

FLT CONT PANELS (may remain on)

RUDDER HYDR LMTR

C On aircraft 001-018, 22,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 22,

MECHANICAL - PUSH

(40) After completing tests:

(a) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(b) Turn off electrical power if no longer required (Ref. 24-41-00).

(c) Disconnect air data tester hoses from pitot-static tubes (Ref. 34-14-00).

(d) Remove RAT ground safety lock.

(41) Remove tags and close circuit breakers in the following sequence:

(a) MLG GND SENSE (CB2-L8)

(b) RAT AUTO DEPLOY (CB1-L3)

R LOAD RELIEVING SYSTEM (LRS) COMPUTER - ADJUSTMENT AND TEST

R 1. General

R This section contains procedures for performing the following
R test:

R LRS Computer BITE Test (Para. 4A)

R LRS Computer Operational Test (Para. 4B)

R LRS Computer Monitor Circuits Functional Test (Para. 4C)

R The following Acronyms (abbreviations) are used in this
R procedure:

R	FCAU	Flight Control Auxiliary Unit
R	FESC	Forward Electronic Service Center
R	LRS	Load Relieving System
R	CAWP	Caution And Warning Panel
R	DADC	Digital Air Data Computer
R	IAS	Indicated Air Speed
R	FE/SO	Flight Engineer/Second Officer

R 2. Equipment and Materials

R Air Data Tester, Milhard Engineering Co. PN 127, or equivalent

R Resistors: 150 ohm, 1 watt

R 3. Referenced Procedures

R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-21-00	Rudder Control System - Fault Isolation
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	34-14-00	Digital Air Data Computer - Fault Isolation

R EFFECTIVITY: AIRCRAFT WITH TWO DIGITAL AIR DATA
R COMPUTERS
R
002B

4. Adjustment/Test

A. LRS Computer BITE Test

R NOTE: Steps 4A(1) through 4A(18) are used as part of LRS Computer Operational Test (Ref. Para. 4B); complete all Steps in Paragraph 4A for BITE Test.

(1) Verify following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

SPOILER DWELL - DC (B7)

NO. 1 NAVIGATION - AIR DATA CMPTR (G8)

NO. 2 NAVIGATION - AIR DATA CMPTR (G27)

NO. 1 INSTRUMENT - CAPT - IAS/MACH (F1)

NO. 2 INSTRUMENTS - F/O - IAS/MACH (F19)

(b) On Flight Engineer/Second Officers (FE/SO) overhead circuit breaker panel CB2, zone 215:

RUD HYDR LMTR - CHAN 1 (H12),

RUD HYDR LMTR - CHAN 2 (H20)

NOTE: Circuit breakers H12 and H20 may be labled FLAP LOAD RELIEF - CHAN 1 and CHAN 2.

RUDDER SERVO - A, B, and C (K12, K13, and K14)

INDICATOR - T/O AURAL WRNG (H7)

C On aircraft 001-018,

C 022,

RUDDER MECH LMTR - A(K15) and B(K16)

(c) On FE/SO aft circuit breaker panel CB3, zone 215:

IND LT - PFCS/ADS/DH (G8)

IND LT - FLT CONT ALT ALERT (G9)

(2) Verify following circuit breakers are opened and tagged.

WARNING: IT IS ESSENTIAL RAT AUTO DEPLOY CIRCUIT BREAKER IS OPENED BEFORE OPENING MLG GND SENSE CIRCUIT BREAKER.

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

RAT AUTO DEPLOY (L3)

CR R R (b) On aircraft 001-018, 022, On FE/SO overhead circuit breaker panel CB2, zone 215.

MLG GND SENSE (L8)

WARNING: PRIOR TO MAINTENANCE PROCEDURES IN OR NEAR HYDRAULIC SERVICE CENTER, VERIFY THE RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED UNDER THE RAT DOOR.

(3) Turn on electrical power (Ref. 24-41-00).

(4) Verify RUDDER HYDRAULIC LIMITER A, B, C, and C REG lights on the Flight Control Auxiliary Unit (FCAU) are on. The FCAU is located in the Forward Electronic Service Center (FESC), center rack, below the bottom shelf.

(a) If any light is off, depress LAMP TEST to check bulb.

(b) If A, B, or C light stays off, check for servo pressure switch failing in high pressure state (Ref. 27-21-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES. LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on hydraulic systems A, B, C, and D (Ref. 29-11-00).

NOTE: It is not essential that hydraulic system D be on, but some hydraulic fluid may transfer to system D if it is off.

Test results will be invalid unless normal hydraulic power is supplied to the flap system (25 gpm at 3000 psi). Do not use AC pumps; use ATM's or ground hydraulic sources.

(6) Position flaps full up.

(7) On Pilots overhead PFCS panel, verify RUDDER switchlight is depressed (latched in) and OFF light is off.

(8) In FESC, locate Load Relieving System (LRS) computer on center rack, shelf 1. (LRS computer may be identified as LOAD LIMITER COMPUTER.) On LRS computer, verify switch is in RUN position.

(9) On Pilots overhead panel, operate TEST switchlight on LIGHTS panel; verify following lights come on and then go off when TEST switchlight is released and RESET pushbutton on Pilots center panel is operated:

(a) On Caution and Warning panel (CAWP):

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LIMITER

R (b) On Pilots Overhead Flight Control panel:

C On aircraft 001-018, 022,

MECHANICAL - MNL/PUSH

R MECHANICAL - ±8°/±30°

NOTE: Anytime RUDDER HYDR LMTR light on CAWP comes on, the HYD LMTR FAULT light on FCAU will also come on.

C (10) On aircraft 001-018, 022,
R on Pilots Overhead Flight Control panel, verify MECHANICAL and HYDRAULIC switchlights are depressed (latched in) and only the ±30 degree light is on.

C (10) On aircraft 019-021, 023-999,
R the Pilots Overhead Flight Control panel, verify

R HYDRAULIC switchlight is depressed (latched in) and OFF
R legend is off.

NOTE: The indications in Steps 4A(9) and 4A(10) should not change unless noted in this procedure. Disregard changes of FLT CONT PANELS light on Caution and Warning panel unless specifically noted.

The following steps will require a man in the FESC to operate the Digital Air Data Computers (DADC) self test, and the LRS computer BITE switch.

Steps 4A(11) through 4A(16) check LRS computer operation using the DADC self test program. Step 4A(11) is a self test of the DADC. Step 4A(12) initiates the programmed airspeed output required for Steps 4A(13) through 4A(16).

(11) Simultaneously depress DADC 1 and 2 PUSH TO TEST switches for 1 second and release.

(12) When the TEST IN PROGRESS lights on both DADC 1 and 2 start to flash (approximately 10 seconds after start of self test), simultaneously depress both PUSH TO TEST switches for 1 second and release.

(13) Approximately 1 minute after initiating programmed airspeed outputs, as Indicated Air Speed (IAS) increases to 164 knots, verify following:

C (a) On aircraft 001-018, 022, on FCAU in the FESC the RUDDER A and B lights come on.

C (a) On aircraft 019-021, 023-999, on FCAU in the FESC the RUDDER A and C-REG lights come on.

C (b) On aircraft 001-018, 022, on Flight Control panel, MECHANICAL ±8°/±30°
R switchlight indication changes from ±30° to ±8°.

CR (14) On aircraft 001-018, 022,
R as IAS increases to 260 knots, C-REG light on FCAU
R comes on.

CR (14) On aircraft 019-021, 023-999,
R as IAS increases to 260 knots, B light on FCAU comes
R on.

(15) When IAS starts to decrease from its peak value, depress and release PUSH TO TEST button on DADC 1.
R Verify on CAWP, RUDDER HYDR LMTR light flashes for 10
R seconds and then remains on.

(16) Approximately 20 seconds after releasing PUSH TO TEST switch on DADC 1, operate FIM SW toggle switch on LRS computer face. Verify CADC fault FIM ball trips to white.

(17) Depress and release push to TEST button on DADC 2. After a short delay (2 minutes maximum) verify following lights go off:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

C (b) On aircraft 001-018, 022, on Pilots Overhead Flight Control panel:

MECHANICAL - PUSH

(c) On FCAU:

RUDDER A, B, and C-REG

(18) On LRS computer face turn BITE selector switch to RESET for 5 seconds and then to RUN.

(19) Position flaps to four degrees:

(20) On FE/SO overhead circuit breaker panel CB2, pull RUD HYDR LMTR - CHAN 1 (H12) circuit breaker. Verify following lights come on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

(21) On LRS computer face turn BITE switch to TEST 1. Verify following lights remain on:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

(22) On LRS computer face turn BITE switch to TEST 2. Verify following lights remain on:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

R (23) On overhead circuit breaker panel, CB2, close RUD HYDR LMTR - CHAN 1 (H12) circuit breaker. On LRS computer face turn BITE switch to RESET for at least 2 seconds, and then to RUN. Verify following lights go off:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

R (24) On FE/SO overhead circuit breaker panel, CB2, open RUD HYDR LMTR - CHAN 2 circuit breaker (H20). Verify following lights come on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

(25) On LRS computer face turn BITE switch to TEST 1. Verify following lights remain on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

(26) On LRS computer face turn BITE switch to TEST 2. Verify following lights remain on:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

(27) On FE/SO overhead circuit breaker panel, CB2, close RUD HYDR LMTR - CHAN 2 circuit breaker (H20).

(28) On LRS computer face turn BITE switch to RESET for at least 2 seconds and then to RUN. On CAWP, depress and release RESET pushbutton. Verify following lights are off:

NOTE: Lights may go off in either Steps 4A(27) or 4A(28).

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) On FCAU:

HYD LMTR FAULT

NOTE: Steps 4A(29) through 4A(37) check LRS computer operation using the DADC self test program. Step 4A(29) is a self test of the DADC. Step 4A(30) initiates the programmed airspeed output required for Steps 4A(31) through 4A(37).

(29) On both DADC's, simultaneously depress PUSH TO TEST switches for 1 second and release.

(30) When the TEST IN PROGRESS light on both DADC 1 and 2 start to flash (approximately 10 seconds after start of self test), simultaneously depress both PUSH TO TEST switches for 1 second and release.

(31) When IAS exceeds 200 kts, depress and hold DADC 1 and 2 self test buttons to stop airspeed. Keep self-test buttons depressed until Step 4A(40) is completed.

(32) On LRS computer face momentarily (20 seconds maximum) place 150 ohm resistor between pins 7 and 9. Verify following lights come on:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(33) On LRS computer face, operate FIM SW toggle switch. Verify COMP fault FIM ball trips to white.

(34) On LRS computer face remove resistor and turn BITE switch to RESET for 5 seconds and then to TEST 1.
R Verify following lights come on:

R (a) On CAWP:

R RUDDER HYDR LMTR

R On aircraft 001-018, 022,

R RUDDER MECH LMTR

(35) On LRS computer face momentarily (20 seconds maximum) place 150 ohm resistor between pins 7 and 9. Verify
R following:

R (a) On CAWP following lights remain on:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

R (b) On Pilots Overhead Flight Control panel following
R lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(36) On LRS computer face remove resistor and turn BITE switch to RESET for 5 seconds and then to TEST 2. Verify following lights come on:

(a) On CAWP:

RUDDER HYDR LMTR

On aircraft 001-018, 022,

RUDDER MECH LMTR

(37) On LRS computer face momentarily (20 seconds maximum) place 150 ohm resistor between pins 7 and 9. verify following:

(a) On CAWP following lights remain on:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(38) Release both DADC self-test buttons.

(39) On LRS computer face turn BITE selector switch to RESET for 5 seconds and then to RUN.

(40) Turn Turn off hydraulic power if no longer required (Ref. 29-11-00).

(41) Turn off electrical power if no longer required (Ref. 24-41-00).

(42) Remove tags and close following circuit breakers in sequence shown:

C (a) On aircraft 001-018, 022,
MLG GND SENSE (CB2-L8).

(b) RAT AUTO DEPLOY (CB1-L3).

B. LRS Computer Operational Test

NOTE: The following is a list of troubleshooting references if a fault occurs during the LRS Computer Operation Test:

RUDDER HYDR LMTR Annunciator Light On, 27-21-00

RUDDER Limiting System Electrical Schematic, 27-21-00

Digital Air Data Computer (DADC), 34-14-00

C On aircraft 001-018, 022,

RUDDER MECH LMTR Annunciator Light On, 27-21-00

(1) Accomplish Steps 4A(1) thru 4A(18) of LRS Computer BITE Test (Ref. Para. 4A) to complete the LRS Computer Operational Test.

(2) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(3) Turn off electrical power if no longer required (Ref. 24-41-00).

(4) Remove tags and close circuit breakers in the following sequence:

C (a) On aircraft 001-018, 022,
MLG GND SENSE (CB2-L8).

(b) RAT AUTO DEPLOY (CB1-L3).

C. LRS Computer Monitor Circuits Functional Test

(1) Verify following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

SPOILER DWELL - DC (B7)

NO. 1 NAVIGATION - AIR DATA CMPTR (G8)

NO. 2 NAVIGATION - AIR DATA CMPTR (G27)

NO. 1 INSTRUMENT - CAPT - IAS/MACH (F1)

NO. 2 INSTRUMENT - F/O - IAS/MACH (F19)

(b) On Flight Engineer/Second Officers (FE/SO) overhead circuit breaker panel CB2, zone 215:

RUD HYDR LMTR - CHAN 1 (H12)

RUD HYDR LMTR - CHAN 2 (H20)

RUDDER SERVO - A, B, and C (K12, K13, and K14)

INDICATOR - T/O AURAL WRNG (H7)

C On aircraft 001-018, 022,

RUDDER MECH LMTR A (K15)

C On aircraft 001-018, 022,

RUDDER MECH LMTR B (K16)

(c) On FE/SO aft circuit breaker panel CB3, zone 215:

IND LT - PFCS/ADS/DH (G8)

IND LT - FLT CONT ALT ALERT (G9)232 (2)
Verify following circuit breakers are opened and tagged. 423 IT IS ESSENTIAL RAT AUTO DEPLOY CIRCUIT BREAKER IS OPENED BEFORE OPENING MLG GND SENSE CIRCUIT BREAKER. 234
(a) On Pilots overhead circuit breaker panel CB1, zone 210:

RAT AUTO DEPLOY (L3)

C (b) On aircraft 001-018, 021,
On FE/SO overhead circuit breaker panel, CB2, zone 215:

MLG GND SENSE (L8)

WARNING: PRIOR TO MAINTENANCE PROCEDURES IN OR NEAR HYDRAULIC SERVICE CENTER, VERIFY THE RAM AIR TURBINE (RAT) GROUND SAFETY LOCK IS INSTALLED UNDER THE RAT DOOR.

(3) Turn on electrical power (Ref. 24-41-00).

(4) Check status lights on Flight Control Auxiliary Unit (FCAU), located in the Forward Electronic Service Center (FESC), center rack, below the bottom shelf. Verify RUDDER HYDRAULIC LIMITER A, B, C, and C-REG lights are on.

(a) If any light is off, depress LAMP TEST to check bulb.

(b) If A, B, or C light stays off, check for servo pressure switch failing in high pressure state (Ref. 27-21-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

NOTE: The following procedures will require 3 men. One man in the FESC to operate LRS computer BITE selector switch and Digital Air Data Computer (DADC) 1 and 2 PUSH TO TEST switches. A second in the FESC to operate the FCAU buttons. A third man in the flight station to verify annunciations on CAWP and RUDDER LIMITER Panel.

(5) Turn on hydraulic systems A, B, C, and D (Ref. 29-11-00).

NOTE: It is not essential that hydraulic system D be on, but some hydraulic fluid may transfer to system D if it is off.

Test results will be invalid unless normal hydraulic power is supplied to the flaps (25 gpm at 3000 psi). Do not use AC pumps; use ATM's or ground hydraulic sources.

(6) Verify flaps are fully retracted.

(7) On Pilots overhead PFCS panel, verify RUDDER switchlight is depressed (latched in) and OFF light is off.

(8) In FESC, locate Load Relieving System (LRS) computer on center rack, shelf 1. (LRS computer may be identified as LOAD LIMITER COMPUTER.) On LRS computer, verify selector switch is in RUN position.

(9) On Pilots overhead panel, operate TEST switchlight on LIGHTS panel; verify following lights are on.

(a) Caution and Warning Panel (CAWP):

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) Pilots Overhead RUDDER LIMITER Panel:

HYDRAULIC - OVRD/PUSH

C On aircraft 001-018, 022,

MECHANICAL - MNL/PUSH

MECHANICAL - ±8°/±30°

(10) On Pilots overhead panel, turn off TEST switchlight, then operate the RESET pushbutton on the center panel; verify following lights go off:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - OVRD/PUSH

C On aircraft 001-018, 022,

MECHANICAL - MNL/PUSH

MECHANICAL - ±8°/±30°

(11) On the Pilots Ovehead Flight Control panel, verify HYDRAULIC switchlight is depressed (latched in).

(12) Verify following lights on FCAU are off:

HYD LMTR FAULT

A

B

C

C-REG

(13) On the FCAU panel, press and hold RUDDER HYDRAULIC LIMITER C pushbutton. Verify following lights come on:

(a) On CAWP:

RUDDER HYDR LMTR

(b) On FCAU:

HYD LMTR FAULT

R C

NOTE: Anytime RUDDER HYDR LMTR light on CAWP comes on, the HYD LMTR FAULT light on FCAU will also come on.

(14) On Pilots Overhead Flight ControlE panel verify HYDRAULIC - PUSH light is off.

(15) Keeping C pushbutton depressed, depress and hold A pushbutton. Verify following lights come on:

(a) On CAWP:

FLT CONT PANELS

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

(c) On FCAU:

HYD LMTR FAULT

A

R C

(16) Release C and A pushbuttons. Verify following lights go off:

(a) On CAWP:

RUDDER HYDR LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

(c) On FCAU:

HYD LMTR FAULT

A

R C

(17) On CAWP depress and release RESET pushbutton. Verify FLT CONT PANELS light goes off.

(18) On both Digital Air Data Computers (DADC), simultaneously depress PUSH TO TEST switches for 1 second and release.

(19) When the TEST IN PROGRESS lights on both DADC 1 and 2 start to flash (approximately 10 seconds after start of self test), simultaneously depress both PUSH TO TEST switches for 1 second and release.

(20) When Indicated Air Speed (IAS) exceeds 164 knots but is less than 260 knots, verify following:

C (a) On aircraft 001-018, 022, onFCAU following lights come on:

A

B

C (a) On aircraft 019-021, 023-999, on FCAU following lights come on:

A

C-REG

C (b) On aircraft 001-018, 022, on RUDDER LIMITER panel, ±30° light goes off and ±8° light comes on.

C (c) On aircraft 001-018, 022, onCAWP following light comes on:

RUDDER MECH LMTR

(21) On DADC 1 and 2, depress and hold both PUSH TO TEST switches to stop airspeed at above 200 knots and below 250 knots.

C (22) On aircraft 001-018, 022, on Pilots Overhead Flight Control panel, release (out) MNL/PUSH and ±8°/±30° switchlights. Verify following lights come on:

(a) On CAWP:

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

MNL

±8°

R (23) On FCAU, depress and hold C button. Verify following:

(a) On FCAU, A light goes off and C light comes on.

R (b) On CAWP following light comes on:

RUDDER HYDR LMTR

C (24) On aircraft 001-018, 022, on FCAU, release C button and depress C-REG button. Verify following:

(a) On FCAU C light goes off, A and C-REG lights come on.

R (b) On CAWP following light remains on:

RUDDER HYDR LMTR

C (24) On aircraft 019-021, 023-999, on FCAU, release C button and depress B button. Verify following:

(a) On FCAU, C light goes off, A and B lights come on.

R (b) On CAWP following light remains on:

RUDDER HYDR LMTR

C (25) On aircraft 001-018, 022,
R on FCAU, release C-REG button. Verify following lights go off:

(a) On FCAU:

C-REG

(b) On CAWP:

RUDDER HYDR LMTR

C (25) On aircraft 019-021, 023-999, on FCAU, release B button. Verify following lights go off:

(a) On FCAU:

B

(b) On CAWP:

RUDDER HYDR LMTR

(26) On CAWP depress and release RESET pushbutton. Verify FLT CONT PANELS goes off.

(27) Extend flaps to 4 degrees.

(28) Verify IAS is above 200 knots and below 250 knots.

(29) Release DADC 1 PUSH TO TEST switch. Verify following lights come on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(30) After 20 seconds, operate FIM SW toggle switch on LRS computer face. Verify CADC fault FIM ball trips to white.

(31) On LRS computer face turn BITE selector switch to TEST 1. Verify following lights remain on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(32) On LRS computer face turn BITE selector switch to TEST 2. Verify following lights remain on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(33) Release DADC 2 PUSH TO TEST switch. Verify following lights go off:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(34) On DADC 1 and 2, simultaneously depress both PUSH TO TEST switches for one second and release.

(35) When TEST IN PROGRESS lights on both DADC 1 and 2 start to flash (approximately 10 seconds after start of self test), depress both PUSH TO TEST switches for one second and release.

C (36) On aircraft 001-018, 022,
R when IAS exceeds 164 knots, A and B lights on FCAU come on, when IAS exceeds 260 knots, C-REG light comes on.

C (36) On aircraft 019-021, 023,
when IAS exceeds 164 knots, A and C-REG lights on FCAU come on, when IAS exceeds 260 knots, B light comes on.

(37) Push and release PUSH TO TEST on DADC 1. Verify following lights come on:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(38) On LRS computer face turn BITE selector switch to TEST 1. Verify following lights remain:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(39) On LRS computer face turn BITE selector switch to TEST 2. Verify following lights remain on:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(40) Push and release PUSH TO TEST on DADC 2.

(41) On DADC 1 and 2, simultaneously depress both PUSH TO TEST switches for one second and release.

(42) When TEST IN PROGRESS lights on both DADC 1 and 2 start to flash (approximately 10 seconds after start of self test), depress both PUSH TO TEST switches for one second and release.

(43) When IAS exceeds 164 knots, push and hold both PUSH TO TEST switches and momentarily (20 seconds maximum) place 150 ohm resistor between pins 7 and 9 on face of LRS computer. Verify following:

C (a) On aircraft 001-018, 022, on CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

RUDDER MECH LMTR

C (a) On aircraft 019-021, 023-999, on CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

C (b) On aircraft 001-018, 022, on Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

MECHANICAL - PUSH

C (b) On aircraft 019-021, 023-999, on Pilots Overhead Flight Control panel following light comes on:

HYDRAULIC - PUSH

(c) Operate FIM SW toggle switch on LRS computer face. COMP FAULT FIM ball must trip to white.

NOTE: Keep DADC 1 and 2 PUSH TO TEST switches depressed until Step 4C(47) is completed.

(44) On LRS computer face remove resistor and turn BITE selector switch to RESET for 5 seconds then to TEST 1.

(45) On LRS computer face momentarily (20 seconds maximum) place 150 ohm resistor between pins 7 and 9. Verify following:

(a) On CAWP following lights come on:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) Operate FIM SW toggle switch on LRS computer face. COMP FAULT FIM ball must trip to white.

(46) On LRS computer face remove resistor and turn BITE selector switch to RESET for 5 seconds then to TEST 2.

(47) On LRS computer face momentarily (20 seconds maximum) place 150 ohm resistor between pins 7 and 9. Verify following:

(a) On CAWP following lights come on:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel following lights come on:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(c) Operate FIM SW toggle switch on LRS computer face. COMP FAULT FIM ball must trip to white.

(48) On LRS computer face remove resistor. Release both DADC PUSH TO TEST switches.

(49) Verify following lights are off:

(a) On CAWP:

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(50) On CAWP depress and release RESET pushbutton and verify FLT CONT PANELS light is off.

(51) On FE/SO overhead circuit breaker panel, CB2, pull RUD HYDR LMTR - CHAN 1 circuit breaker (H12). Verify following lights come on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(52) Close RUD HYDR LMTR - CHAN 1 circuit breaker (H12).

(53) On CAWP depress and release RESET pushbutton and verify FLT CONT PANELS is off.

(54) On FE/SO overhead circuit breaker panel, CB2, pull RUDDER HYDR LMTR - CHAN 2 circuit breaker (H20). Verify following lights come on:

(a) On CAWP:

FLT CONT PANELS

RUDDER HYDR LMTR

C On aircraft 001-018, 022,

RUDDER MECH LMTR

(b) On Pilots Overhead Flight Control panel:

HYDRAULIC - PUSH

C On aircraft 001-018, 022,

MECHANICAL - PUSH

(55) After completing tests:

(a) Turn off hydraulic power if no longer required.

(b) Turn off electrical power if no longer required.

(c) Remove RAT ground safety lock.

(56) Remove tags and close circuit breakers in the following sequences:

C (a) On aircraft 001-018, 022,
MLG GND SENSE (CB2-L8)

(b) RAT AUTO DEPLOY (CB1-L3)

FLAP LOAD RELIEVING SYSTEM ACTUATOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Rig pin, 5/16-inch diameter, 3 inches long (R3), PN 1302695-105, or equivalent

Rig pins (2), 3/16-inch diameter, Curtiss-Wright ST 7138-187, or equivalent

2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-00	Trailing Edge Flap System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

R A. Removal (Ref. Fig. 401)

(1) Verify that hydraulic systems A and C are shut off (Ref. 29-11-00).

(2) Install warning tags on the Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

(3) Verify that the flap control handle on the right side of the center console in the flight station is in the 0-degree detent position.

R R (4) Install 3/16-inch rig pins in the left and right PDU upper control arms and the PDU to prevent tripping the comparator when PDU input rods are disconnected (Ref. Fig. 401).

NOTE: On later PDU's, upper control arm rig pin holes are removed. On these PDU's, lock-wire the left and right input arms against the up-stops.

(5) Disconnect electrical connector from the load relieving system (LRS) actuator.

NOTE: The actuator is attached to a bracket near the ceiling at the aft end of the hydraulic service center.

CR CR (6) Disconnect the two control rods from the input arms of the actuator. Disengage the anti-backlash springs and link from the control rod connecting bolts.

CAUTION: VERIFY THAT RIG PINS ARE INSTALLED IN PDU (OR INPUT ARMS ARE LOCK-WIRED AGAINST UP-STOP) BEFORE DISCONNECTING BUNGEE RODS TO PREVENT TRIPPING THE DIVERGENCE COMPARATOR IN THE PDU. IF COMPARATOR IS TRIPPED, RESET IN ACCORDANCE WITH 27-51-08, PARA. 5, RESETTING COMPARATOR.

CR CR (7) Disconnect the two bungee control rods from the output arms of the actuator. Remove the anti-backlash springs and link; do not lose.

(8) Support LRS actuator and remove the mounting bolts. (Bolts are threaded into top of actuator.)

B. Installation (Ref. Fig. 401)

(1) Verify that hydraulic systems A and C are shut off and that hydraulic panels are tagged.

(2) Position LRS actuator under bracket with the electrical connector toward right side of aircraft. Attach actuator to bracket with bolts.

(3) Connect electrical connector to the actuator.

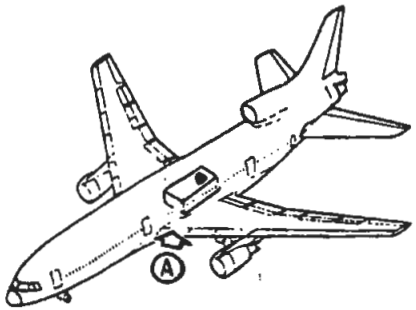
CR (4) DELETED

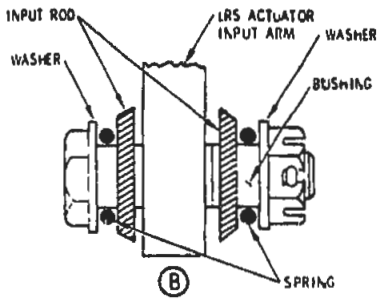
(5) With flap handle in 0° detent, install rig pin R3 in flap aft cable quadrant in the hydraulic service center.

(6) Position LRS actuator input arms against the internal flaps-up stop (input arms pointing to left side of aircraft); adjust input control rods between aft cable quadrant and LRS actuator to minimum backlash and connect to LRS actuator.

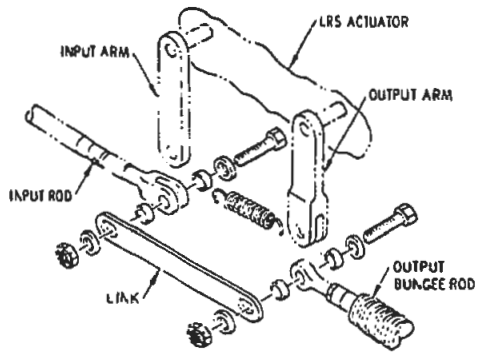
(7) Adjust bungee (output) control rods to zero backlash and connect to PDU.

CR CR CR NOTE: Verify that anti-backlash springs and link are installed on bushings between LRS actuator input and output arms (Ref. Fig. 401).

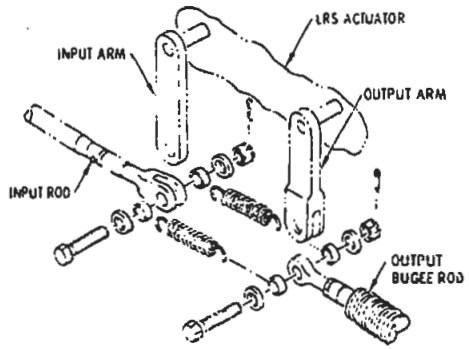




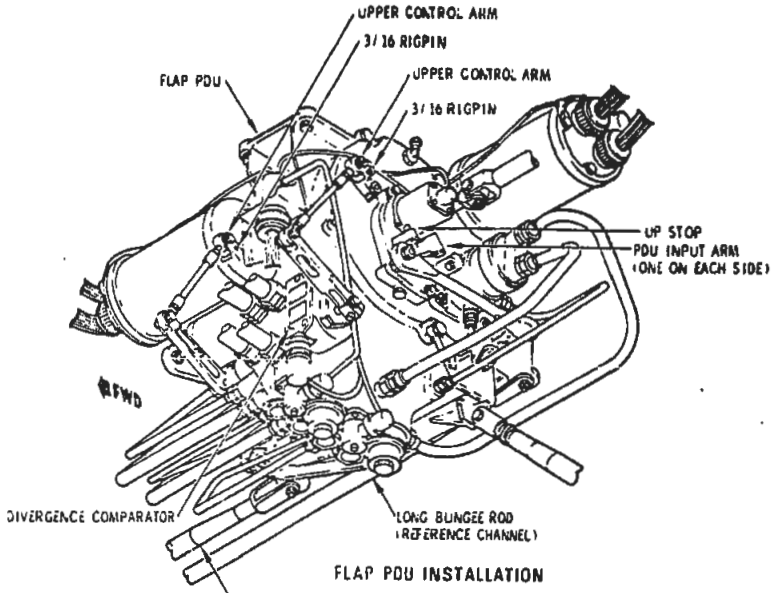
TYPICAL SPRING ATTACHMENT



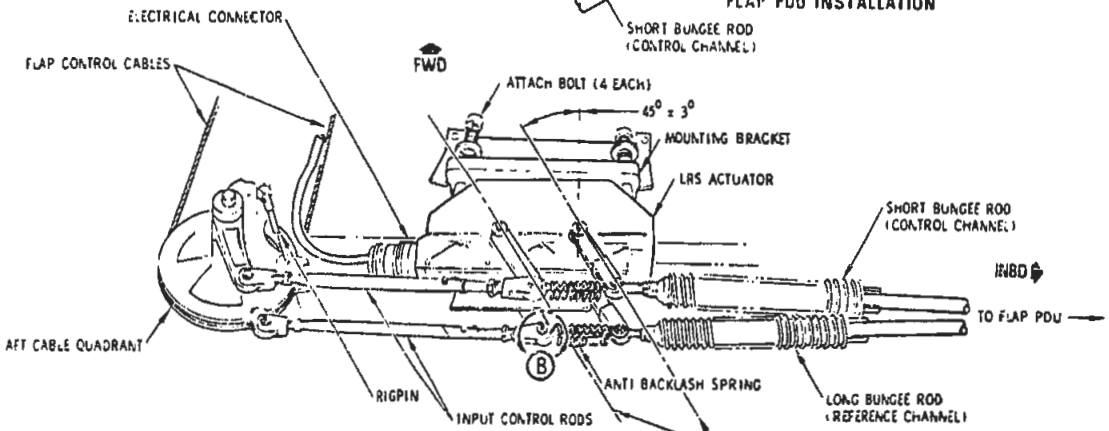
FWD LRS ACTUATOR ARM ATTACHING HARDWARE



AFT LRS ACTUATOR ARM ATTACHING HARDWARE



FLAP PDU INSTALLATION



LRS ACTUATOR INSTALLATION

A

VIEW LOOKING UP AND AFT

M1-0000-27-1242

CR Flap Load Relieving System Actuator - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

001B

(8) Remove rig pins from PDU upper control arms (or remove lock-wire holding input arms to up-stops) and recheck for backlash. If backlash exists, reinstall rig pins in PDU upper control arms (or lock-wire input arms against up-stops) and readjust bungees to remove the backlash. Then remove rig pins from upper control arms (or lock-wire from input arms) and recheck backlash.

NOTE: The bungees are in correct adjustment when no backlash exists in either input linkage with only the rig pin in aft cable quadrant installed. A small amount of backlash can be tolerated in the long bungee reference channel; no backlash is acceptable in the short bungee control channel. Bungee preload in either channel must not exceed 1/2 turn.

(9) Remove rig pins from aft cable quadrant and PDU (if installed).

(10) Remove tags from hydraulic panels.

WARNING: VERIFY THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS.

(11) Operate flaps to fully extended position (Ref. 27-51-00).

CR (12) DELETED

CR (13) DELETED

CR (14) DELETED

(15) Return flap control handle to 0-degree position; verify that flaps move to retracted position.

(16) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(17) Turn off electrical power if no longer required (Ref. 24-41-00).

FLAP POWER DRIVE UNIT - REMOVAL AND INSTALLATION

1. General

Procedures are provided for removal and installation of the power drive unit (Para. 4) and for resetting the divergence comparator (Para. 5).

R R The following is a list of flap PDU Line Replaceable Units (LRU's):

R Solenoid shutoff Valve, 27-51-10

R PDU Brake, 27-51-11

R PDU Switchbox, 27-51-12

R PDU Hydraulic Motor, 27-51-14

R PDU Filter, 27-51-15

R PDU Divergence Comparator, 27-51-58

R PDU Relief Valve, 27-51-63

R PDU Start-up Switch, 27-51-64

2. Equipment and Materials

Portable Hoist, P/N 672523, or equivalent

Power Drive Unit Adapter, P/N B-898, or equivalent

Power Drive Unit Transfer Rail, P/N BA48, or equivalent

Power Drive Unit Lift Jack Set, P/N BA47, or equivalent

Ratchet or Speed Handle, 1/2-inch drive

Lubricant, MIL-G-21164, Molybdenum Disulfide Grease, or equivalent

Containers for catching oil spillage (two 1 gallon)

Protective Caps

Rig pin, 5/16-inch diameter, 3 inches long (R3), or equivalent

Rig pins (2 each), 3/16-inch diameter, Curtiss-Wright ST 7138-187, or equivalent

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
	12-23-20	Flap, Vane, and Spoiler Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-51-00	Flap Control System - Adjustment and Test
R R	27-51-12	Flap P.D.U. Limit Switch Switchbox - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

NOTE: The flaps must be in the retract rig position before connecting the flap torque shafts to the PDU. However, if the flap system is inoperative or it is inconvenient to retract the flaps, the flap PDU can be removed with the flaps in any position. If the flap PDU will be removed with flaps extended, ignore Steps (1) through (4).

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic systems A and C (Ref. 29-11-00).

(3) Operate wing flaps to the fully retracted rig position.

NOTE: Flap PDU is in the fully retracted rig position when flap PDU brake indicator rod is flush with hex head on brake, indicating that brake has actuated (Ref. Fig. 401).

(4) Shut down hydraulic systems A and C. Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(5) Open and tag the following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: NO. 2 ASYM BK LE SLAT (J10), NO. 2 ASYM BK TE FLAP (J11), LOCK LIGHT TE FLAP (J13).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: NO. 1 ASYM BRAKE TE FLAP (H21), NO. 1 ASYM BRAKE LE SLAT (H22).

(6) To prevent a disconnected flap drive system from moving and becoming misrigged, trip the asymmetry brake on the wing being worked as follows:

(a) Open applicable access door, 571AB-1 (left wing), 671AB-1 (right wing) (Ref. 6-40-00).

(b) Pull brake reset knob outboard to trip.

(7) Open hydraulic service center aft access door, 147BB.

(8) Install 3/16-inch rig pins in both PDU upper control arms (one on each side of PDU) (Ref. Fig. 401) . If rig pin holes are not available, lock-wire input arms (one on each side of PDU) to up-stops. The rig pins (or lock-wire) prevent the divergence comparator from tripping after the PDU input bungee rods are disconnected.

NOTE: On later PDU's, rig pin holes are removed from all flap PDU control arms.

(9) Disconnect five electrical connectors on forward and outboard sides of PDU. Disconnect grounding jumper on aft side of PDU.

(10) Disconnect four rigid hydraulic lines (SYS A and SYS C) on forward side of PDU, and install protective caps on lines and PDU fittings. Use containers to catch any oil spill.

(11) Disconnect seal drain line from each hydraulic motor, and install protective caps on drain lines and motor fittings.

CAUTION: VERIFY THAT RIG PINS ARE INSTALLED IN PDU UPPER CONTROL ARMS (OR INPUT ARMS LOCK-WIRED TO UP-STOP) BEFORE DISCONNECTING BUNGEE RODS TO PREVENT TRIPPING THE DIVERGENCE COMPARATOR IN THE PDU. IF COMPARATOR IS TRIPPED, RESET IN ACCORDANCE WITH PARA. 5.

(12) Disconnect two bungee rods at aft side of PDU.

(13) Disconnect support brace at aft left side of PDU.

WARNING: BEFORE DISCONNECTING THE FLAP P.D.U. DRIVE SHAFT, VERIFY THAT THE FLAPS ARE SUITABLE BLOCKED AGAINST LOWERING OR THAT THE LEFT AND RIGHT DRIVE SHAFTS ARE CLAMPED TO PREVENT ROTATION.

(14) Remove the smaller diameter bolt at the left and right PDU to torque shaft U-joint. Note location of U-joint washers for reinstallation.

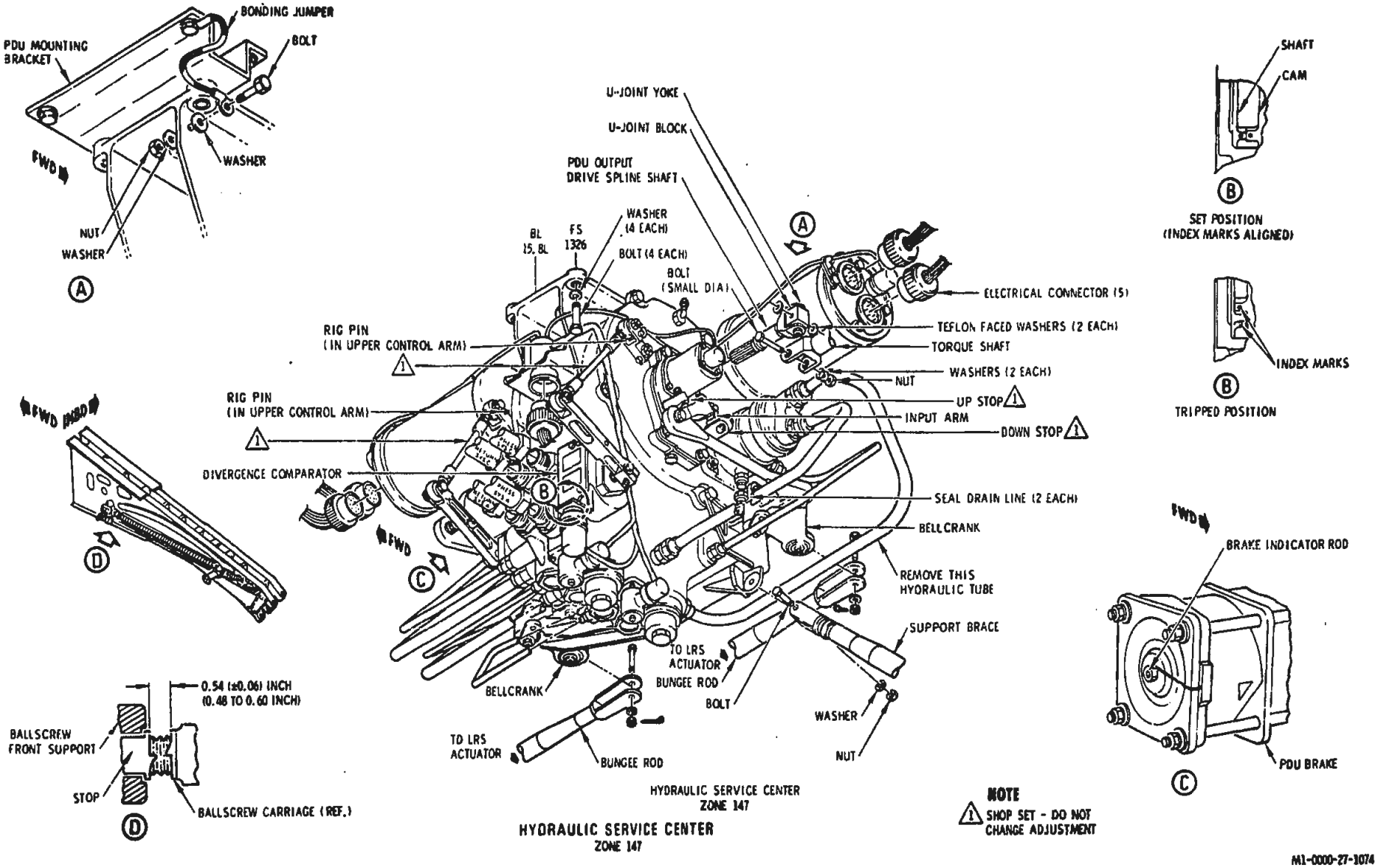
(15) Disengage spline shaft of left and right torque shafts from PDU output drive spline.

(16) Temporarily remove hydraulic tube between valve package and hydraulic motor on left side (Ref. Fig. 401). (This is necessary to permit PDU to be lowered through access door.) Install protective caps on fittings and hydraulic tube.

(17) Remove the electrical connector bracket at the forward top end of PDU to allow installation of lift jack. Position electrical connector and bracket out of way. Remove bonding jumper from aft PDU support bracket.

(18) Install lift jacks (BA47) to floor beams just forward and aft of PDU with four quick release pins (Ref. Fig. 402).

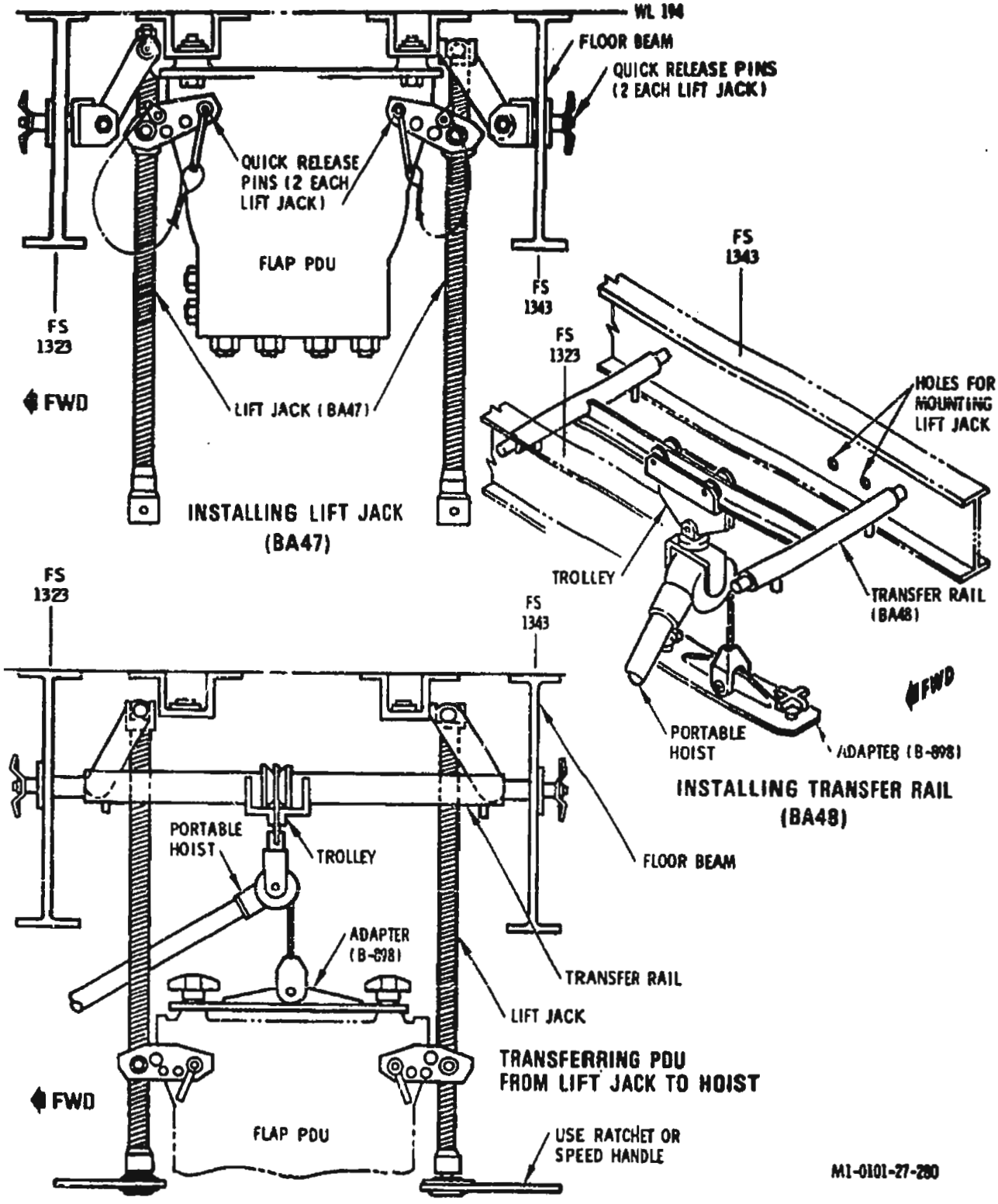
NOTE: Four holes are provided in each floor beam web; two holes are used to attach the lift jack and two are used to attach the transfer rail.



CR Power Drive Unit - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

001B



Flap PDU Removal and Installation - Ground Support Equipment
Figure 402

(19) Attach lift jack to forward and aft ends of PDU with quick release pins.

Two holes are provided in the forward and aft ends of the PDU support bracket.

(20) Remove PDU attachment bolts and washers.

(21) Lower PDU using lift jack.

NOTE: Flap PDU weighs 90 pounds.

(22) Install transfer rail (⊟A48) to floor beam web.

(23) Attach adapter (B-898) to two threaded holes in top of PDU.

(24) Attach portable hoist to transfer rail trolley.

(25) Attach portable hoist to adapter on top of PDU. Take up on cable slack to support PDU with hoist.

(26) Remove four quick release pins attaching lifting jacks to PDU.

(27) Slide PDU and hoist, using transfer rail, over the hydraulic service center aft access door.

(28) Lower PDU to ground using portable hoist.

(29) Remove adapter from PDU.

(30) Replace hydraulic tube on PDU removed in Step 4A(16).

B. Installation

(1) Verify that hydraulic systems A and C are shut off and panels tagged.

(2) Verify that 3/16-inch rig pins are installed in PDU upper control arms (or, if rig pin holes are unavailable, verify that PDU input arms are lock-wired to up-stop). The rig pins (or lock-wire) prevent the divergence comparator from tripping and requiring reset.

(3) Temporarily remove hydraulic tube between valve package and hydraulic motor on left side (Ref. Fig. 401). Install protective caps on tube and motor fittings.

(4) Verify that electrical connector bracket at the forward top end of PDU is removed to allow installation of lift jack.

(5) Install PDU adapter (B-898) to top of PDU.

(6) Check that power drive unit transfer rail, portable hoist, and power drive unit lift jack set are installed in hydraulic service center.

NOTE: The PDU weighs 90 pounds.

(7) Connect portable hoist to adapter on top of PDU.

(8) Raise PDU into hydraulic service center using portable hoist. Slide PDU and hoist, using transfer rail, to position PDU under PDU mounting brackets.

(9) Raise PDU with hoist so that the lifting jacks can be connected to support bracket on PDU with four quick release pins.

(10) Disconnect portable hoist from adapter on PDU.

(11) Remove adapter from PDU.

(12) Remove portable hoist from trolley.

(13) Remove transfer rail from floor beams.

(14) Raise PDU into the installed position using lift jacks.

(15) Install PDU mounting bolts and washers.

(16) Disconnect lift jacks from PDU.

(17) Remove lift jacks from floor beams.

(18) Install bonding jumper to PDU frame.

(19) Replace hydraulic tube between valve package and hydraulic motor removed in Step 4B(3).

(20) Connect support brace at aft side of PDU.

(21) Install electrical connector bracket to front of PDU removed in Step 4B(4).

(22) On aircraft 001-031 without SB27-118, connect two bungee rods at aft side of PDU as follows:

(a) Install rig pin (R3) in flap aft cable quadrant.

(b) Turn on electrical power (Ref. 24-41-00).

(c) Verify that FLAP LOAD RELIEF circuit breakers (CB2-H12, 13, and 20) are closed.

(d) Reset flap LRS by operating BITE switch on LRS computer in forward electronic service center to RESET for five seconds, then to RUN. (LRS computer is located on the center rack, forward end of shelf 1.)

NOTE: LRS computer may be identified on rack decal as LOAD LIMITER COMPUTER.

Resetting LRS computer positions LRS actuator arms to in-phase (non-relieved) position.

(e) Adjust bungee rods to zero backlash and connect to PDU.

C
C
C CAUTION: DO NOT ADJUST ANY RODS OR STOPS ON THE PDU. INPUT ARM STOPS, DIVERGENT ARMS AND RODS ARE SHOP SET.

(f) Remove rig pins from PDU upper control arms (or remove lock-wire holding input arms against up-stops) and recheck for backlash. If backlash exists, reinstall rig pins in PDU upper control arms (or lock-wire input arms) to up-stops and readjust bungees to remove backlash. Then remove rig pins from upper control arms (or lock-wire from input arms) and recheck backlash.

NOTE: The bungees are in correct adjustment when no backlash exists in either input linkage with only the rig pin in the aft cable quadrant installed. A small amount of backlash can be tolerated in the long bungee reference channel; no backlash is acceptable in the short bungee control channel. Bungee preload in either channel must not exceed 1/2 turn.

(g) Safety bungee rods.

(22) On aircraft 001-031 with SB27-118 and 032-999, install two bungee rods at aft side of PDU as follows:

(a) Insert rig pin (R3) through flap aft cable quadrant and its support bracket.

(b) Verify that rig pin (R6) can be freely inserted through idler bracket and both idler bellcranks. If not, adjust pushrods between aft cable quadrant and idler bellcranks.

(c) Remove rig pin from idler bellcranks. Leave rig pin in aft cable quadrant.

(d) Verify that the two input control arms on the PDU are against the fixed external UP stops (forward stops). Verify that there is no backlash in either control system by trying to lightly push the arms away from the stops. If control arms are not against the stops or backlash is excessive, accomplish following:

NOTE: A very small amount of backlash can be tolerated in the long bungee rod (reference channel); no backlash is acceptable in the short bungee rod (control channel).

• Install two 3/16-inch rig pins in PDU upper control arms to prevent actuation of the divergence comparator switches when the flap PDU input bungee rods are disconnected.

NOTE: On later PDUs, rig pin holes have been eliminated. On these PDUs, lock-wire input arms against up-stops.

• Disconnect the affected bungee rod from the idler bellcrank and adjust bungee rod to meet requirements of Step (d) and connect to idler bellcrank.

• Remove rig pins from PDU upper control arms (or remove lock-wire holding input against up-stops) and recheck for backlash. If backlash exists, reinstall rig pins in PDU upper control arms (or lock-wire input arms against up-stops) and readjust bungees to remove the backlash.

NOTE: The bungees are in correct adjustment when no backlash exists in either input linkage with the rig pins or lock-wire removed from PDU input arms. A small amount of backlash can be tolerated in the long bungee reference channel; no backlash is acceptable in the short bungee control channel. Bungee preload in either channel

must not exceed 1/2 turn.

• Safety bungee rods.

• Remove rig pins from PDU upper control arms (or remove lock-wire).

• Remove rig pin from the aft cable quadrant.

(23) Remove protective caps and connect seal drain line to each hydraulic motor.

(24) Remove protective caps and connect four rigid hydraulic lines (SYS A and SYS C) on forward side of PDU.

(25) Connect five electrical connectors at forward and outboard sides of PDU.

C (a) Safety wire connectors.

(26) Check that PDU has been serviced with oil (Ref. 12-23-20).

(27) Remove the R3 rig pin from flap aft cable quadrant and two rig pins (if installed) from the PDU. Remove lock-wire holding PDU input arms to up-stops, if installed.

(28) Remove tags from hydraulic panels.

(29) Remove tags and close circuit breakers opened in Step A(5).

(30) Turn on electrical power (Ref. 24-41-00).

(31) Turn on hydraulic systems A and C (Ref. 29-11-00).

(32) Bleed flap hydraulic systems by operating flap handle from zero to full flaps. Cycle flap PDU until PDU operation is smooth.

NOTE: After bleeding hydraulic system, accomplish AIR BLEED check on the reservoir service instruction placard (Ref. 12-13-01).

(33) Check PDU for hydraulic leaks.

(34) Position flap handle to the 0-degree detent (full retract).

CR (34A) Verify brake indicator pin in center of PDU brake is
CR retracted (Ref. Fig. 401, Detail C).

C (35) Measure and record the upstop gap for all trailing edge
C flap upstops.

C (a) Adjust the clearance on all jackscrew stops within
C 0.120 inches of each other.

C (b) Disconnect torque tubes at the PDU and pull
C circuit breakers CB 2-H21 and CB 1-J11.

C (c) Rotate torque tubes to contact jackscrew upstops.
C Back off torque tubes so that 1/4 to 1/2 turn
C clearance exists at jackscrew stops that were
C contacting.

C (36) Connect torque tubes to PDU as follows:

C (a) Coat the U-joint bolt and the mating surfaces of
C the U-joint with grease (MIL-G-23827).

C (b) Engage spline shaft to left and right PDU output
C drive splines. Engage splines so that U-joints
C can be coupled with minimum torque shaft rotation.

C NOTE: Special teflon-faced washers are installed
C between the U-joint yoke and block. When
C assembling U-joint, verify that teflon face
C is against block.

C (c) Install U-joint connecting bolt, washers, and nut.
C Install cotter pin.

C (d) Close CB's CB 2-H21 and CB 1-J11 and extend flaps
C to 4 degrees.

CR (e) Retract flaps to 0 degrees.

CR (f) Pull CB 1-J11 and CB 2-H21 circuit breakers one at
CR a time. Check that torque tubes at the PDU rotate
C 1 to 4 turns. If out of limits, adjust electric
CR shut off switch in affected PDU switch can.

C (g) When the rotational difference of the torque tube
C shaft is within the 1 to 4 turns, check that all
C jackscrews upstops have clearance i.e., are not
C contacting (1/4 to 1/2 turn off upstops) at the
C hydraulic shutoff point.

C (h) Close circuit breakers CB 1-J11 and CB 2-H21 and
C extend flaps to 4 degrees.

C (37) Retract flaps to 0 degrees and check T.E. flap miss
C match and fair with torque box is within limits.
C (Reference 27-51-00, Figure 503)

(38) If the retracted rig position of the flaps is suspect, accomplish the following steps to position the flaps to the retract rig position before connecting the flap drive torque shafts to the PDU:

(a) Reset asymmetry brakes by pushing reset knobs inboard.

(b) In the left and right main wheel wells, manually rotate both the left and right flap torque shafts to position the left and right No. 1 flaps in the retract rig position.

NOTE: Use a rope wrapped several times around the torque shaft or a strap wrench to rotate flap torque shafts.

(c) Rotate the torque shafts until both ball screw actuators on the left and right No. 1 flaps are positioned so that there is 0.54 (±0.06) inch clearance (0.48 to 0.60 inch) between the flat on forward face of ballscrew carriage and flat on the aft face of the ballscrew front support (Ref. Fig. 401, View D).

(d) With flaps and flap PDU at retract rig position, connect torque shafts to PDU as follows:

• Coat the U-joint bolt and the mating surfaces of the U-joint with grease (MIL-G-21164).

• Engage spline shaft to left and right PDU output drive splines. Engage splines so that U-joints can be coupled with minimum torque shaft rotation.

NOTE: Special teflon-faced washers are installed between the U-joint yoke and block. When assembling U-joint, verify that teflon face is against block.

• Install U-joint connecting bolt, washers, and nut. Install cotter pin.

(39) Reset asymmetry brakes by pushing reset knobs inboard if not previously reset.

(40) Turn on hydraulic systems A and C.

WARNING: VERIFY THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS.

IF FLAP DRIVE SHAFTS WERE CLAMPED OR LOCKED TO PREVENT ROTATION, VERIFY THAT DRIVE SHAFT CLAMPS OR RESTRAINTS ARE REMOVED.

NOTE: Operating flags and slats with electric pumps can cause "jerky' operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic systems using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources, each capable of 25 gpm at 3000 psi, may be used to pressurize the A and C hydraulic systems.

(41) Position flaps to full down through each detent position. Verify that flap operation is normal. Verify that flaps position to each selected position (flap position indicator tapes should be within range marks limits of each detent position).

(42) Position flaps to full up through each detent position. Verify that flap operation is normal. Verify that flaps position to each selected position (flap position indicator tapes should be within 0-degree range mark limits of each detent position).

CR NOTE: If the following checks are not successful, do not adjust or replace switch cans until all wiring and other components have been verified.

CR (43) Cycle flaps from zero to full flaps and back to zero to exercise flaps PDU switchbox. After flaps fully retract position speedbrake handle full aft to MAX and verify following:

CR (a) No. 1 spoilers on both wings stay down; spoilers 2 through 6 on both wings extend approximately 60 degrees. This checks that switch No. 14 in the switchbox No. 1 and switch No. 13 in switchbox No. 2 are in the flaps-up mode.

CR (b) The ROLL SPEED BRAKE light on the pilots annunicator panel and the SPOILER L5&6 and R5&6 PUSH lights on the PFCS panel are off. This checks that switch No. 14 in switchbox No. 2 is in the flaps-up mode.

CR NOTE: Switch No. 13 in switchbox No. 1 is a
CR spare.

CR (44) Position speedbrake handle full forward to 0 degrees.
CR All spoilers must be full down.

CR (45) Position flaps to 4 degrees.

CR (46) Position speedbrake handle full aft to MAX; and verify
CR following:

CR (a) Spoilers 1 through 4 on both wings extend;
CR spoilers 5 and 6 on both wings stay down. This
CR checks that switch No. 14 in switchbox No. 1 and
CR switch No. 13 in switchbox No. 2 are in the
CR flaps-down mode (flaps extended more than 2.5
CR degrees).

CR (b) The ROLL SPEED BRAKE light on the Pilots
CR annunciator panel and the SPOILER L5&6 and R5&6
CR PUSH lights on the PFCS panel are off. This
CR checks that switch No. 14 in switchbox No. 2 is in
CR the flaps-down mode.

CR (47) Position speedbrake handle full forward to 0 degrees.
CR All spoilers must be full down.

CR (48) Position flap handle to zero degrees. When flaps fully
CR retract, verify that flap PDU brake has applied (brake
CR indicator pin is flush with hex head).

R (49) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

R (50) Turn off electrical power if no longer required (Ref.
R 24-41-00).

R (51) Install access door under asymmetry brakes.

5. Resetting Divergence Comparator

C A. Precautions When Resetting A Flap Drive Comparator

C (1) Control input levers are wired in place when shipped
C and should not be moved individually. If a lever is
C moved during installation or maintenance, the
C divergence comparator will trip and must be reset very
C carefully as follows:

C (2) Remove Comparator Cover.

C (3) Carefully move cam away from black plastic "tanged
C cup". In moving cam, DO NOT pry on the black plastic
C cup.

C (4) Rotate control input lever to align tang marks. DO NOT
C force the arms, as this will sheer the rivets which
CR attach the plastic tanged cup to the comparator shaft.

C (5) Replace cover.

B. Procedure

(1) Verify that hydraulic systems A and C are shut off (Ref. 29-11-00).

(2) Install warning tags on the Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

(3) On the power drive unit (PDU) remove comparator cover (Ref. Fig. 401).

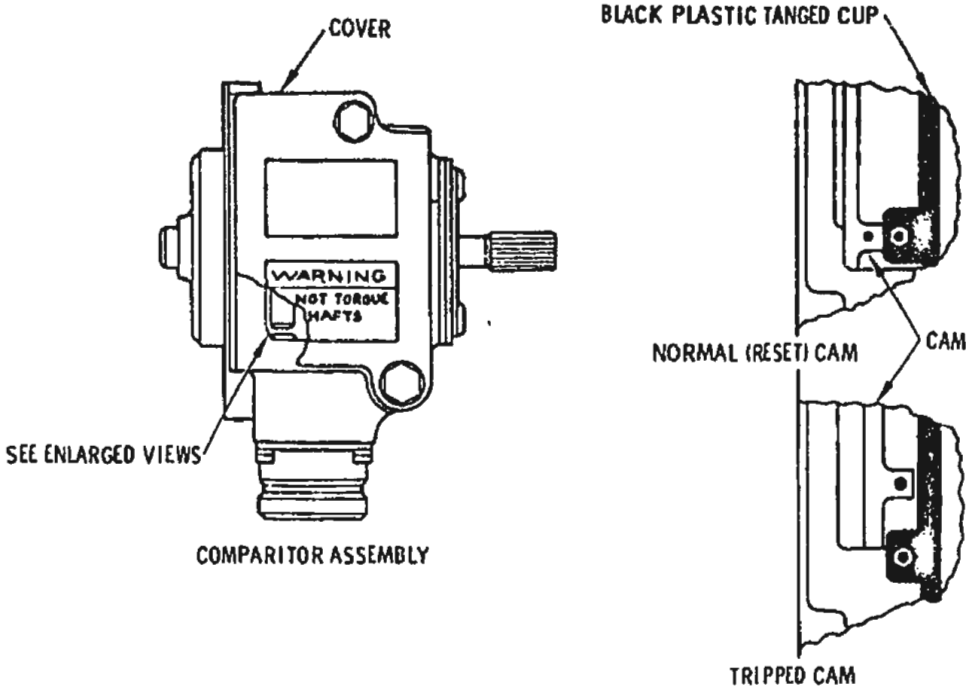
(4) Using a small screwdriver (or finger if possible), move the cam away from the shaft, then with approximately four pound-inches clockwise torque, rotate the shaft sufficiently to align the index mark on the shaft lug with the index mark on the cam lug.

(5) Replace comparator cover.

(6) Remove warning tags from hydraulic panels.

(7) Operate flaps through a full extend to retract cycle. Verify that flap operation is normal.

(8) Perform Switchbox Operational Check (Ref. 27-51-12).



M1-0000-27-1180

C
C Flap Drive Comparator
Figure 403

R EFFECTIVITY: ALL
R
001B

FLAP PDU SOLENOID SHUTOFF VALVE - REMOVAL AND INSTALLATION

R 1. General

R The solenoid shutoff valve can be replaced as an assembly, or
R the solenoid coil can be replaced separately without disturbing
R the hydraulic portion of the shutoff valve. Replace the coil
R only if the valve malfunction appears to be an electrical
R problem.

R 2. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Container, 1 gallon (to catch spilled hydraulic fluid)

R 3. Referenced Procedures

12-13-01	Hydraulic Bootstrap Reservoir - Servicing
24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-12	Flap PDU Switchbox - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

R 4. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Preparation

(1) Verify that the following circuit breakers are opened and tagged:

(a) On the pilots overhead circuit breaker panel CB1, zone 210: NO. 2 ASYM BK - TE FLAP (J11).

(b) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: NO. 1 ASYM BRAKE - TE FLAP (H21).

(2) Open access door 14AB or 147BB to gain access to hydraulic service center.

(3) Locate solenoid shutoff valve on bottom of flap PDU (Ref. Fig. 401).

R B. Removal of Solenoid Shutoff Valve

R (1) Disconnect electrical connector to the solenoid shutoff valve.

R (2) Remove four screws securing solenoid shutoff valve to the hydraulic manifold. Remove solenoid shutoff valve. (Use container to catch oil spill.)

R C. Installation of Solenoid Shutoff Valve

(1) Inspect hydraulic manifold cavity and seal area of replacement solenoid shutoff valve for cleanness.

(2) Verify that O-ring seals and backup rings are installed on the solenoid shutoff valve (Ref. Fig. 401).

(3) Coat O-ring seals with hydraulic fluid. Install shutoff valve on hydraulic manifold. Install and tighten attach screws. Lock-wire screws.

(4) Connect electrical connector to shutoff valve and lock-wire.

R D. Removal of Solenoid Coil Assembly

R (1) Remove lock-wire and remove screw on top of shutoff
R valve assembly (Ref. Fig. 401).

R (2) Disassemble coil from valve assembly as follows:

R (a) Remove stepped washer, washer, and spacer.

R (b) Pull coil assembly to disengage electrical
R connector from servo and remove coil assembly from
R valve housing.

R E. Installation of Solenoid Coil Assembly

R (1) Verify that a spacer is installed on valve housing
R (Ref. Fig. 401).

R (2) Verify that electrical connectors on servo and shutoff
R valve are not contaminated with hydraulic oil. If they
R are, wash out with approved solvent.

R (3) Slide coil assembly on valve housing while positioning
R coil assembly electrical connector through hole in
R valve flange. Verify that electrical connectors are
R properly engaged.

R (4) Install spacer, washer, and stepped washer on valve
R housing.

R (5) Install screw through stepped washer and into end of
R valve housing. Tighten screw and lockwire.

R (6) Check solenoid valve operation per Paragraph F.

R F. Checkout of Solenoid Shutoff Valve Assembly

R (1) Remove tags and close circuit breakers opened in Step
R A(1).

R (2) Remove tags from hydraulic control panels.

R (3) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (4) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic systems using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

R (5) Bleed flap PDU by cycling flaps from full down to full
R up.

R (6) Turn off one hydraulic system. Leave on only the hydraulic system supplying replaced shutoff valve.

R (7) Position flaps to full extend. Verify that flap
R operation is normal.

R (8) Position flaps to full retract. When flaps fully retract, verify that the flap PDU brake has actuated to indicate that solenoid shutoff valve has actuated. (Brake actuation is verified by noting that brake indicator rod has retracted, flush with brake housing.)

NOTE: Flap retract position is controlled by electrical stop (actuation of solenoid shutoff valve). If solenoid shutoff valve does not actuate, problem can be caused by mis-rigging of flap PDU switchbox (Ref. 27-51-12).

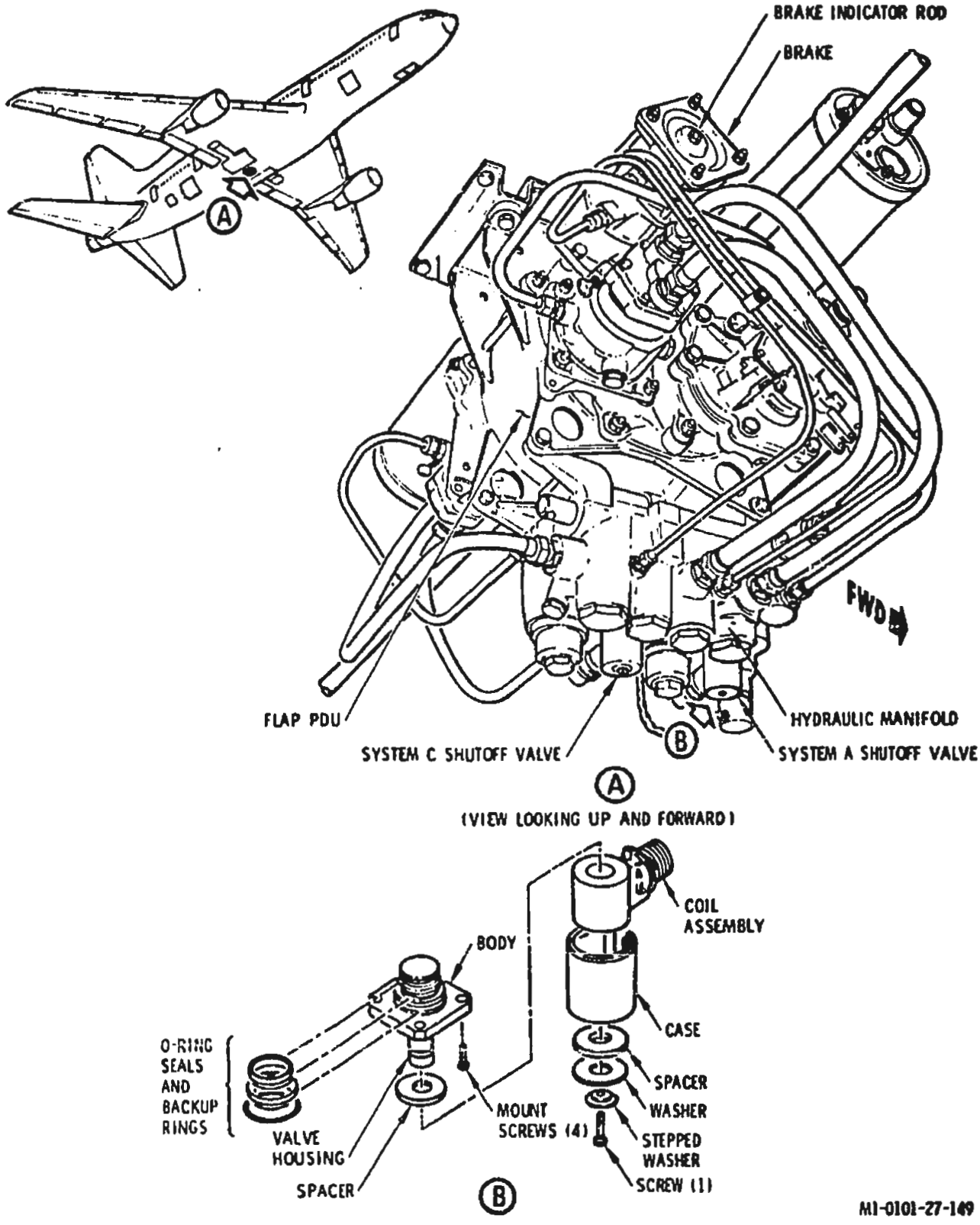
R (9) If shutoff valve was replaced, check shutoff valve for
R hydraulic leakage.

R (10) After bleeding any part of control system, service affected hydraulic system reservoir (Ref. 12-13-01).

R (11) Close access door.

R (12) Turn off hydraulic power (Ref. 29-11-00).

R (13) Turn off electrical power (Ref. 24-41-00).



R Flap PDU Solenoid Shutoff Valve - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

FLAP PDU BRAKE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Container, 1 gallon

Preformed Packing, PN 177718-042, or equivalent

Protective caps

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-51-00	Trailing Edge Flap System - Adjustment and Test
	29-11-00	Hydraulic Power System Maintenance Practices

3. Removal/Installation

A. Removal

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic systems A and C (Ref. 29-11-00).

(3) Fully extend flaps (Ref. 27-51-00).

(4) Turn off hydraulic systems A and C (Ref. 29-11-00).

(5) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

R (6) Trip both asymmetry brakes as follows:

R (a) Open access doors 571 AB-1 and 671 AB-1 (Ref.
R 6-40-00).

R (b) Pull brake reset knobs outboard to trip.

R (7) Disconnect hydraulic lines from brake; use container to catch drained fluid. Install protective caps on hydraulic fittings.

R (8) Remove bolt that attaches brake to flange on gearbox
R housing.

R (9) Remove bolts which secure brake to gearbox housing.

R (10) Remove brake; remove and discard packing.

B. Installation

(1) Install new packing and brake on gearbox assembly. Torque bolts 50 to 70 lb in. and lock-wire.

NOTE: Wet preformed packing with hydraulic fluid before installation.

(2) Connect hydraulic lines to brake. Torque B-nuts 120 to 168 lb in.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Remove warning tags [Ref. Para. 3A(5)] and turn on hydraulic systems A and C (Ref. 29-11-00).

CAUTION: WHEN BLEEDING HYDRAULIC BRAKE, PLACE CLOTH OVER BLEED PORTS TO PREVENT FLUID FROM SPRAYING AREA.

(4) Loosen the hydraulic brake bleed plugs slightly until clear fluid flows from bleed ports. Torque bleeder plugs 10 to 15 lb in.

(5) Verify that indicator rod at end of brake protrudes from bushing.

(6) Retract flaps (Ref. 27-51-00).

R (7) Reset both asymmetry brakes by pushing in reset knobs.
R Close asymmetry brake access panels.

R (8) With flaps fully retracted, verify that indicator rod
R at end of brake has returned flush or below face of
R bushing.

R (9) Service hydraulic systems A and C bootstrap reservoirs
R (Ref. 12-13-01).

R (10) Turn off hydraulic systems A and C (Ref. 29-11-00).

R (11) Turn off electrical power (Ref. 24-41-00).

FLAP PDU LIMIT SWITCH SWITCHBOX - REMOVAL AND INSTALLATION

1. General

The flap power drive unit (PDU) drives two switchboxes. Each switchbox is coupled to the PDU through a reducer to gear down the rpm of the PDU to the low rpm requirement of the switchbox. This procedure covers the removal and installation of the switchbox and the reducer coupling.

CAUTION: DO NOT REMOVE THE REDUCER COUPLING UNLESS THE SWITCHBOX TIMING MUST BE CHANGED OR THE REDUCER COUPLING IS FAULTY.

CR A. An MO activates the 18 unit position for take-off flaps on the two Five Star aircraft only. The activation is accomplished by:

CR (1) Removing a filler plate at the 18 unit position of the flap handle detent plate;

CR (2) Modifying the LH (No. 2) flap PDU switch can to extend the take-off warning range to beyond 18 units of flaps; and,

CR (3) Installing light plates with "18" illuminated. The aircraft will be returned to the standard configuration when leased to TWA.

CR B. A separate stock number, 37916, has been set up for the A01403-3 switch can.

CR NOTE: With a regular switch can, a T. O. warning will occur at 18 units of take-off flaps.

CR If a flap PDU stock number 10504 is changed, the LH (No. 2) flap switch can should be transferred to the new drive.

CR NOTE: Separate stock numbers are not planned for the light plates.

2. Equipment and Materials

Preformed O-ring packing, Curtiss-Wright PN 177717-032, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

3. Referenced Procedures

22-15-00	Yaw Stability Augmentation System - Adjustment and Test.
24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-00	Trailing Edge Flap Control System - Fault Isolation
27-51-00	Trailing Edge Flap Control System - Adjustment and Test
27-51-08	Flap Power Drive Unit - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Flaps-Up Electrical Shutoff Check

NOTE: The flaps-up electrical shutoff should be checked prior to switchbox removal. Accomplish check as follows:

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes. Pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of

25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(3) Gain access to hydraulic service center. Operate flaps to 4 degrees and then to full up.

NOTE: Observe flap PDU output shafts as flaps retract; the output shafts must stop abruptly and the PDU brake indicator pin on the brake must pull in flush with hex head on brake (brake applied), indicating electrical shutoff of the flap PDU. Electrical shutoff of the flap PDU should stop the flap system so that there is some clearance at all flap ballscrew retract stops.

(4) If PDU shutoff is not as described above, correct condition before replacing switchbox or the reducer coupling.

(5) If PDU output shafts creep to a stop but brake pin does not pull in (brakes do not apply), check following:

(a) Check flap PDU input rigging by pushing both PDU input arms against the up-stops. If output shafts creep further up and brake indicator pin pulls in, rerig flap PDU input (Ref. 27-51-00, 501).

CAUTION: IF COMPARATOR TRIPS (INPUT ARMS DO NOT SYNCHRONIZE), DO NOT MOVE INPUT ARMS WITHOUT FIRST RESETTING COMPARATOR OR INTERNAL DAMAGE MAY RESULT (REF. 27-51-08).

(b) Check for 28V dc power to the PDU start-up switches, flaps-up limit switch, and the solenoid shutoff valve and correct as necessary (Ref. 27-51-00, 501).

(c) If PDU output shafts continue at speed, or only start to slow down, then stop abruptly but the brake indicator pin does not pull in, the flap ballscrew(s) may be contacting their associated retract stop before the flaps-up limit switch is actuated.

(d) Check all flap ballscrews for some clearance at the retract stop. Rerig as necessary (Ref. 27-51-00, 501).

NOTE: The condition of ballscrew contacting the retract stop can be confirmed and the offending side located by disconnecting the

PDU output shafts one at a time and repressurizing the hydraulic systems. With both PDU shafts disconnected, the PDU brake indicator pin must pull in.

B. Removal of Switchbox

(1) If not previously accomplished, operate flaps to the normal full-up (electrical shutoff) position.

(2) Turn off hydraulic systems A and C (Ref. 29-11-00).

(3) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

(4) Verify that the following circuit breakers are opened and tagged:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

AUTO THROTTLE SERVO (A1)

SPEED CONT (A20)

FCES L AC&AOA (B5)

SPOILER DWELL DC (B7)

NO. 2 ASYM BK TE FLAP (J11)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

R AOA (F1)

T/O AURAL WRN (H7)

FLAP LOAD RELIEF CHAN 1 (H12)

FLAP LOAD RELIEF CHAN 2 (H20)

NO. 1 ASYM BRAKE TE FLAP (H21)

(c) On Flight Engineer/Second Officers overhead circuit breaker panel CB3, zone 215:

IND LT PFCS ADS/DH (G8)

(5) Gain access to hydraulic service center.

(6) Remove electrical connectors from end of switchbox (Ref. Fig. 401).

(7) Remove electrical harness clamp from switchbox.

CAUTION: DO NOT LOOSEN OR REMOVE THE REDUCER COUPLING RETAINING HEX SCREW ON THE PDU SWITCHBOX MOUNTING PAD. THE HEX SCREW IS LOCATED ON THE FRONT OF THE RIGHT PAD AND THE REAR OF THE LEFT PAD. LOOSENING HEX SCREW WILL ALLOW REDUCER COUPLING TO DISENGAGE FROM GEARBOX AND REQUIRE RETIMING OF REDUCER COUPLING.

(8) Remove nuts and washers which secure switchbox to gearbox and remove switchbox.

NOTE: Switchbox is coupled to reducer coupling with a nylon key and may require some force to separate.

C. Installation Of Switchbox

(1) Verify that the flap PDU is in the normal flaps-up position (electrical shutdown of the flap PDU). (Flat on reducer coupling shaft in gearbox will be in horizontal position, facing up.)

(2) Verify that switchbox is set to flaps-up position as detailed in either of the following procedures 4B(2)(a) or 4B(2)(b):

(a) Looking at drive end of switchbox, rotate switchbox shaft counterclockwise to the internal stop, then clockwise 15 to 30 degrees to position flat on nylon key horizontally, facing down. [Nylon key should be oriented to the word TOP stenciled on the switchbox (Ref. Fig. 401).]

(b) Rotate switchbox shaft until switch No. 1 just closes. (This can be determined by checking for continuity between pin 2 of switchbox receptacle J1 and pins 1 and 3 on receptacle J1. Note that there are internal diodes in circuits of pins 1 and 3 with pin 2 being positive.)With switch No. 1 just closing, flat on nylon key should be horizontal, facing down.

(3) Install lubricated O-ring packing into groove of switchbox. (Lubricate O-ring with oil from gearbox.)

(4) Install switchbox on gearbox and torque nuts 50 to 70 lb. in.

(5) Install electrical connectors. (Verify that electrical connectors are not contaminated with oil. If they are, clean with approved solvent.)

(6) Secure electrical harness clamp to switchbox.

(7) Disconnect small electrical connector on other switchbox (switchbox that was not removed).

(8) Close circuit breakers NO. 1 ASYM BRAKE TE FLAP CB2 (H21) and NO. 2 ASYM BK TE FLAP CB1 (J11).

NOTE: The No. 1 switch on either the left or right switchbox will shut down the flap PDU. Controlling flap shutdown from the switchbox that was replaced will check reducer coupling and switchbox timing on the replaced components.

(9) Close the following circuit breakers:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

AUTO THROTTLE SERVO (A1)

SPEED CONT (A20)

FCES L AC & AOA (B5)

SPOILER DWELL DC (B7)

NO. 2 ASYM BK TE FLAP (J11)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

R AOA (F1)

T/O AURAL WRN (H7)

FLAP LOAD RELIEF CHAN 1 (H12)

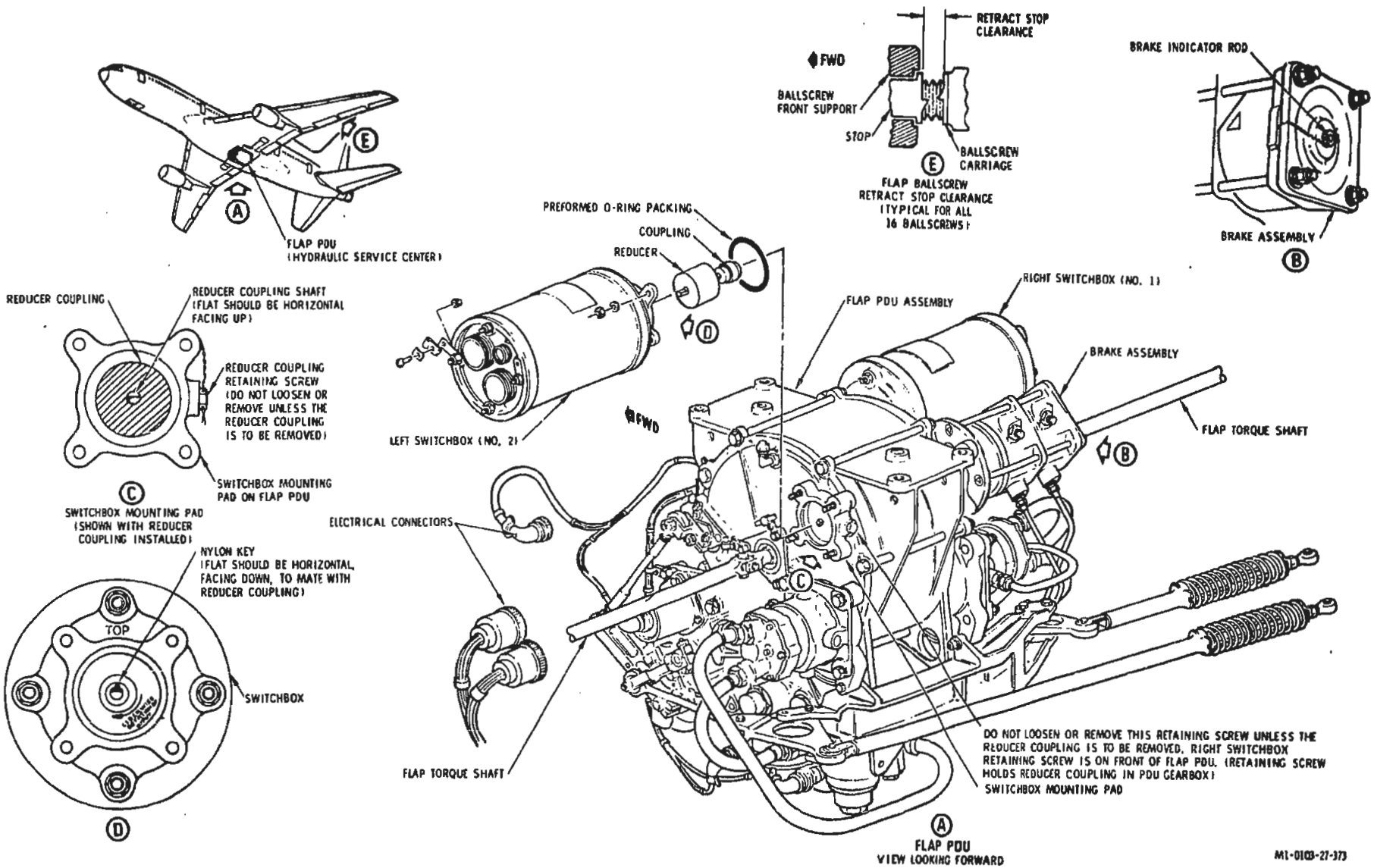
FLAP LOAD RELIEF CHAN 2 (H20)

NO. 1 ASYM BRAKE TE FLAP (H21)

(c) On Flight Engineer/Second Officers overhead circuit breaker panel CB3, zone 215:

IND LT PFCS ADS/DH (G8)

(10) Turn on electrical power (Ref. 24-41-00).



Flap PDU Switchbox - Removal and Installation
Figure 401

(11) Remove tags from hydraulic control panels and turn on hydraulic systems A and C (Ref. 29-11-00).

(12) Position flap handle to 4-degree detent. After flaps reach 4 degrees, position flap handle to 0-degree detent and observe PDU operation.

(13) When flaps fully retract, flap drive shaft should stop abruptly and the PDU brake indicator pin on the brake should pull in flush with hex-head on brake indicating electrical shutoff of flap PDU (Ref. Fig. 401).

C (14) Remove small electrical connector on switchbox that was
C removed. (Small electrical connectors on both
C switchboxes now disconnected). The flap torque shafts
C should rotate 1 to 4 turns before the PDU hydraulic
C null is reached (hydraulic shutdown). The up stops
C should be 1/4 to 1/2 turn from contacting.

CR NOTE: Deleted

C (15) If torque shafts rotate more than 4 turns, retime reducer coupling as follows:

C (a) Note how many turns torque shaft exceeds the 4 turn maximum allowable.

(b) Shut off hydraulic power (29-11-00).

(c) Remove switchbox in accordance with Paragraph B.

(d) Carefully remove reducer coupling assembly in accordance with Paragraph D. Rotate reducer input shaft to adjust actuation point of switchbox switches (3-3/4 turns of reducer shaft will change torque shaft rotation one turn). For No. 1 (right) reducer, rotate shaft CW (looking at input
C shaft) if torque shaft rotation exceeds 4 turns.
For No. 2 (left) reducer, rotate shaft CCW if
C torque shaft rotation exceeds 4 turns.

(e) Carefully reinstall reducer coupling in accordance with Paragraph 4E.

(f) Install switchbox and recheck timing of reducer and switchbox in accordance with Paragraph 4C.

(16) Tighten reducer retaining screw and lock-wire.

(17) Install electrical connectors on both switchboxes.

C (a) Safety wire connectors.,

(18) Perform operational check in accordance with Paragraph 4F.

D. Removal Of Reducer Coupling

CAUTION: DO NOT REMOVE REDUCER COUPLING UNLESS ABSOLUTELY NECESSARY. THE REDUCER COUPLING SHOULD ONLY BE REMOVED IF THE SWITCHBOX TIMING MUST BE CHANGED OR THE REDUCER COUPLING IS FAULTY.

(1) Remove switchbox in accordance with Paragraph 4B.

(2) Remove retaining screw that locks the reducer coupling to the PDU housing and remove reducer coupling.

NOTE: The reducer coupling assembly consists of the reducer and the reducer shaft coupling. DO NOT SEPARATE THE COUPLING FROM THE REDUCER.

E. Installation of Reducer Coupling

(1) Verify that the flap PDU is in the normal flaps-up position (electrical shutdown of the flap PDU).

(2) Install the reducer coupling assembly in the PDU by engaging coupling on the PDU square drive shaft. Install reducer coupling so that the flat on the reducer coupling output shaft is horizontal (facing up) and the retaining screw hole in the reducer is aligned with the retaining screw hole in the PDU mounting pad.

CAUTION: CARE SHOULD BE TAKEN TO ALIGN THE HOLE IN THE REDUCER WITH HOLE IN THE PDU BEFORE INSERTING RETAINING SCREW IN PDU TO PREVENT DAMAGE TO THE REDUCER. RETAINING SCREW SHOULD BE THREADED IN AND SEATED BY HAND. USE A WRENCH ONLY FOR FINAL TIGHTENING.

(3) Install the retaining screw with O-ring packing in the PDU so that retaining screw pin engages the hole in the reducer and tighten retaining screw but do not lock-wire at this time.

(4) Install switchbox in accordance with Paragraph 4C.

F. Switchbox Operational Check

(1) Perform following operational checks to verify proper switchbox operation:

NOTE: Switchbox contains up to 16 switch functions plus several potentiometer outputs. To check

all systems receiving switchbox outputs would require an excessive number of hours; however, at least one switch function from each electrical connector is checked to provide confidence that the electrical connectors are properly connected and the switchbox is functioning correctly.

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on all four hydraulic systems (Ref. 29-11-00).

NOTE: Operating flaps and slats with AC pumps cause "jerky" operation and trip the overspeed governor in the asymmetry brakes. To provide normal flap and slat operation, pressurize the B and C hydraulic systems using ATM pumps and the A and D systems using the PTU's. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C systems.

(4) Cycle flaps from zero to full flaps and back to zero to exercise flap PDU switchbox. After flaps fully retract position speedbrake handle full aft to MAX and verify following:

(a) No. 1 spoilers on both wings stay down; spoilers 2 through 6 on both wings extend approximately 60 degrees. This checks that switch No. 14 in switchbox No. 1 and switch No. 13 in switchbox No. 2 are in the flaps-up mode.

(b) The ROLL SPEED BRAKE light on the pilots annunciator panel and the SPOILER L5&6 and R5&6 PUSH lights on the PFCS panel are off. This

checks that switch No. 14 in switchbox No. 2 is in the flaps-up mode.

NOTE: Switch No. 13 in switchbox No. 1 is a spare.

(5) Position speedbrake handle full forward to 0 degrees. All spoilers must be full down.

(6) Position flaps to 4 degrees.

(7) Position speedbrake handle full aft to MAX; and verify following:

(a) Spoilers 1 through 4 on both wings extend; spoilers 5 and 6 on both wings stay down. This checks that switch No. 14 in switchbox No. 1 and switch No. 13 in switchbox No. 2 are in the flaps-down mode (flaps extended more than 2.5 degrees).

(b) The ROLL SPEED BRAKE light on the Pilots annunciator panel and the SPOILER L5&6 and R5&6 PUSH lights on the PFCS panel are off. This checks that switch No. 14 in switchbox No. 2 is in the flaps-down mode.

(8) Position speedbrake handle full forward to 0 degrees. All spoilers must be full down.

(9) Position flap handle to zero degrees. When flaps fully retract, verify that flap PDU brake has applied (brake indicator pin is flush with hex head).

(10) Prepare YAW Stability Augmentation System for operation (Ref. 22-15-00).

(11) Verify that flaps are full up.

(12) On Pilots overhead FCES panel, verify that both YAW SAS switchlights are depressed (latched in) with no FAIL light on.

(13) Rotate either aileron control wheel full left and right then center control wheel. Verify that no YAW SAS FAIL light comes on.

NOTE: Verify that YAW SAS is operating by noting that rudder responds with roll inputs. Use surface position indicator to verify rudder movement.

(14) Position flaps to 4 degrees and verify that no YAW SAS FAIL light is on.

(15) Rotate either aileron control wheel full left and right then center control wheel and verify that no YAW SAS FAIL light comes on.

(16) Position flaps to 33 degrees and verify that no YAW SAS fail light is on.

(17) Rotate either aileron control wheel full left and right then center control wheel and verify that no YAW SAS FAIL light comes on. If no YAW SAS FAIL lights come on during the above tests, switches No. 2, 4, 6, and 7 in switchbox are operating properly.

(a) If no YAW SAS FAIL light comes on at 0 degree flaps but comes on at 4 or 33 degrees flaps, check replaced PDU switchbox electrical connector for tightness (P5 for left switchbox; P6 for right switchbox.

(b) If YAW SAS FAIL light still comes on, perform continuity check of affected switches (Ref. 22-15-00).

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-41-00).

R # FLAP PDU HYDRAULIC MOTOR - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Container - 1 gallon

R Hydraulic fitting protective caps

R 2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
R	20-29-01	Fluid Lines and Fittings Assembly - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Removal/Installation

R A. Removal

R (1) Verify that hydraulic systems A and C are shut off and hydraulic control panels tagged.

R (2) Open access door 147AB or 147BB to gain access to hydraulic service center (Ref. 6-40-00).

R (3) Disconnect the four hydraulic lines to the hydraulic motor (use container to catch fluid). Install protective caps on hydraulic lines and fittings (Ref. Fig. 401).

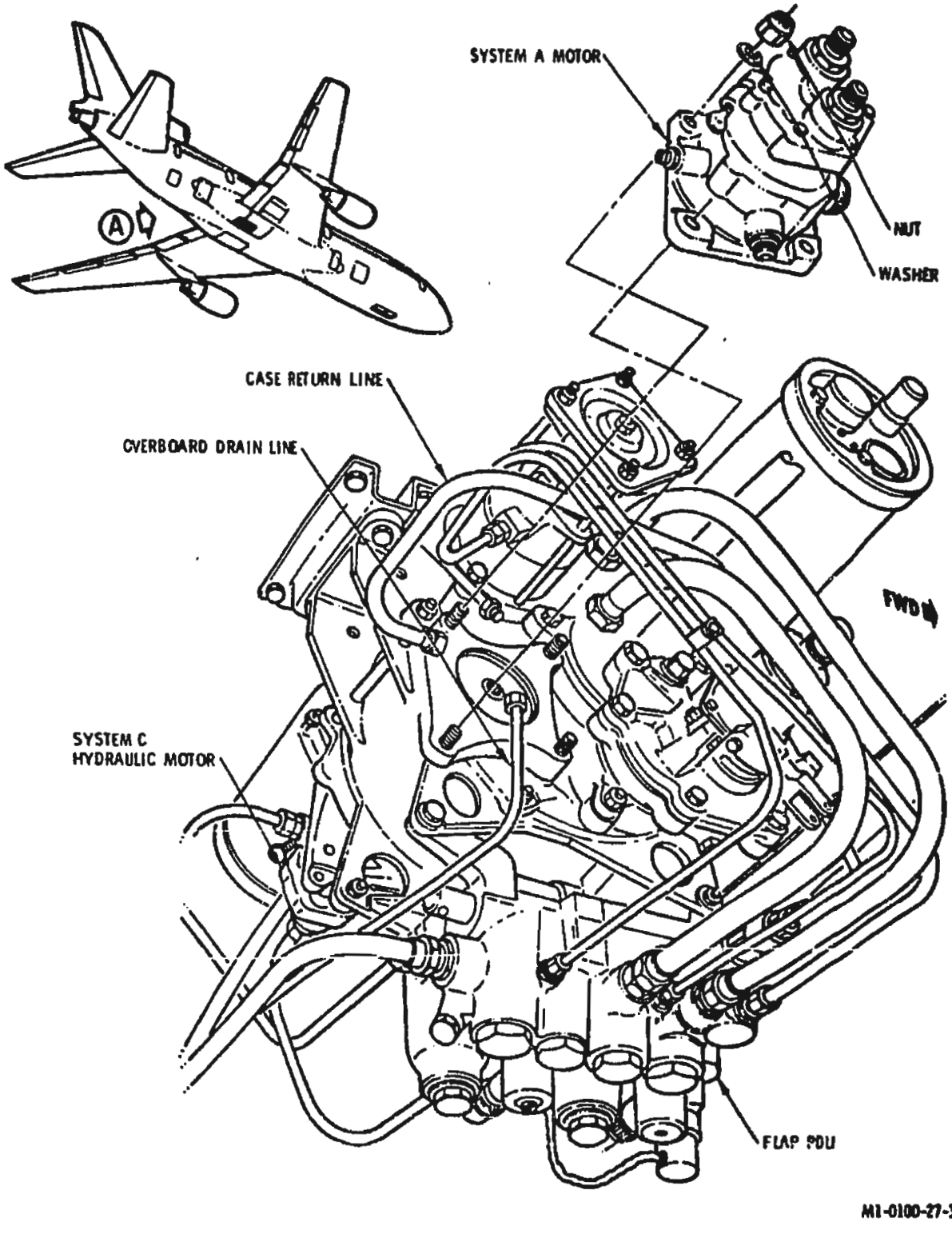
R (4) Remove four nuts holding the hydraulic motor to the PDU. Remove hydraulic motor.

R NOTE: If the two large motor hydraulic lines interfere with motor removal, loosen the other end of the hydraulic lines and line clamps to improve accessibility.

R B. Installation

R (1) Verify that hydraulic systems A and C are shut off.

R (2) Position hydraulic motor with inlet ports in a vertical position and install motor on four studs.



R Flap PDU Hydraulic Motor - Removal and Installation
R Figure 401

R (3) Install four washers and nuts on hydraulic motor attaching studs and tighten.

R (4) Verify that drain line fitting is on aft side of hydraulic motor. If not, transfer plug and fitting so that fitting is on aft side.

R (5) Remove protective caps from fittings and lines and install the four hydraulic lines. Torque hydraulic fittings (Ref. 20-29-01). (Install and tighten hydraulic line clamps if removed.)

R (6) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (7) Turn on hydraulic systems A and C (Ref. 29-11-00).

R NOTE: If AC pumps are used, deactivate the slats by releasing (out) SLAT LOCK switchlight on SLAT MONITOR panel (on FE/SO upper instrument panel).

R (8) Bleed hydraulic motor by cycling flaps from full up to full down and back to full up. Bleed until flap operation is smooth.

R (9) Check hydraulic motor fittings for leakage.

R NOTE: After bleeding flap system, bleed hydraulic reservoir (Ref. 12-13-01).

R (10) Shut off hydraulic power (Ref. 29-11-00).

R (11) Depress (in) SLAT LOCK switchlight on SLAT MONITOR panel if released.

FILTER ELEMENT, POWER DRIVE UNIT (PDU) REMOVAL AND INSTALLATION

1. Equipment and Materials

Drip pan, 1-gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

2. Referenced Procedures

R 27-51-00 Flap Control System - Adjustment and Test

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Open hydraulic service center access door 147AB.

(2) In hydraulic service center, zone 147, place drip pan under drive unit to catch hydraulic fluid.

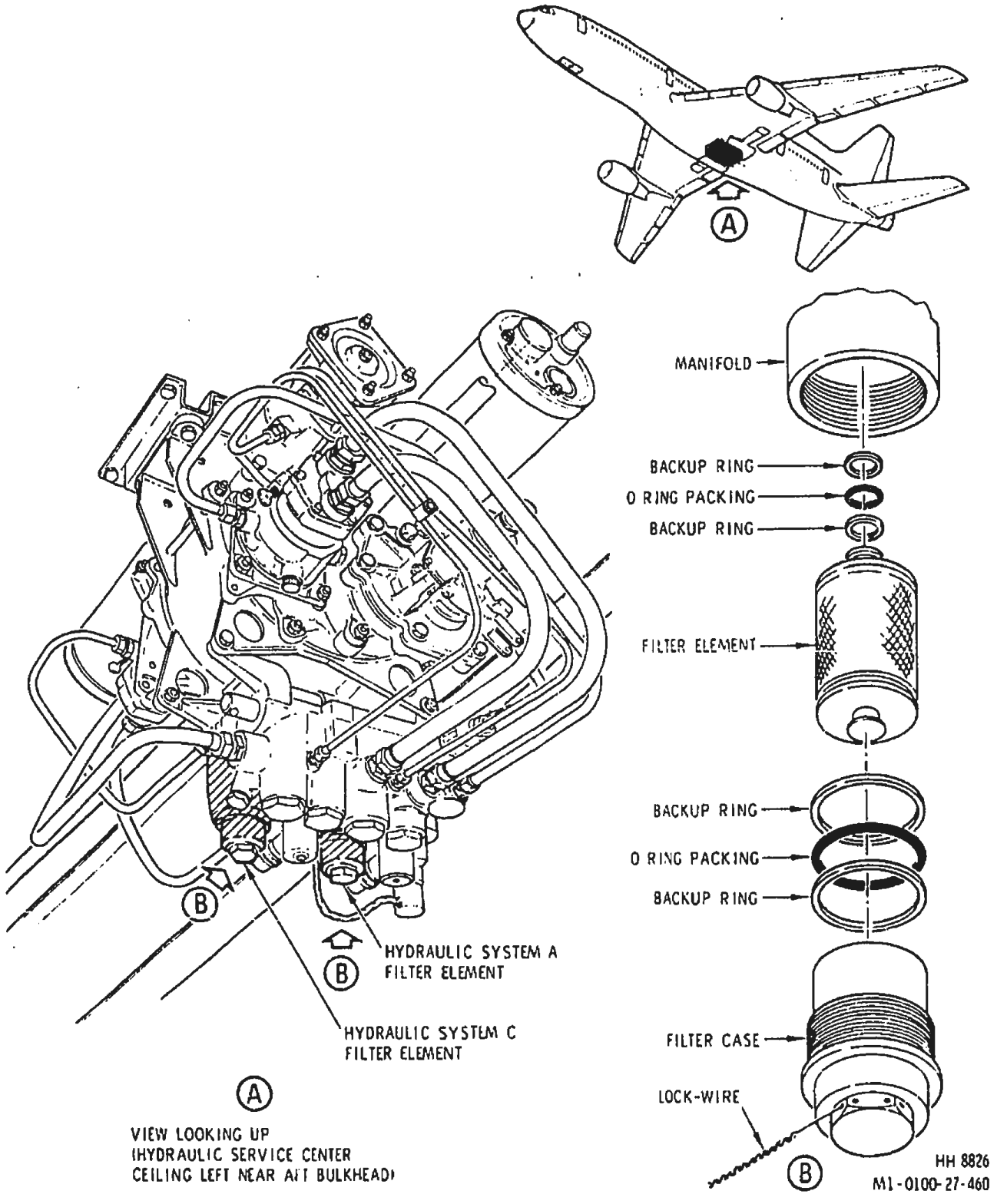
(3) Remove filter case from power drive unit (Ref. Fig. 401).

(4) Remove and discard backup ring, preformed packing, and backup ring from filter case.

(5) Pull filter element from power drive unit. Remove and discard backup ring, preformed packing and backup ring from filter element.

B. Installation

(1) Wet preformed packings and backup rings with hydraulic fluid before installation.



Filter Element, Power Drive Unit - Removal and Installation
Figure 401

(2) Install backup ring, preformed packing, and backup ring on filter element.

(3) Install filter element in power drive unit.

(4) Install backup ring, preformed packing, and backup ring in groove on filter case.

(5) Install filter case over filter element and torque 300 to 450 lb in. Attach lock-wire to filter case and manifold.

(6) Remove placards installed at beginning of Paragraph 3.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic system (Ref. 29-11-00) associated with filter element being installed (Ref. Fig. 401).

R (8) Bleed power drive unit by cycling pilots flap control
R lever in flight station, zone 210, from 0-degree to
R full down position and back to 0-degree position (Ref.
R 29-51-00). Visually determine that filter case is not leaking.

(9) Turn off hydraulic power (Ref. 29-11-00).

(10) Close and secure access door opened in Step 3A(1).

FLAP 90-DEGREE ANGLE GEARBOX - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Grease, MIL-G-23827, or equivalent

R Lock-wire, Fed Spec QQ-W-423, Form I, Cond A, 0.032-inch diameter, or equivalent

Cotter Pin, MS24665-132, or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	12-23-20	Wing Flap Drive System - Servicing
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Open access panel 571AB or 671AB to gain access to asymmetry brake (Ref. 6-40-00).

(2) Actuate asymmetry brake by pulling asymmetry brake reset knob (left asymmetry brake for left gearbox replacement, right asymmetry brake for right gearbox replacement) (Ref. Fig. 401).

NOTE: An asymmetry brake is located in each wing outboard of No. 4 flap.

Actuating asymmetry brake locks the flap drive system and maintains proper shaft indexing.

(3) Remove small-diameter bolt that secures torque shaft U-joint to clevis on input side of angle gearbox.

NOTE: Gearbox is located near the top, at the aft outboard end of the main wheel well.

(4) Remove bolts, washers, and nuts that secure the gearbox to structure.

(5) Support torque shaft connected to output end of gearbox. Move gearbox up and aft to slide splined end of gearbox free of torque shaft.

CR CR (6) Remove check valve from drain port for installation in new gearbox.

B. Installation

(1) Lubricate spline end of torque shaft and mating splined shaft of gearbox with grease MIL-G-23827 or equivalent.

(2) Turn input clevis of gearbox so that output splined shaft will mate with spline on torque shaft and input clevis will mate with U-joint of input torque shaft. Align gearbox on mounting pad of structure and install mounting bolts.

(3) Lubricate U-joint bolt and all contacting surfaces of U-joint with grease. Install U-joint bolt, washers, and nut. Torque nut 12 to 15 lb in. Install cotter pin.

NOTE: Verify that torque shaft retainers are not rubbing on torque shaft.

CR CR (4) Install check valve in drain port. Service gearbox with grease-oil mixture (Ref. 12-23-20).

(5) Release asymmetry brake by pushing in reset knob on the unit.

(6) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

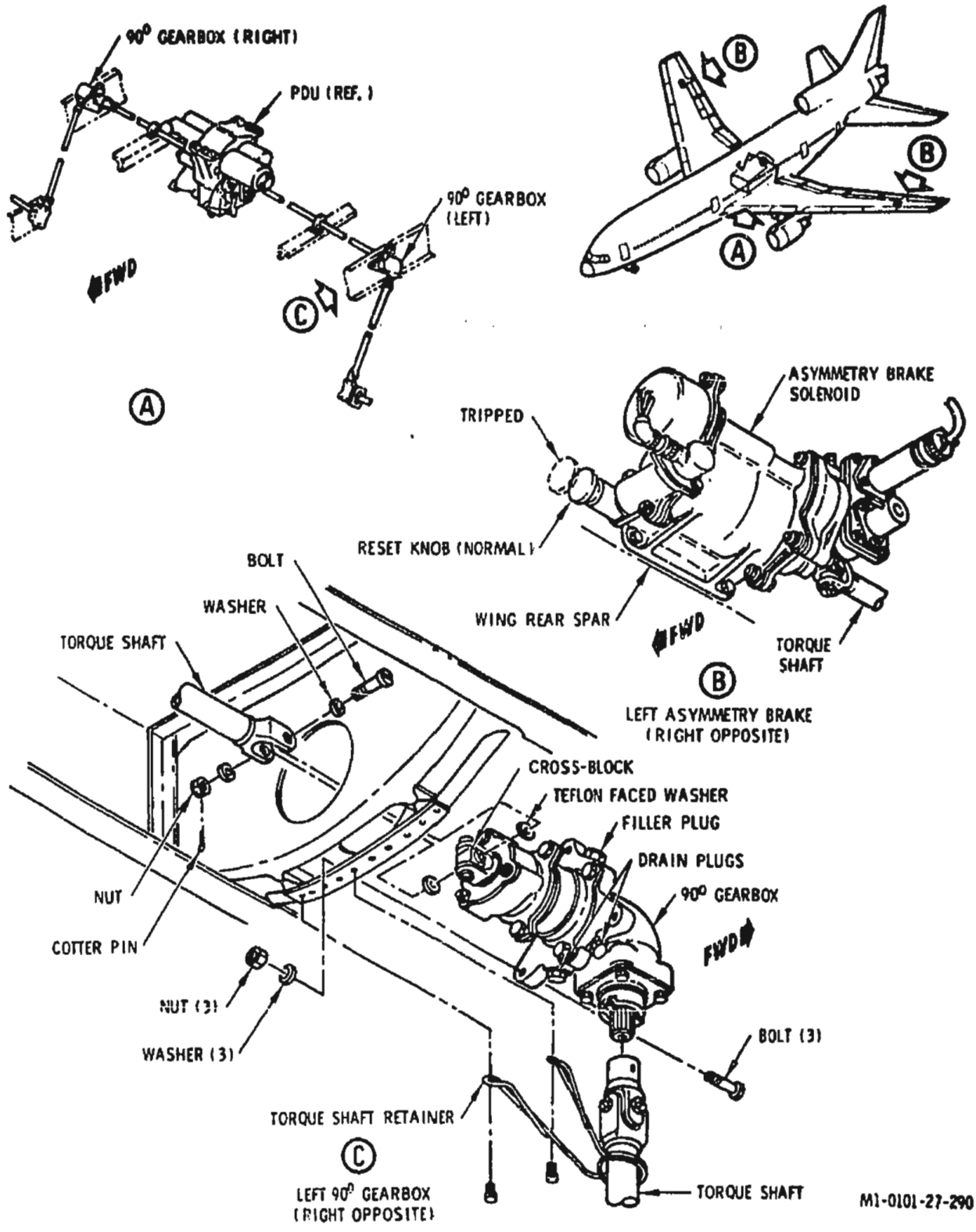
THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources, each capable of 25 GPM at 3000 psi, may be used to pressurize the A and C hydraulic systems.

(8) Cycle flap handle from full up to full down and back to full up for several cycles. Verify normal operation of flaps. Visually verify normal operation of replacement gearbox.

(9) Turn off hydraulic power (Ref. 29-11-00).



R Flap Drive System 90-degree Gearbox - Removal and Installation
R Figure 401

FLAP FORWARD FUSELAGE GEARBOX - REMOVAL AND INSTALLATION

1. Equipment and Materials

Grease, MIL-G-23827, or equivalent

Lock-wire, Fed Spec QQ-W-423, Form I, Condition A, 0.032-inch diameter, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-20	Wing Flap Drive System - Servicing
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) Verify that hydraulic systems A and C are shut off (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers Hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(3) Open access panel 571AB or 671AB to gain access to asymmetry brake (Ref. 6-40-00).

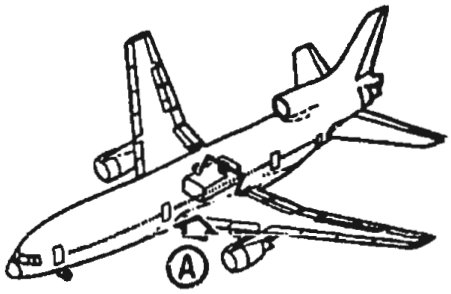
(4) Actuate asymmetry brake by pulling asymmetry brake reset knob (left asymmetry brake for left gearbox replacement, right asymmetry brake for right gearbox replacement).

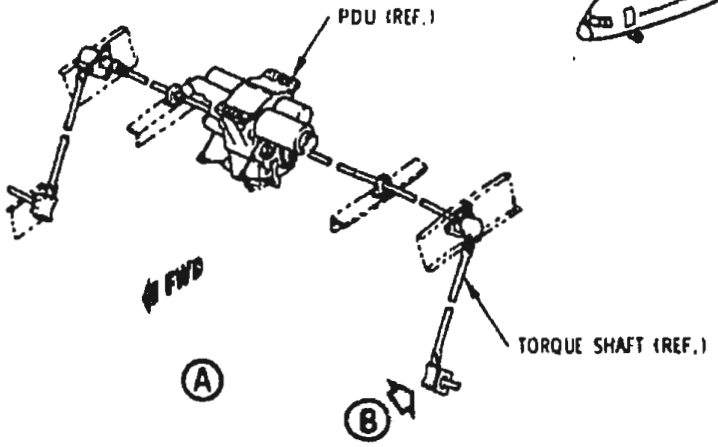
NOTE: Actuating asymmetry brake locks the system and maintains proper shaft indexing.

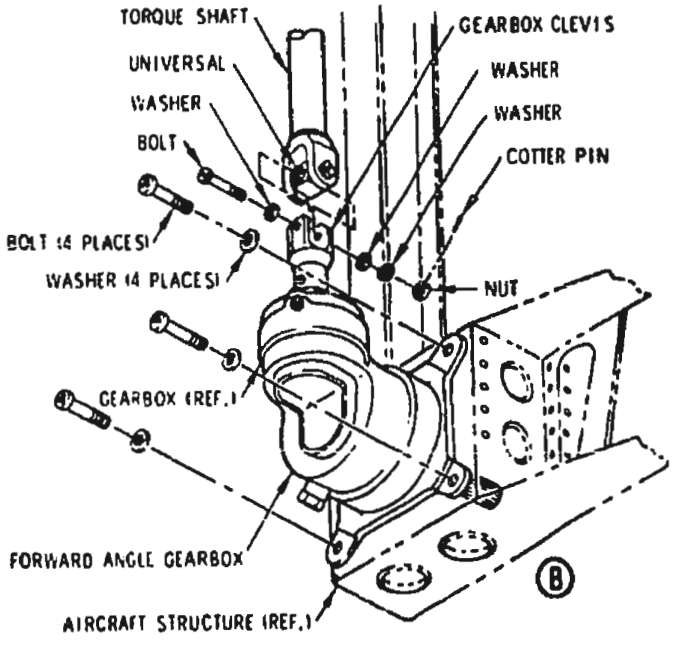
(5) Remove smaller diameter bolt from U-joint and separate U-joint (Ref. Fig. 401).

(6) Remove gearbox mounting bolts. Move gearbox inboard until output shaft clears splined shaft. Remove gearbox.

CR (7) Remove check valve from drain port.







ROTATED CLOCKWISE FOR CLARITY

NOTE

1. FORWARD ANGLE GEARBOXES ARE LOCATED ON OUTBOARD WALL OF MAIN LANDING GEAR WHEEL WELLS.
2. LEFT FORWARD ANGLE GEARBOX SHOWN - RIGHT FORWARD ANGLE GEARBOX OPPOSITE.

MA 0802
M1-0100-27-241

R Flap Forward Fuselage Gearbox - Removal and Installation
R Figure 401

B. Installation

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Verify that asymmetry brake reset knob is pulled.

NOTE: Left and right forward gearboxes are not interchangeable as output of left and right gearboxes rotate in opposite directions. Left and right gearboxes have different part numbers and are easily identified by outward appearance.

(2) Lubricate splined shaft and mating gearbox shaft with grease.

(3) Support and mate gearbox yoke with torque shaft.

(4) Mate gearbox output torque drive shaft with splined shaft and align gearbox on mounting pad. Install mounting bolts.

(5) Lubricate U-joint bolt and contacting surfaces of U-joint with grease. Install U-joint bolt, washers and nut. Torque U-joint nut 12 to 15 lb in. Install cotter pin.

NOTE: Verify that torque shaft retainers are not rubbing on torque shaft. Reposition retainers to provide equal clearance around torque shaft.

CR CR (6) Install check valve in drain port. Service gearbox with grease-oil mixture (Ref. 12-23-20).

NOTE: Gearbox should be installed for several minutes before checking oil level to allow oil to drain into various gearbox cavities.

(7) Release asymmetry brake by pushing in reset knob on unit.

(8) Remove tags from hydraulic control panels.

R **WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:**

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources, each capable of 25 GPM at 3000 psi, may be used to pressurize the A and C hydraulic systems.

(10) Cycle flap handle from full up to full down and back to full up for several cycles. Verify normal operation of flaps. Visually verify normal operation of gearbox.

(11) Turn off hydraulic power (Ref. 29-11-00).

FLAP TORQUE SHAFT - REMOVAL AND INSTALLATION

1. General

R R There are 46 torque shafts in the flap drive system: two in the hydraulic service center and two in each main wheel well, and twenty in each wing. Basically, there are two types of torque shafts: a splined torque shaft, and a torque shaft with U-joint. The splined torque shaft is used to couple the back-to-back gearboxes at each flap torque box. The torque shaft with U-joint is used to couple the remaining flap drive system components.

2. Equipment and Materials

Lubricant, MIL-G-23827, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal of Splined Torque Shaft

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) To prevent a disconnected flap drive system from moving and becoming misrigged, trip the asymmetry brake on the wing being worked, as follows:

(a) Open applicable access door, 571AB-1 (left wing), 671AB-1 (right wing) (Ref. 6-40-00).

(b) Pull brake reset knob outboard to trip.

(2) For removal of splined torque shaft in No. 1 torque box (torque shaft couples forward fuselage 90 degree gearbox to flap No. 1 gearbox):

(a) Remove forward fuselage gearbox (Ref. 27-51-19).

(b) Remove torque shaft.

(3) For removal of splined torque shaft in No. 2 and No. 5 torque boxes (torque shaft in No. 2 torque box couples flap gearbox No. 2 and 3. Torque shaft in No. 5 torque box couples flap gearbox No. 6 and 7):

(a) Remove wing access panel 541DB, 641DB (No. 2 torque box); 561BB, 651BB (No. 5 torque box).

(b) Remove flap drive gearbox (Ref. 27-51-25).

(c) Remove torque shaft.

B. Removal of Torque Shaft with U-Joint

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) To prevent a disconnected flap drive system from moving and becoming misrigged, trip the asymmetry brake on wing being worked, as follows:

(a) Open applicable access door, 571AB-1 (left wing), 671AB-1 (right wing) (Ref. 6-40-00).

(b) Pull brake reset knob outboard to trip.

(2) Remove appropriate wing lower trailing edge access panel (Ref. 6-40-00).

(3) If torque shaft includes a bearing housing, remove bolts attaching bearing housing to structure.

(4) Remove small-diameter bolt from U-joint. Separate U-joint; note washers between cross-block and yoke.

NOTE: If torque shaft includes two U-joints and no spline, remove small-diameter bolt from other U-joint.

CAUTION: SMALL-DIAMETER BOLT GOES THROUGH LARGE-DIAMETER BOLT. DO NOT ATTEMPT TO REMOVE LARGE-DIAMETER BOLT WITH SMALL-DIAMETER BOLT INSTALLED.

(5) Remove torque shaft. If torque shaft retainers interfere with torque shaft removal, remove retainers.

CR CR Remove torque shaft. Do not bend or defect retainer to remove shaft.

C. Installation of Splined Torque Shaft

(1) Install splined torque shaft in No. 1 gearbox as follows:

(a) Butter-lubricate spline mating surfaces with grease (MIL-G-23827).

(b) Engage splined torque shaft on the No. 1 flap inboard drive gearbox.

(c) Install forward gearbox (Ref. 27-51-19).

(d) Check flap system per following Steps (e) and (g).

(e) Turn on electrical power (Ref. 24-41-00)...

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(f) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(g) Cycle flaps, from full up to full down and back to full up at least two times. Verify normal

operation of flaps. Visually verify normal operation of replaced torque shaft.

NOTE: To check rigging of flaps that were disconnected from flap drive system, accomplish following: Position flaps full up. Check first ballscrew actuator outboard of torque shaft that was disconnected: the clearance between flat on aft face of ballscrew front support and forward face of ballscrew carriage must be 0.54 (±0.06) inch (0.48 to 0.60 inch) (Ref. 27-51-00, Fig. 502).

(h) Install access panel.

(2) Install splined torque shaft in No. 2 or No. 5 flap torque box as follows:

(a) Butter-lubricate spline mating surfaces with grease (MIL-G-23827).

(b) Install splined torque shaft on installed gearbox spline.

(c) Install flap drive gearbox (Ref. 27-51-25).

(d) Reset asymmetry brake by pushing in reset knob. A 25- to 30-pound force is required.

(e) Check flap system. Accomplish Steps C(1)(d) through (f).

(f) Install access door.

D. Installation of Torque Shaft with U-joint

CAUTION: THE TORQUE SHAFT WITH THE BEARING HOUSING ON BOTH ENDS RESTRICTS LATERAL MOVEMENT OF THE TORQUE SHAFTS BETWEEN THE FLAP ACTUATOR GEARBOXES IN THE WING. IF THE BEARING IS REMOVED OR REPLACED, VERIFY THAT THE RETAINING PIN IS INSTALLED IN THE BEARING SEAT AND YOKE BEFORE INSTALLING BEARING ON BEARING SEAT (REF. FIG. 401, VIEW B). A MISSING RETAINING PIN COULD RESULT IN THE TORQUE SHAFT SEPARATING FROM THE ACTUATOR GEARBOX SPLINE SHAFT.

BEARING AND BEARING SEAT MUST BE INSTALLED WITH THRUST FLANGE ON BEARING SEAT AND THRUST FLANGE ON BEARING HOUSING ON OPPOSITE SIDES OF BEARING.

(1) If torque shaft retainers were removed for torque shaft removal, slip retainers on torque shaft.

CR CR CR (a) If torque shaft retainers are intalled, assure adequate clearance between retainers and torque shaft while torque shaft is rotating under load.

(2) If torque shaft has a splined end, butter-lubricate spline mating surfaces with grease (MIL-G-23827) and engage spline in mating spline.

(3) Lubricate U-joint contacting surfaces with grease (MIL-G-23827).

(4) Couple torque shaft U-joint with mating U-joint. Verify that a teflon-faced washer is installed between the crossblock and each yoke tang. The teflon face must be against cross-block. Install small diameter bolt, washers, and nut. Tighten nut 30 - 40 lb in. Install cotter pin. (Small-diameter bolt goes through large-diameter bolt. If necessary, rotate large diameter bolt to align hole for inserting small diameter bolt.)

NOTE: If torque shaft has two U-joints, couple both U-joints to mating U-joint.

(5) If torque shaft includes a bearing housing, install bearing housing attach bolts.

NOTE: A Vendor Service Bulletin revises the shaft assemblies to add a witness hole thru the female spline end fitting to make verification of spline engagement. On those female splines, that have the witness hole, the splines are properly engaged if any portion of the male spline end fitting is exposed thru the witness hole. The torque shaft must be replaced if no portion of the male spline is exposed in the witness hole.

(6) Install torque shaft retainers.

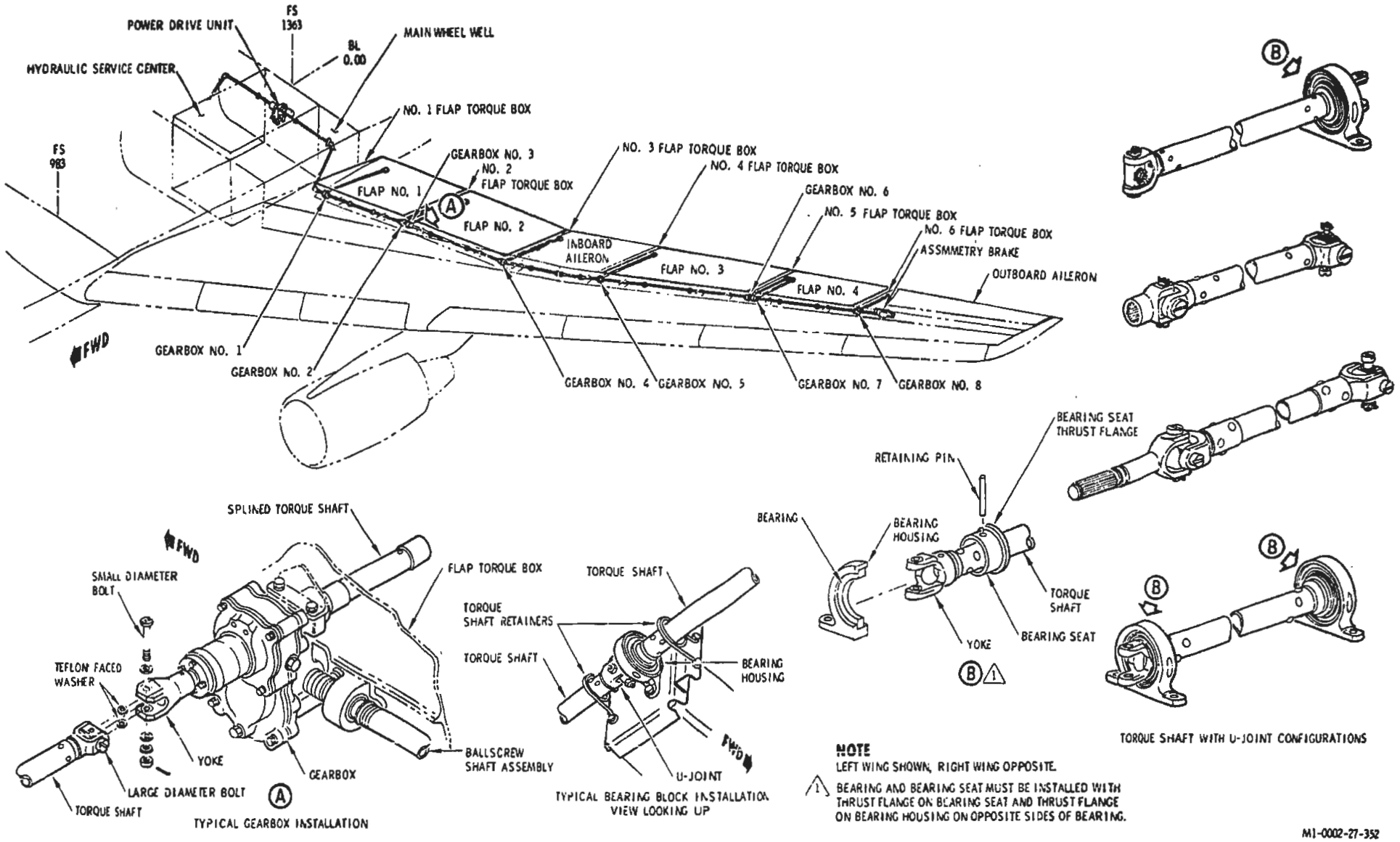
NOTE: Verify that the torque shaft is centered within the retainer. Reposition or form retainer as required to center.

(7) Reset asymmetry brake by pushing in reset knob. (A 25- to 30-pound force is required.)

(8) Remove tags from hydraulic control panels.

(9) Check flap system. Accomplish Steps C(1)(d) through (f).

(10) Install access doors.



NOTE
LEFT WING SHOWN, RIGHT WING OPPOSITE.

1. BEARING AND BEARING SEAT MUST BE INSTALLED WITH THRUST FLANGE ON BEARING SEAT AND THRUST FLANGE ON BEARING HOUSING ON OPPOSITE SIDES OF BEARING.

M1-0002-27-352

R Flap Torque Shaft - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

FLAP TORQUE SHAFTS - INSPECTION AND CHECK

1. General

R This section provides the limits for flap torque shaft wear and
R torque shaft "wobble" and for torque shaft U-joint wear.

2. Referenced Procedures

6-40-00 Exterior Access Doors and Panels

3. Inspection/Check

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Flap Torque Shaft Wear

(1) Remove appropriate wing trailing edge access panels to gain access to flap torque shafts (Ref. 6-40-00).

(2) Inspect torque shafts for signs of wear (indicated by a radial groove).

NOTE: Wear can be caused by interference with torque shaft retainers, or other trailing edge components.

(3) If wear is less than limits in Table 601, smooth abraded area and brush with alodine per structural repair manual 51-21-02. If wear exceeds limits in Table 601, replace torque shaft.

Flap Torque Shaft Wear Limits
Table 601

LAC P/N	VENDOR P/N	MAX. RADIAL GROOVE WEAR LIMITS (INCHES)
671941-101	179622-1	0.012
671941-103	179622-2	0.012
671941-105	179622-3	0.012
671941-109	179622-5	0.003
671941-123	179622-6	0.012
671941-127	179622-8	0.012
671941-137	179626-8	0.003
671941-141	179626-9	Non Allowable
671941-143	179622-9	0.002
671941-145	179623-3	0.012
671941-147	179623-4	0.012
671941-149	179621-2	0.012
671941-151	179627-5	0.003

(4) Close access panels opened for inspection.

(5) Remove tags from hydraulic control panels.

B. Torque Shaft Wobble

During flap operation, the flap torque shafts may exhibit some "wobble" due to being slightly bent or bowed. Allowable torque shaft "wobble" with flap system operating at normal speed is ±0.050 inch, from the torque shaft centerline, per lineal foot of the torque shaft assembly overall length (0.10 inch total amplitude per lineal foot). (Example: Maximum allowable "wobble" of a torque shaft four feet long between bearing supports is ±0.20 inch or 0.40 inch total amplitude.)

R C. Torque Shaft U-Joint and Splined Coupling Wear

R There are 46 torque shafts in the flap drive system. The
R torque shafts include U-joint and splined couplings. The
R U-joints allow for torque shaft alignment changes due to
R wing deflection. The splined couplings allow for lateral
R displacement of the flap drive components and for coupling
R the torque shafts to the flap power drive unit, flap
R actuation gearboxes, and the asymmetry brakes. This section
R provides the maximum allowable rotational wear tolerance for
R the U-joints and the spline couplings.

R (1) U-Joint Wear Limits: 2 degrees maximum rotation for
R each U-Joint.

R (2) Splined Coupling Wear Limits: 1.5 degrees maximum
R rotation for each splined connection.

R NOTE: If any U-Joint or splined coupling exceeds the
R above maximum, replace as required.

R Total angular wrap-up between flap power drive
R unit output shaft and the asymmetry brake would
R be 70 degrees if maximum wear limits were
R reached at all joints.

FLAP DRIVE GEARBOX - REMOVAL AND INSTALLATION

1. General

This procedure is applicable to all 16 flap drive gearboxes.

2. Equipment and Materials

Grease, MIL-G-23827, or equivalent.

R Bolt, Curtis Wright P/N 180400-1 with hex head, no equivalent.

R Cotter Pin, MS24665-153, or equivalent.

R Lock-wire, Fed Spec QQ-W-423, Form I, Cond A, 0.032-in. Dia., or equivalent.

CR Oil-Grease Mixture - (Ref. 12-20-00, Fig. 301).

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

A. Removal

NOTE: During removal and installation of trailing edge flap
R gear boxes, the flap panels should be supported to

preclude inadvertent movement and resulting misrigging of flaps.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic system C (Ref. 29-11-00).

(3) Operate flaps to fully extend position.

(4) Turn off electrical power.

(5) Turn off hydraulic system C.

WARNING: VERIFY THAT ALL HYDRAULIC POWER IS SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(6) Tag flap handle.

(7) Open the following access panels (Ref. 6-40-00).

For all gearboxes (access to flap asymmetry brake): 571AB1, left wing; 671AB1, right wing.

For No. 1 gearbox: 541BB, left wing; 641BB, right wing.

For No. 2 gearbox: 541DB, left wing; 641DB, right wing.

For No. 3 gearbox: 541FB, left wing; 641FB, right wing.

For No. 4 gearbox: 541GB-2, left wing; 641GB-2, right wing.

For No. 5 and 6 gearbox: 561BB, left wing; 661BB, right wing.

For No. 7 and 8 gearbox: 561CB, left wing; 661CB, right wing.

(8) Activate asymmetry brake by pulling reset knob (left asymmetry brake for left wing gearbox replacement, right asymmetry brake for right wing gearbox replacement).

NOTE: Activating asymmetry brake and shutting off hydraulic system A and C will lock flap drive system and maintain proper drive shaft indexing.

(9) On gearboxes 1, 2, 3, 6, and 7, remove smaller diameter bolt from shaft U-joint. Slide splined yoke from gearbox (Ref. Fig. 401).

NOTE: On gearboxes 4, 5, and 8, there are two U-joints; remove bolt from inboard U-joint on gearboxes 4 and 8, and remove bolt from outboard U-joint on gearbox 5.

(10) On the gearbox, slide rubber boot forward and remove quill shaft connecting bolt. Slide quill shaft into gearbox.

(11) On flap drive gearboxes 6 and 7, disconnect inboard and outboard end of spoiler No. 5 input pushrod. Do not remove from aircraft.

NOTE: Do not disturb spoiler No. 5 input pushrod rod end adjustment.

(12) Remove gearbox mounting bolts and remove gearbox.

(13) Remove plug, quill shaft, and rubber boot from gearbox.

CR CR (14) Remove check valve from drain port, retain for use in replacement gearbox.

B. Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Verify flap control handle is tagged in extend position.

(2) Verify that asymmetry brake on wing being worked is tripped (Step 4A(8).

(3) Install plug in the gearbox forward quill shaft cavity (Ref. Fig. 401).

(4) Lubricate all splined shafts and U-joint contacting surfaces with grease.

CR CR (5) Insert quill shaft (with connecting bolt hole facing the ballscrew) into gearbox. Install check valve in drain port.

(6) Align gearbox spline shaft with spline torque shaft passing through torque box (or splined U-joint yoke)

and slide gearbox into position. Install and tighten two top mounting bolts. Check for gap between gearbox lower mounting flange and torque box. If gap exceeds 0.010 inch, add shim or washer between gearbox and torque box. Install and tighten lower mounting bolt.

(7) Position rubber boot between gearbox and ballscrew actuator. Slide quill shaft rearward and mate with ballscrew spline. Install quill shaft connecting bolt; torque bolt 50 to 70 lb in.

CAUTION: THE QUILLSHAFT HOLE IS LARGER THAN BALLSCREW HOLES TO ASSURE THAT TORTIONAL LOADS WILL BE TRANSMITTED BY SPLINE AND NOT BY BOLT. THE QUILL SHAFT CAN BE COUPLED TO BALLSCREW IN TWO POSITIONS, 180 DEGREES APART. IN THE INCORRECT POSITION, CONNECTING BOLT HOLE ALIGNMENT IS OFF A HALF SPLINE. IF CONNECTING BOLT IS INSTALLED IN THIS CONDITION (PUSH FIT) THE BOLT CAN ABSORB TORTIONAL LOADS AND THE QUILL SHAFT CAN EVENTUALLY FAIL.

TO ENSURE CORRECT INSTALLATION, VERIFY THAT CONNECTING BOLT FITS EASILY THROUGH BALLSCREW AND THE QUILL SHAFT CAN MOVE AXIALLY (FORE AND AFT) AT LEAST 0.040 INCH AFTER BOLT INSTALLATION.

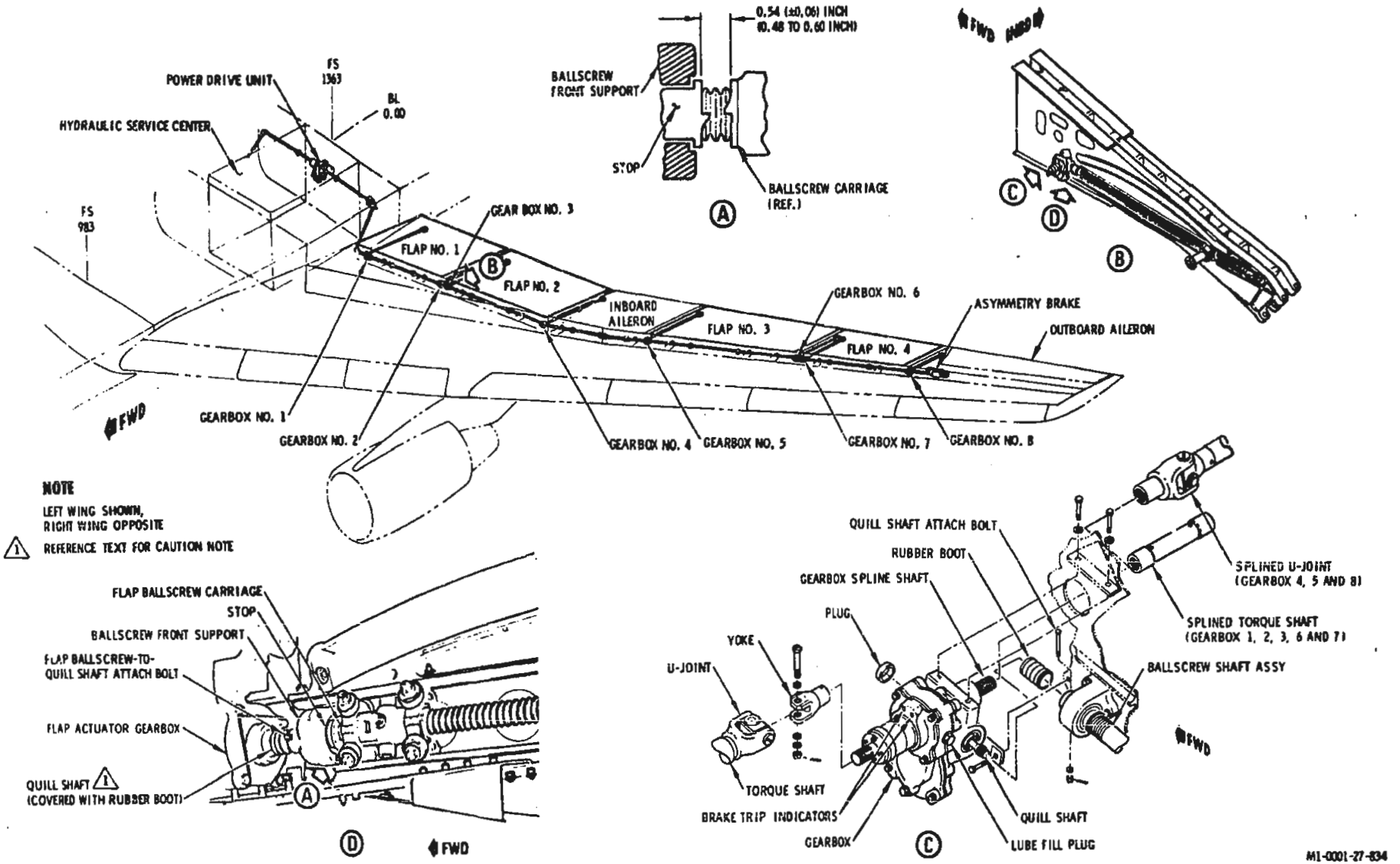
NOTE: The vendor(Curtiss Wright) has designed a new bolt with an undersized shank to allow quill shaft to be installed either way (Curtiss Wright SB 27-01). If possible, replace old bolt (PN 179923-1 with 12-point external wrenching head) with new bolt (PN 180400-1 with hex head).

CR CR CR CR CR NOTE: One piece shims can be installed between the screw assembly front support and the torque box in order to provide alignment with the transmission. Quill shaft binding can occur if alignment is not assured

(8) Slide rubber boot into position.

(9) Slide U-joint yoke onto gearbox shaft. Coat U-joint attaching bolt with grease before installing. Torque bolt 30-40 lb in. and install cotter pin. Add or remove washers under nut to allow cotter pin installation at specified torque.

NOTE: Verify teflon-faced washer is installed between cross-block and each yoke tang. The teflon face must be against cross-block.



Flap Actuating Gearbox - Removal and Installation
Figure 401

R
R
0018 EFFECTIVITY: ALL

CR (10) Service gearbox with oil-grease mixture (Ref. CR 12-23-20).

(11) Install and torque fill plug 25 to 50 lb in. lock-wire plug.

(12) After installing flap drive gearbox 6 or 7, install spoiler actuator No. 5 input pushrod with attaching hardware.

NOTE: Do not disturb spoiler No. 5 input pushrod rod end adjustment.

(13) Verify both brake trip indicators on gearbox are reset (depressed).

(14) Release asymmetry brake by pushing in reset knob.

(15) Remove tags from hydraulic control panels and from flap handle.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(16) Turn on electrical power (Ref. 24-41-00).

(17) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize B and C hydraulic system using ATM pumps and A hydraulic system using PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize A and C hydraulic systems.

(18) Cycle flap handle from full up to full down and back to full up several times. Verify flaps and replaced gearbox operate smoothly without binding.

(19) Position flap handle to 0-detent position.

(20) With flaps fully retracted, verify replaced gearbox rigging. Clearance between flat on forward face of ballscrew carriage and flat on ballscrew front support stop is 0.54 (±0.06) inch (0.48 to 0.60 inch)(Ref. Fig. 401). If not, reference 27-51-00, Adjustment and Test for adjustment.

NOTE: If a disconnected flap gets out of rig, the gap between ballscrew front support stop and forward face of ballscrew carriage will change with each revolution of flap torque shaft: Actuators 1, thru 4 - .089 inch; actuator 5 - .083 inch; actuators 6 and 7, .072 inch and actuator 8, .064 inch.

(21) If spoiler No. 5 pushrod was disconnected, perform following:

(a) On pilots overhead circuit breaker panel CB1, verify circuit breakers SPOILER DWELL DC and AC (B7, B8) are closed.

(b) Verify hydraulic system B and C are on.

(c) Position flaps full up to couple selector to spoilers No. 5 and 6.

(d) Cycle speedbrake lever from 0 to MAX three times. Spoilers No. 5 and 6 must operate smoothly. Verify pushrod between selector and spoiler No. 5 clears all structure and equipment.

(e) Position speedbrake lever to 0 degrees.

(22) Turn off hydraulic power (Ref. 29-11-00).

(23) Turn off electrical power (Ref. 24-41-00).

(24) Close all access doors and panels opened in Step 4A(7).

FLAP DRIVE GEARBOX - INSPECTION AND CHECK

1. General

Each flap drive gearbox contains a torque brake assembly to limit the load on the flap drive system. If the load on the ballscrew components driven by the gearbox is excessive, the brake will actuate and stall the flap drive system. When the brake actuates, a trip indicator pin extends to indicate that the brake has actuated. There are two trip indicators on each gearbox: one to signal an extension trip and one to signal a retraction trip.

R The trip indicator pin may fail to pop out if corrosion is present in the mechanism. Failure of the trip indicator pin to actuate will not adversely affect the operation of the flap drive gearbox.

R Paragraph 4A verifys proper operation of the trip indicators.

R Paragraph 4B provides an alternate method, not using the trip indicators, to verify proper operation of the flap drive system.

2. Equipment and Materials

Strap Wrench

High Friction Adhesive Tape, One-inch Wide

R Torque Wrench Dial Indicating, 0-100 pound-inch, or equivalent

R Adapter, Trailing Edge Control System U-Joint Kit, Curtiss-Wright Corp P/N ST6918, or equivalent

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	24-00-00	Electrical Power - Maintenance Practices
	27-51-25	Flap Drive Gearbox - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Inspection/Check

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Flap Drive Gearbox Trip Indicator Check

(1) Open associated access panel (Ref. 6-40-00):

For No. 1 gearbox: 541BB, Left wing; 641BB, right wing.

For No. 2 gearbox: 541DB, Left wing; 641DB, right wing.

For No. 3 gearbox: 541FB, Left wing; 641FB, right wing.

For No. 4 gearbox: 541GB-2, Left wing; 641GB-2, right wing.

For No. 5 and 6 gearbox: 561BB, Left wing; 661BB, right wing.

For No. 7 and 8 gearbox: 561CB, Left wing; 661CB, right wing.

(2) Wrap one-inch wide high friction adhesive tapeor adhesive backed Velcro tape (hook) around torque brake housing to provide strap wrench with a non-slip surface.

NOTE: Prior to application of either adhesive tape or adhesive Velcro, wipe surface with a clean dry cloth.

(3) Install strap wrench around torque brake housing (Ref. Fig. 601).

(4) Apply torque of approximately 30 lb ft to torque brake housing. Verify that trip indicator pin pops out. After check, relieve torque and remove strap wrench. When torque is relieved, torque brake will release but indicator pin must be manually reset.

(5) Install strap wrench around torque brake in opposite direction.

(6) Apply torque of approximately 30 lb ft to torque brake housing in opposite direction. Verify that other trip

indicator pin pops out. After check, relieve torque, remove strap wrench and adhesive tape. When torque is relieved, torque brake will release but indicator pin must be manually reset.

(7) If either trip indicator fails to pop out, replace gearbox at the next major maintenance check (Ref. 27-51-25).

NOTE: Failure of the trip indicator pin to pop out does not affect normal operation of the gearbox or the torque brake. The trip indicator pin only indicates that the torque brake has actuated.

(8) Remove adhesive tape or Velcro tape from torque brake housing.

(9) Install access panel removed in Step (1).

(10) Remove tags from hydraulic control panels.

R B. Flap Drive System Torque Check

R (1) Turn on electrical power (Ref. 24-00-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (2) Turn on hydraulic systems A and C (Ref. 29-11-00).

R (3) Fully retract flaps.

R (4) Open access panels 541BB, 561AB, 641BB and 661AB (Ref.
R 6-40-00) and measure and record clearance between the
R flat on the forward face of the ballscrew carriage and
R the flat on the aft face of the ballscrew stop on the
R left and right wing number 1 and 5 actuators (Ref. Fig.
R 602).

R (5) Extend flaps to the 10-degree position.

R (6) Turn off hydraulic systems A and C. Tag Flight
R Engineers/Second Officers hydraulic system panel, zone
R 215, and hydraulic service panel, zone 147, against
R operation.

R (7) Disconnect inboard flap drive torque shaft at input to
R the upper aft angle gearbox on side being checked.

R (8) Install an appropirate adapter on a dial-indicating
R torque wrench and attach to the upper aft angle gearbox
R input drive shaft.

R NOTE: Micrometer adjusting "click"-type torque
R wrenches are not usable.

R Torque wrench must be installed to provide
R maximum possible rotation.

R (9) Rotate input drive shaft in the retract direction at a
R constant speed and record torque required. Normal
R torque is 20 to 40 pound-inches.

R (10) If torque reading does not exceed upper limit, repeat
R Steps 4B(7) through 4B(9) for other side, if required,
R or proceed to Step 4B(17).

R (11) If torque reading exceeds 40 pound-inches, disconnect
R flap drive torque shaft inboard of flap ballscrew
R actuator number 5.

R NOTE: Actuator number 5 is the inboard actuator for
R flap number 3.

R (12) Rotate upper aft angle gearbox input drive shaft in the
R retract direction at a constant speed and record torque
R required. Normal torque is 10 to 25 pound-inches.

R (13) If torque reading exceeds upper limit, inspect inboard
R flaps for source of excessive load.

R (14) If torque reading does not exceed upper limit, install
R torque wrench with adapter on ballscrew actuator number
R 5 gearbox input shaft. Rotate in the retract direction
R at a constant speed and record torque required. Normal
R torque is 10 to 25 pound-inches.

R (15) If torque reading exceeds upper limit, inspect inboard
R flaps for source of excessive load.

R (16) If torque reading does not exceed upper limit, repeat Steps 4B(7) through 4B(15) for other side, if required, or proceed to Step 4B(17).

R (17) When torque requirements are satisfactory, manually retract flaps and reinstall all torque shafts.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

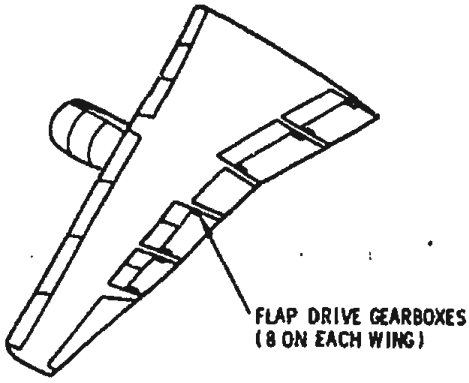
R (18) Turn on hydraulic systems A and C (Ref. 29-11-00).

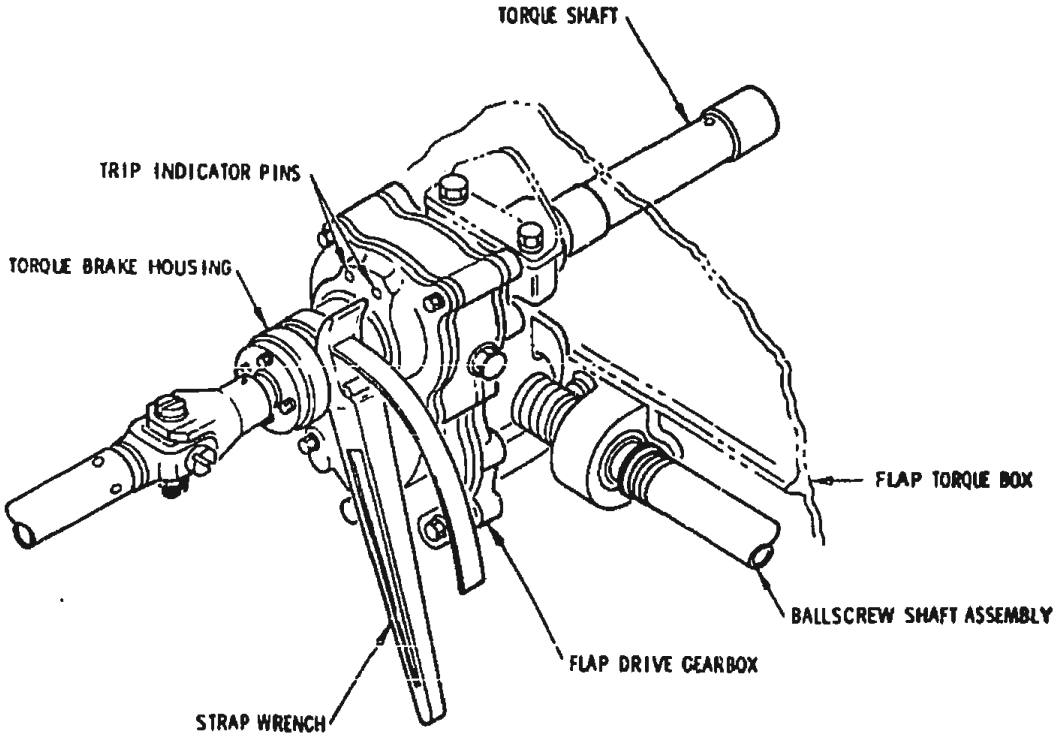
R (19) Cycle flaps down and up and verify normal operation.

R (20) Turn off hydraulic power (Ref. 29-11-00).

R (21) Turn off electrical power (Ref. 24-00-00).

R (22) Close access panels.

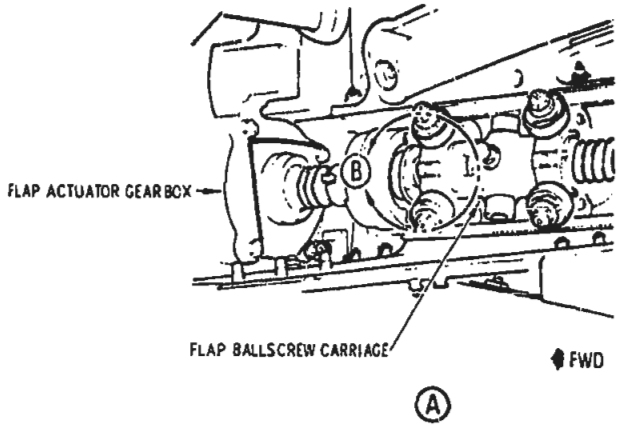




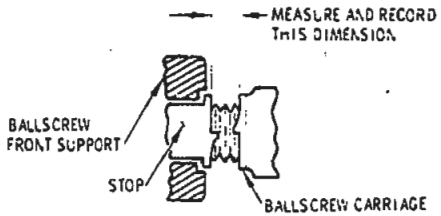
TYPICAL GEARBOX INSTALLATION

M1-0100-27-445

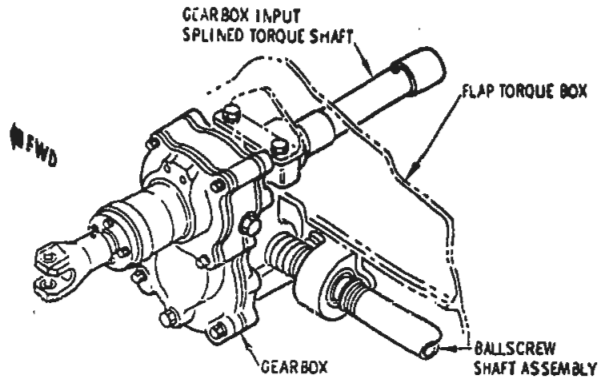
Flap Actuating Gearbox - Inspection and Check of
Trip Indicator Pins
Figure 601



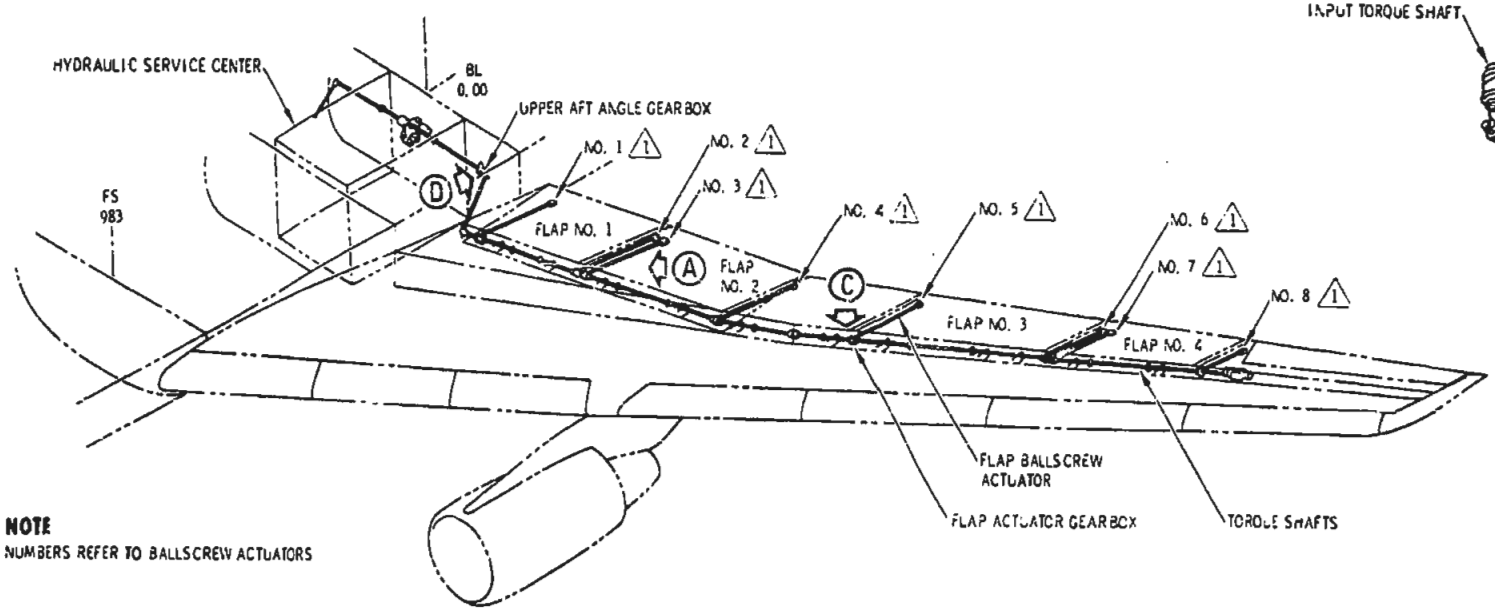
Ⓐ



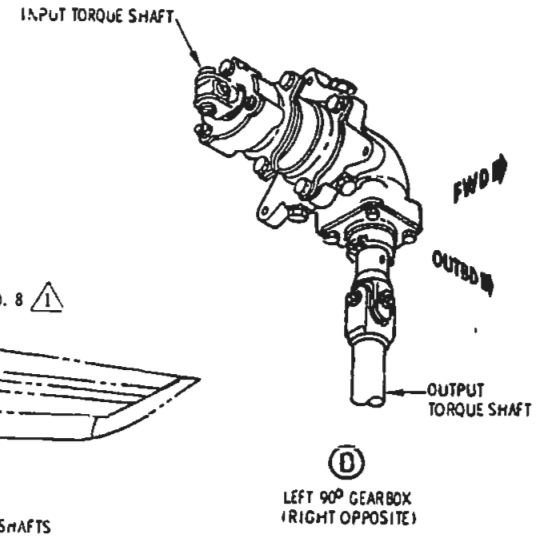
Ⓑ



Ⓒ TYPICAL GEARBOX INSTALLATION



NOTE
1 NUMBERS REFER TO BALLSCREW ACTUATORS



Ⓓ LEFT 90° GEARBOX (RIGHT OPPOSITE)

M1-0000-27-1252

R Flap Drive System Torque Check
R Figure 602

R EFFECTIVITY: ALL
R
0018

FLAP CARRIAGE BALLSCREW ACTUATOR - REMOVAL AND INSTALLATION

1. General

There are sixteen ballscrew actuators in the flap drive system (eight on each wing). This procedure applies to all sixteen ballscrew actuators.

2. Equipment and Materials

Alignment bullet, PN BF91 (used for replacing outboard ballscrew actuator).

R Spacer, Curtiss-Wright 45-SP-0129, or equivalent

R Bolt, Curtiss-Wright 179923-1 or 180400-1, or equivalent

R Cotter pin, MS24665-153

R Grease, MIL-G-23827A

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	12-23-20	Flap, Vane, and Spoiler Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-51-00	Flap Control System - Adjustment and Test
	27-51-30	Flap Yoke Assembly - Removal and Installation
R R	27-51-47	Flap Vane Carriage Assembly - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SERVICES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

WARNING: IF BALLSCREW, QUILL SHAFT OR QUILL SHAFT RETAINING BOLT MUST BE REPLACED, CHECK FAIL-SAFE LINK INSTALLATION FOR STRUCTURAL DAMAGE (Ref. 27-51-35, Fig. 401).

R A. Removal

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic systems C (Ref. 29-11-00).

(3) Operate flaps to fully extended position (Ref. 27-51-00).

(4) Turn off electrical power if no longer required (Ref. 24-41-00).

(5) Turn off hydraulic system C (Ref. 29-11-00).

WARNING: ENSURE THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(6) Removable panels for access to all ballscrew actuator shafts are specified in Table 401. Open only the panels for access to a specific shaft (Ref. 6-40-00).

Access Panels for Ballscrew Actuator Shafts
Table 401

FLAP NO.	BALLSCREW SHAFT	L WING PANEL	R WING PANEL
1	Inboard	541BB	641BB

Access Panels for Ballscrew Actuator Shafts (Cont)
Table 401

FLAP NO.	BALLSCREW SHAFT	L WING PANEL	R WING PANEL
1	Outboard	541DB	641DB
2	Inboard	541FB	641FB
2	Outboard	541GB-2	641GB-2
3	Inboard	561BB	661BB
3	Outboard	561BB	661BB
4	Inboard	561CB	661CB
4	Outboard	561CB	661CB

(7) Disconnect vane actuators from vane and flap fittings (each end of vane)(Ref. Fig. 401).

(8) Slide vane forward to the retracted position and temporarily secure to wing structure.

(9) Support flap panel with maintenance stand and pads.

(10) Disconnect forward side of flap panel from yoke assembly on ballscrew (Ref. Fig. 402).

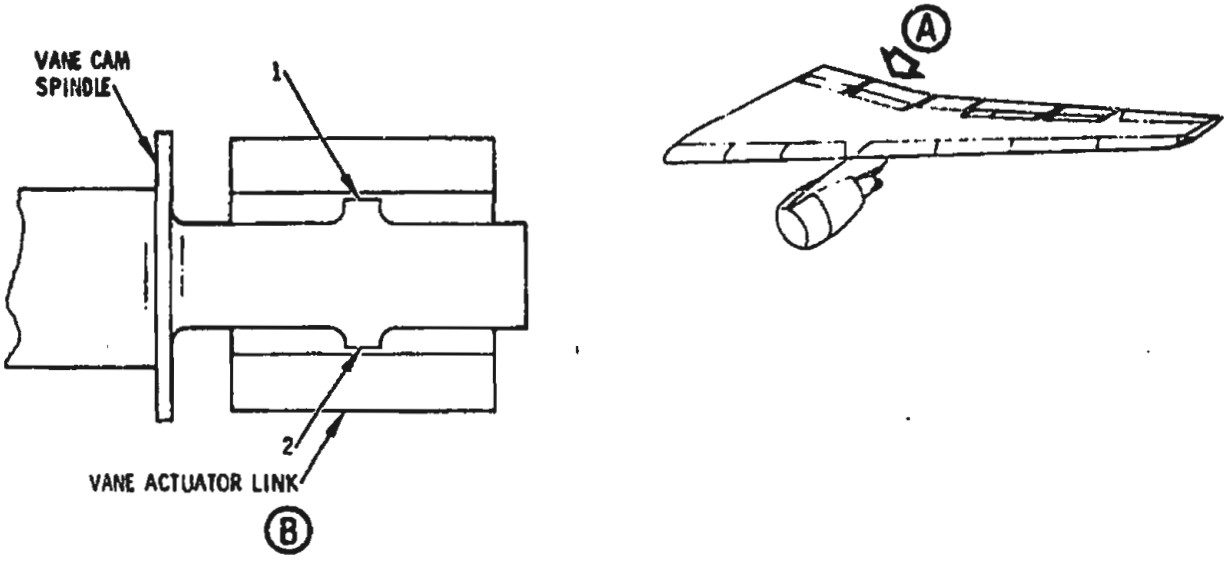
NOTE: Disconnect flap fitting from flap panel before removing from yoke.

NOTE: Note number and location of shims and retain for installation.

(11) For reinstallation reference, measure and record dimension between the flap carriage aft face and the forward face of the rear mount of ballscrew to be removed (Ref. Fig. 402).

R

(12) Remove gearbox quill shaft bolt and move quill shaft forward into gearbox and clear of ballscrew shaft.

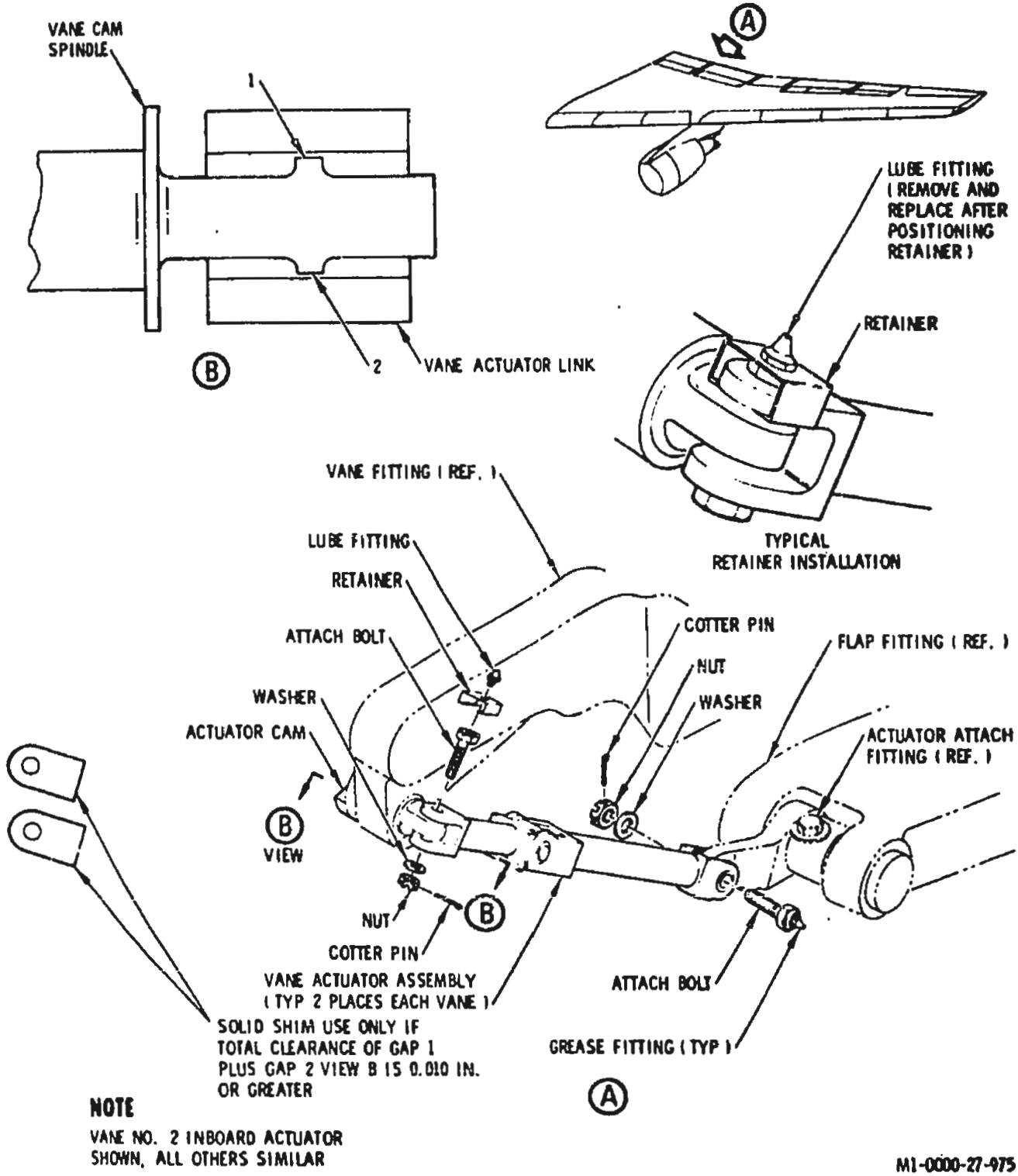


CR
CR

Vane Actuator Installation
Figure 401

EFFECTIVITY: 001-014

001B



CR
CR

Vane Actuator Installation
Figure 401

EFFECTIVITY: 015-999

0018

(13) Remove two forward bolts and loosen aft bolt retaining forward ballscrew shaft support.

NOTE: The aft attach hole on the forward ballscrew shaft support is slotted.

(14) Rotate ballscrew shaft to move carriage to forward ballscrew stop.

(15) Remove bolts attaching ballscrew shaft to rear mount.

R (16) Remove rear mount attach bolts.

(17) Slide ballscrew shaft and forward support forward as far as possible and push shaft in quill shaft, if necessary to obtain further forward movement.

(18) Slide rear mount aft to separate ballscrew shaft from rear mount.

(19) Move aft end of ballscrew shaft to permit rear mount to be moved forward and off torque box.

(20) Remove rear mount.

(21) Rotate ballscrew shaft to move carriage near aft end of shaft.

NOTE: Do not run the carriage aft face past end of ballscrew thread or carriage ballnut bushings will fall out.

(22) Slide ballscrew shaft and forward support forward to disengage forward support from mounting bolt.

(23) Slide ballscrew shaft and carriage assembly aft and off track.

(24) Remove yoke assembly from ballscrew (Ref. 27-51-30).

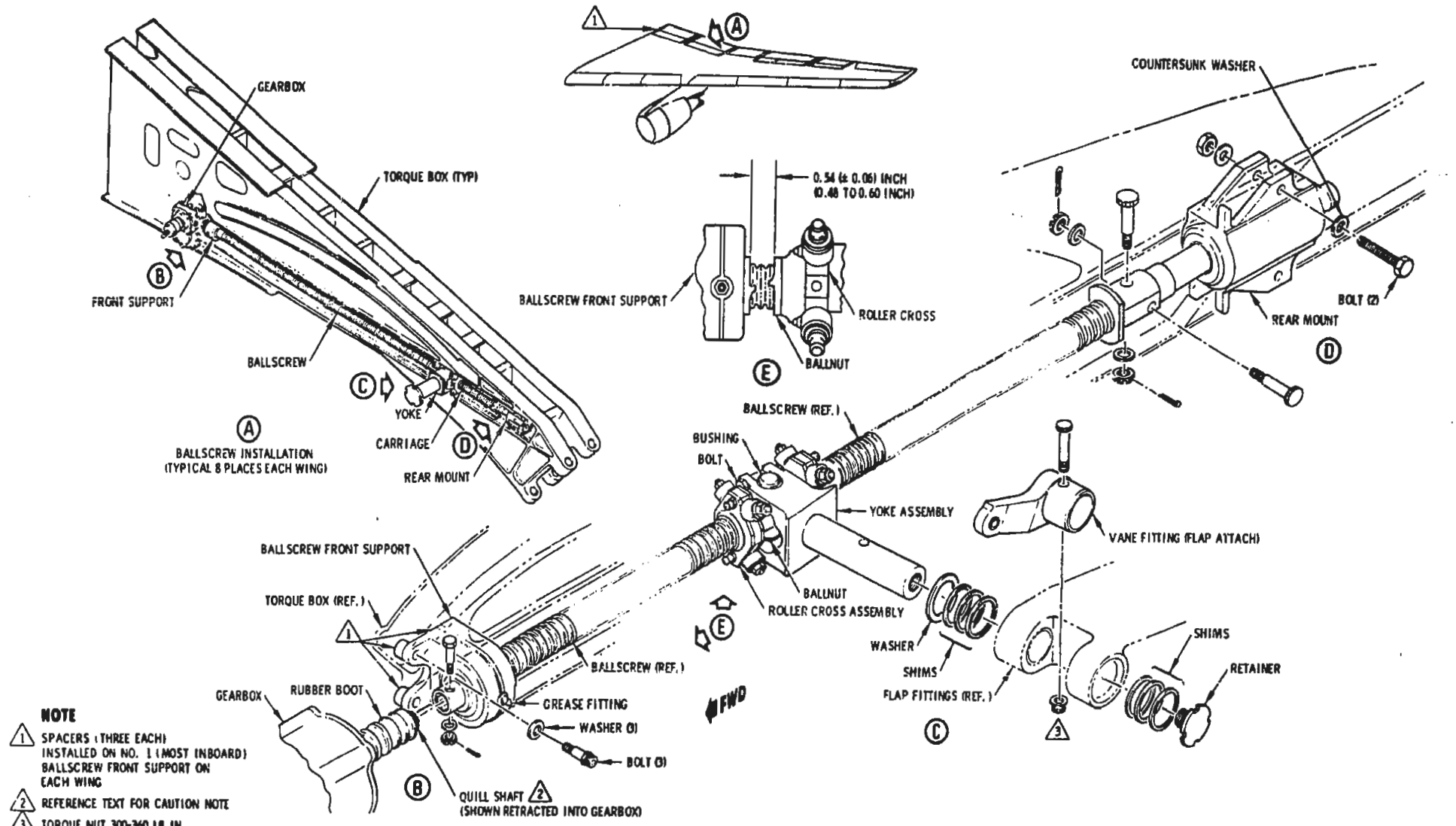
R B. Installation

WARNING: ENSURE THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00).

(1) Verify flap handle is in the fully extended position.

(2) Place replacement carriage ballscrew actuator on stand properly oriented for installation.

(3) Rotate ballscrew to move carriage to aft end of shaft.



R Flap Carriage Ballscrew Actuator Installation
R Figure 402

EFFECTIVITY: ALL

001B

(4) Orient ballscrew nut so that lube fitting is toward flap.

(5) Install yoke with flap attach arm to ballscrew nut (Ref. 27-51-30).

(6) Screw each bearing cross assembly onto ballscrew nut until adjustable bearings on cross assembly are oriented toward the flap with 0±1/2 thread protruding from cross assembly.

(7) Raise ballscrew assembly into position and slide carriage on tracks until ballscrew shaft is as far forward as possible, but do not mate ballscrew shaft with quill shaft.

(8) Rotate ballscrew shaft to move carriage forward to front support.

(9) Move aft end of ballscrew shaft to permit installing rear mount.

(10) Position rear mount forward of attach points and slide aft until ballscrew shaft can be mated with rear mount.

(11) Mate ballscrew shaft with rear mount and install shaft mating bolts, countersunk washers, and nut and torque bolts 50 to 70 lb in.

NOTE: On aircraft 001-023, on the No. 1 inboard flap inboard ball screw, the spacer under the aft end of the forward support should be 3/8-inch outside diameter. If not, replace with proper spacer.

R NOTE: On aircraft 024-999, on the No. 1 inboard flap inboard ballscrew, the spacer under the end of the forward support should be 7/16-inch outside diameter. If not, replace with proper spacer.

NOTE: Place countersunk side of countersunk washer under head of rear mount support bolt.

(12) Mate forward support with its aft mounting bolt by sliding forward support rearward to engage slotted hole with aft mounting bolt.

(13) Install but do not tighten forward support bolts.

(14) Rotate ballscrew shaft to move carriage aft and install rear mount attach bolts.

NOTE: Play between ballscrew and forward mount is provided to assure that flap loads are transmitted through flap tracks and not through forward mount. Normal play between ballscrew and forward mount is 0.040 to 0.050 inch (Radial Play). Maximum allowable play is 0.075 inch.

(15) Rotate ballscrew shaft to run carriage forward and aft several times and locate by feel the tightest point along the track.

(16) C Adjust carriage rollers to fit tightest position in track with only a slight drag when operating by hand. (5 in - lb maximum). Run carriage forward and aft. Check roller-to-track clearance at several points.

NOTE: Maximum allowable clearance at any travel position is 0.025 inch measured at one roller of each frog with other rollers resting against track. With carriage in forward position, verify that there are no vertical or horizontal (bending) loads on the ballscrew. [Carriage must be free to rotate slightly around ballscrew (rollers not riding hard on track).]

Adjust rollers by loosening the adjustable roller retaining nut and rotating the eccentric inner race of the roller. Upper and lower roller pairs should be adjusted equal amounts (Ref. 27-51-47).

(17) Tighten adjustable roller retaining nuts 160 to 190 lb in (4 places per carriage) and ensure that lock devices are properly engaged.

(18) Tighten the three forward support bolts (the aft bolt is hidden by the ballscrew).

NOTE: Don't forget bolt hidden by ballscrew.

(19) R R Rotate ballscrew shaft to move carriage so that clearance between the aft face of the flap carriage and the forward face of the ballscrew rear mount is the same as recorded in 4A(11).

NOTE: Maintaining accurate carriage position established in Step 4(19) while performing Step 4B(20) will minimize possible need for further rigging.

(20) With minimal rotation, mate quill shaft with ballscrew shaft.

NOTE: The quill shaft can be rotated to align bolt holes when pushed forward inside gearbox.

(21) Install quill shaft connecting bolt and torque bolt 50 to 70 lb in.

CAUTION: THE QUILL SHAFT BOLT HOLE IS LARGER THAN BALLSCREW BOLT HOLES TO ASSURE THAT TORSIONAL LOADS WILL BE TRANSMITTED BY SPLINE AND NOT BY BOLT. THE QUILL SHAFT CAN BE COUPLED TO BALLSCREW IN TWO POSITIONS, 180 DEGREES APART. IN THE INCORRECT POSITION, CONNECTING BOLT HOLE ALIGNMENT IS OFF A HALF SPLINE. IF CONNECTING BOLT IS INSTALLED IN THIS CONDITION (PUSH FIT) THE BOLT CAN ABSORB TORTIONAL LOADS AND THE QUILL SHAFT CAN EVENTUALLY FAIL.

TO ENSURE CORRECT INSTALLATION, VERIFY THAT CONNECTING BOLT FITS EASILY THROUGH BALLSCREW AND THE QUILL SHAFT, AND THAT THE QUILL SHAFT CAN MOVE AXIALLY (FORE AND AFT) AT LEAST 0.040 INCH AFTER BOLT INSTALLATION.

NOTE: The vendor (Curtiss Wright) has designed a new bolt with an undersized shank To allow quill shaft to be installed either way (Curtiss Wright SB 27-01). If possible, replace old bolt (PN 179923-1 with 12-point external wrenching head) with new bolt (PN 180400-1 with hex head).

CR NOTE: One piece shims can be installed between the screw
CR assembly front support and the torque box in order to
CR provide alignment with the transmission. Quill shaft
CR binding can occur if alignment is not assured.

(22) Attach yoke and flap attach arm to flap, while maintaining original shim position (Ref. 27-51-30).

NOTE: On outboard ballscrew replacement, use alignment bullet BF91 to align shims when installing the two bolts that secure the flap fitting to the flap.

(23) Move vane aft and attach vane actuators.

CAUTION: VERIFY THAT VANE ACTUATORS ARE FULLY EXTENDED (STRAIGHT). RETRACTING FLAPS WITH A FOLDED VANE ACTUATOR WILL DAMAGE THE VANE CAM AND ROLLER.

(24) Lubricate rear support, carriage, yoke, and forward support (Ref. 12-23-20).

(25) Remove flap support.

(26) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(27) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(28) Turn on electrical power (Ref. 24-41-00).

(29) Cycle flaps from full up to full down and back to full up at least two times.

(a) Verify that flaps and replaced ballscrew actuator operate smoothly without binding.

(30) With flaps in full up position, verify replaced ballscrew flaps-up rigging adjustment:

(a) Clearance between the flat on the forward face of the ballscrew carriage and the aft flat on the ballscrew front support stop must be 0.54 (±0.06) inch (0.48 to 0.60 inch)(Ref. Fig. 402).

NOTE: If clearance is incorrect, disconnect quill shaft from ballscrew, rotate ballscrew to obtain proper clearance and reconnect quill shaft to ballscrew.

(31) Close access panel.

(32) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(33) Turn off electrical power if no longer required (Ref. 24-41-00)

R # FLAP CARRIAGE BALLSCREW - Inspection and Check

R 1. General

R There are sixteen ballscrew actuators in the flap drive system (eight on each wing). This procedure applies to all sixteen ballscrew actuators.

R 2. Equipment and Materials

R Fixture, Ballscrew Backlash Gage, Curtiss-Wright L17491, or equivalent (G/ITEL No. 27-51-169)

R 3. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 4. Inspection/Check

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SERVICES AND GEAR DOOR TRAVEL AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R WARNING: IF BALLSCREW, QUILL SHAFT OR QUILL SHAFT RETAINING BOLT MUST BE REPLACED, CHECK FAIL-SAFE LINK INSTALLATION FOR STRUCTURAL DAMAGE (Ref. 27-51-35, Fig. 401).

R A. Check

R (1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic system C (Ref. 29-11-00).

(3) Operate flaps to fully extended position. (A check can be made at other positions if deemed necessary.)

(4) Turn off electrical power if no longer required (Ref. 24-41-00).

(5) Turn off hydraulic system C (Ref. 29-11-00).

WARNING: ENSURE THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(6) Removable panels for access to all ballscrew actuator shafts are specified in Table 601. Open only the panels for access to a specific shaft (Ref. 6-40-00).

Access Panels for Ballscrew Actuator Shafts
Table 601

	FLAP NO.	BALLSCREW SHAFT	L WING PANEL	R WING PANEL
	1	Inboard	541BB	641BB
	1	Outboard	541DB	641DB
	2	Inboard	541FB	641FB
	2	Outboard	541GB-2	641GB-2
R	3	Inboard	561BB	661BB
	3	Outboard	561BB	661BB
	4	Inboard	561CB	661CB
	4	Outboard	561CB	661CB

(7) At the ballscrew to be checked, push hard on the flap to insure that all freeplay in the AFT direction is eliminated. Remove grease from ballscrew in area for mounting check fixture.

R (8) Place the ballscrew gaging clamp around the ballscrew, slide it AFT to the ballnut and rotate the clamp so that its tang contacts the lower stop of the ballnut.

R NOTE: There should be approximately .05 axial clearance between the tang and the ballnut.

R Tighten the clamp. This prevents any rotational movement of the screw. When reverse load is applied, only axial displacement (or backlash) of the ballnut is indicated.

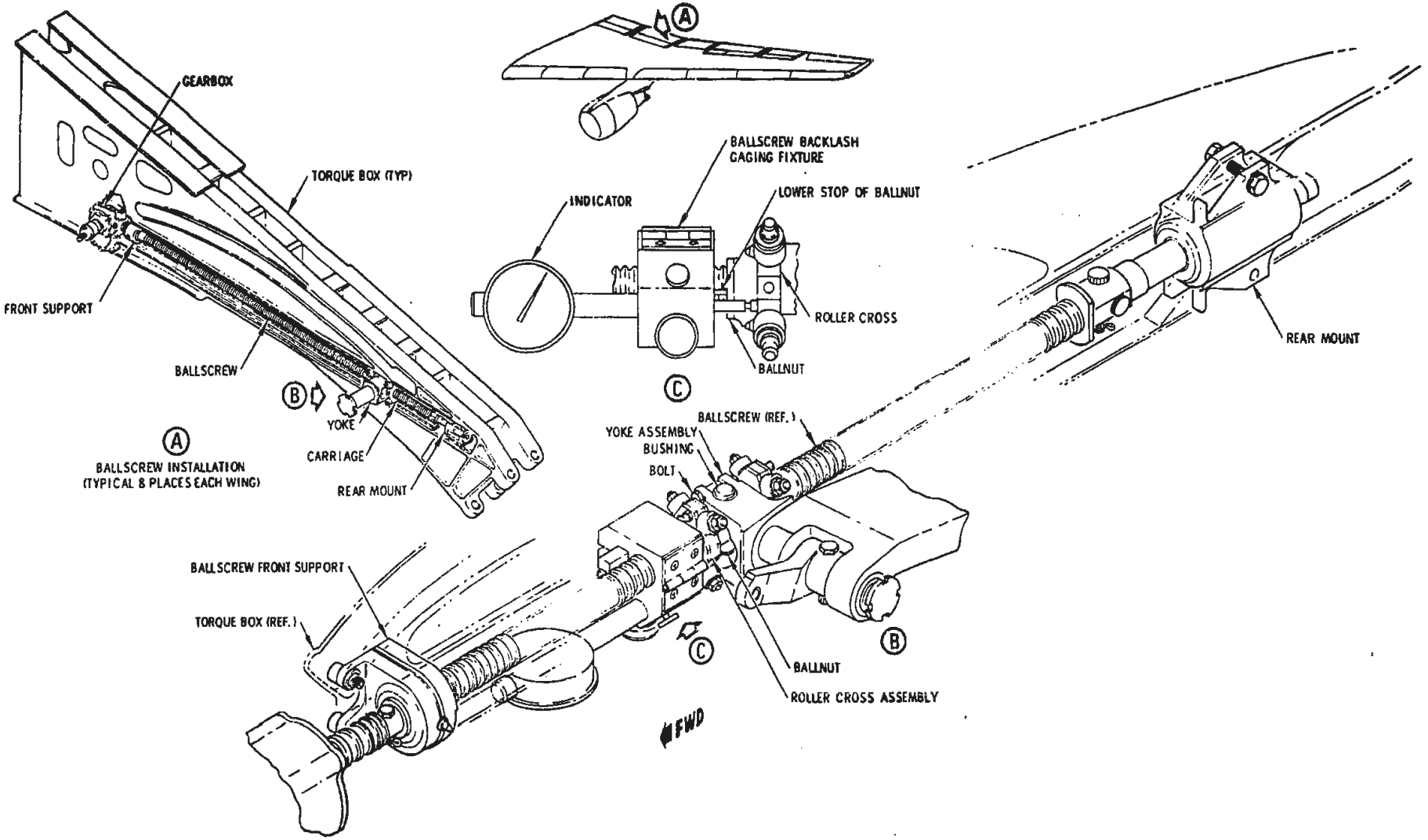
R (9) Place the indicator into the axial hole provided in the clamp. Insert it until it contacts the end face of the ballnut with an initial displacement of approximately .05 inches. Secure indicator in position by tightening small thumb-screw against the 3/8 dia. shank of the indicator. Push down on the flaps to eliminate all backlash in the AFT direction. Zero indicator.

R (10) Reading the backlash will require at least 2 men; one man in position to read the indicator and one man to manually raise the flap, thereby applying a reverse load to the nut assembly.

R Raise the wing flap and read the lash on the dial indicator. Maximum backlash should be 0.030 inches.

R (11) Remove clamp from ballscrew.

R (12) Close access panels (Ref. Table 601).



M1-0000-27-1051

R Ballscrew Backlash Check - Inspection and Check
R Figure 601

R EFFECTIVITY: ALL
R
001B

FLAP YOKE ASSEMBLY - REMOVAL AND INSTALLATION

1. General

Flap tracks are numbered 1 through 8 on each wing, with No. 1 being the most inboard track of each wing.

2. Reference Procedures

12-23-20	Flap, Vane, and Spoiler Lubrication
27-51-26	Flap Carriage Ballscrew Actuator - Removal and Installation

3. Equipment and Materials

Cotter Pin MS17825-5

4. Removal/Installation

A. Removal

(1) Remove flap carriage ballscrew actuator with yoke assembly attached (Ref. 27-51-26).

(2) Remove yoke assembly from flap carriage ballnut as follows (Ref. Fig. 401):

(a) Remove two bolts that attach yoke fitting forks to bearing shafts of flap carriage ballnut.

(b) Remove upper and lower bushings from bearing shafts on flap carriage ballnut.

(c) Slide yoke fitting free of carriage.

B. Installation

R (1) On flap tracks 1 and 3,
R install yoke assembly by sliding yoke fitting forks
R onto bearing shafts of flap carriage ballnut, with
R large radius cutout facing aft toward trailing edge of
R wing (Ref. Fig. 401).

R (1) On flap tracks 2 and 4,
R install yoke assembly by sliding yoke fitting forks
R onto bearing shafts of flap carriage ballnut, with

R large radius cutout facing forward toward leading edge
R of wing.

R (1) On flap tracks 5 through 8,
R install yoke assembly by sliding yoke fitting forks
R onto bearing shafts of flap carriage ballnut.

R NOTE: On flap tracks 5 thorugh 8,
R yoke fitting forks cannot be installed
R incorrectly onto bearing shafts of flap
R carriage ballnut on outboard flaps due to
R swept back on trailing edge of wing.

R (2) Install bushings on ballnut bearing shafts.

R (3) Install bolts, spacers, and nuts that secure yoke fitting to ballnut and torque nuts 75 to 100 lb in.

R (4) Install flap carriage ballscrew actuator, with yoke assembly attached, to torque box on the wing.

R (5) Install flap fitting onto flap yoke assembly shaft as follows (Ref. Fig. 401).

(a) Install washer and 3 shims.

(b) Insert flap attach vane actuator fitting through open slot of the flap fitting.

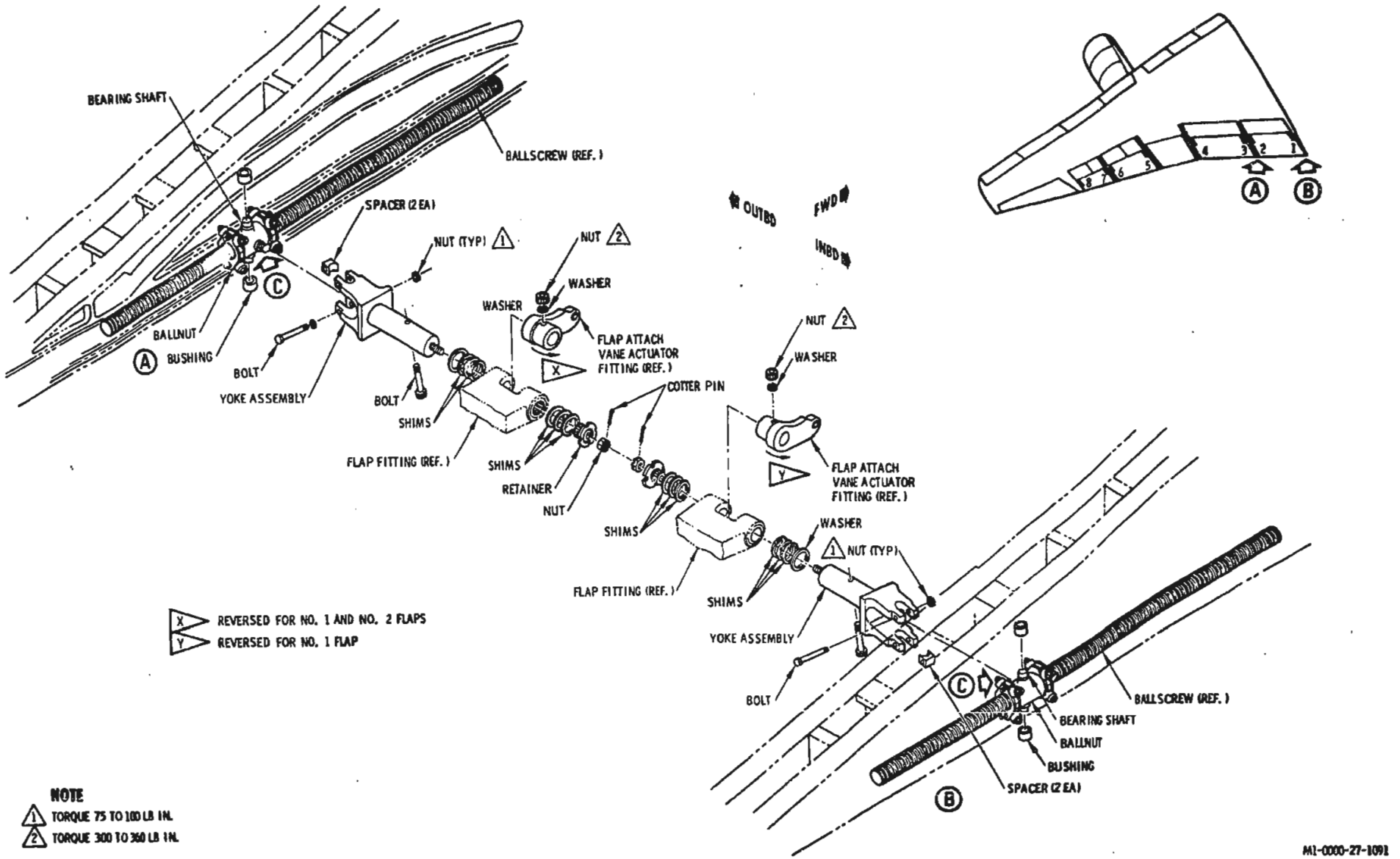
NOTE: Flap attach vane actuator fitting arm must face forward toward leading edge of the wing.

(c) Slide both the flap attach vane actuator fitting and flap fitting onto flap yoke assembly shaft (Ref. 27-51-26).

(d) Insert bolt through flap attach vane actuator fitting and flap yoke assembly shaft, and install washer, nut, and torque nut 300-360 lb in.

(e) Install at the end of flap yoke assembly 3 shims, retainer, nut, and cotter pin.

R (6) Lubricate yoke fitting and flap carriage ballscrew actuator (Ref. 12-23-20).



CR Yoke Assembly - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL

001B

R WING FLAP BALLSCREW REAR MOUNT - REMOVAL AND INSTALLATION

R 1. General

R There are sixteen ballscrew actuator rear mounts in the flap drive system (eight on each wing). This procedure applies to all sixteen rear mounts.

R 2. Referenced Procedures

R	12-23-20	Flap, Vane and Spoiler Lubrication
R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Removal/Installation

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R A. Removal (Ref. Fig. 401)

R (1) Turn on electrical power (Ref. 24-41-00).

R (2) Turn on hydraulic system C (Ref. 29-11-00).

R (3) Position flap handle to fully extend flaps.

R (4) Turn off hydraulic system C (Ref. 29-11-00).

R WARNING: ENSURE THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00).

(5) Remove the two bolts that attach the rear mount to the torque box.

(6) Replace rear mount bolts with undersize bolts. (Bolts can be installed without nuts.)

(7) Turn on hydraulic system C.

(8) Retract flaps until the top surface of the flap is just below the rear mount. (This moves the ballscrew as far forward as possible and still allows access to the rear mount.)

(9) Remove the two undersize bolts installed in the rear mount.

(10) Remove the two bolts connecting the ballscrew shaft to the rear mount.

(11) Pull the stop aft until it clears the ballscrew shaft.

(12) Using HAND PRESSURE only, pull ballscrew shaft out and up. While holding ballscrew in this position, slide rear mount forward to clear attaching flange, then out and aft.

(13) Release ballscrew shaft.

B. Installation (Ref. Fig. 401)

(1) Position the stop on the rear mount shaft.

(2) Using HAND PRESSURE only, pull ballscrew shaft out and up. While holding ballscrew shaft in this position, slide rear mount forward and behind ballscrew until the rear mount clears the attaching flange. Then slide rear mount aft into position.

(3) Release ballscrew shaft.

(4) Slide rear mount and stop forward onto ballscrew shaft.

R (5) Install original bolts, washers and nuts attaching rear mount to torque box.

R NOTE: Do not use undersized bolts to attach rear mount
R to torque box.

(6) Install bolts through stop, rear mount shaft and the ballscrew shaft. Install washers, nuts and cotter keys.

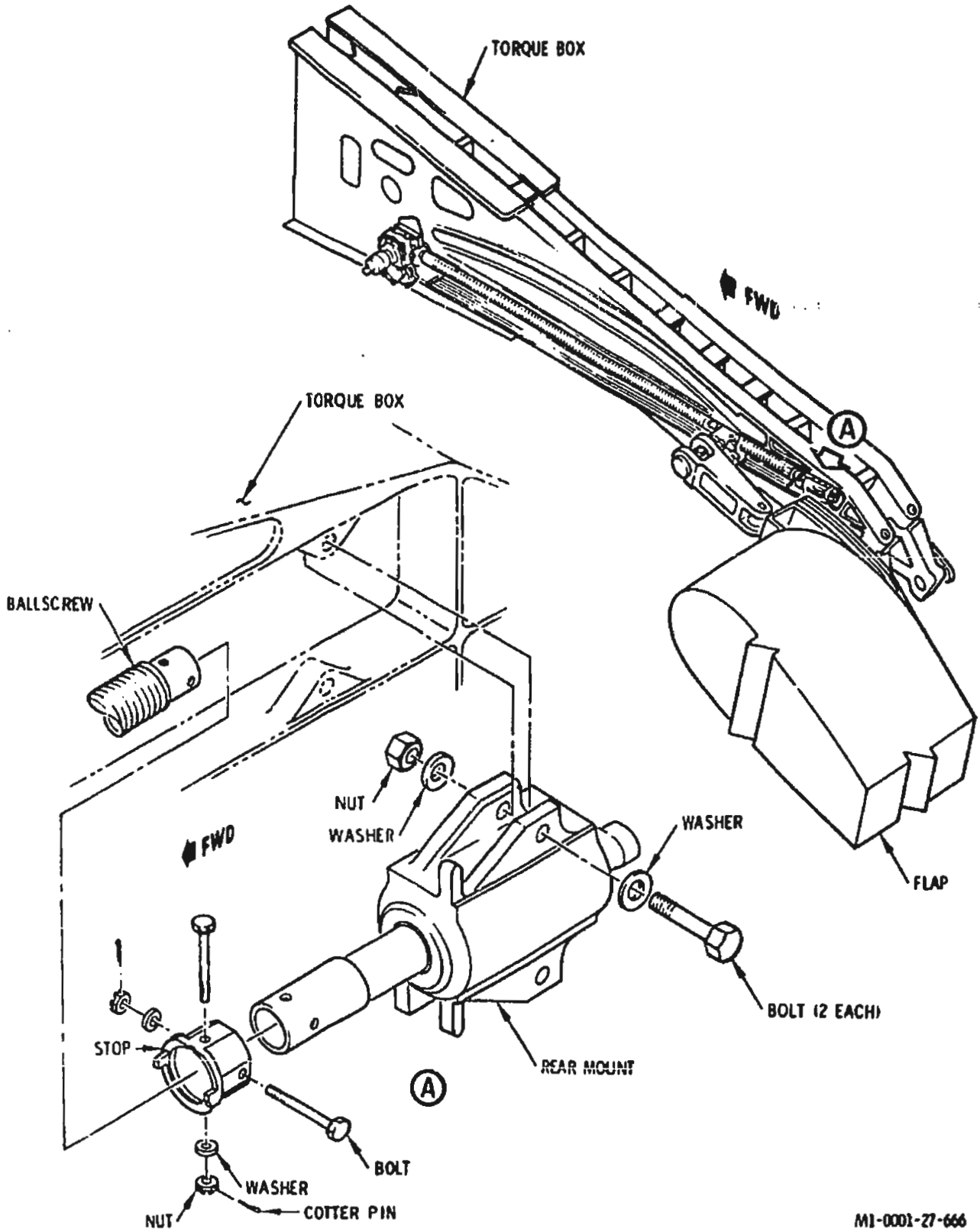
(7) Lubricate rear mount (Ref. 12-23-20).

(8) Turn on hydraulic system C (Ref. 29-11-00).

(9) Operate flaps through several full extend to full retract cycles. Verify normal operation of the flap actuation system.

(10) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(11) Turn off electrical power if no longer required (Ref. 24-41-00).



R Wing Flap Ballscrew Rear Mount - Removal and Installation
R Figure 401

WING FLAP - REMOVAL AND INSTALLATION

1. Equipment and Materials

Grease, MIL-G-23827A, or equivalent

Corrosion Preventive Compound, Grade 4, MIL-C-16173, or equivalent

Sling Assembly, General Purpose, PN B-715, or equivalent

Hoist, 500-Pound Minimum Capacity

Alignment Bullets, PN BF91 and BF92, or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	12-23-20	Flap, Vane, and Spoiler Lubrication
	20-00-03	Sealing of Threaded Steel Joints for Corrosion Protection - PB75-484A
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-51-00	Wing Trailing Edge Flap Control System - Adjustment and Test
R	27-51-42	Vane - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices
	57-00-00	Structure Repair Manual - Flap Actuator Fitting Bolts, Salvage Procedure

3. Removal/Installation

R A. Removal

(1) Remove appropriate access panels from underside of wing. Refer to Table 401 (Ref. 6-40-00).

Wing Access Panels
Table 401

FLAP NUMBER	LEFT WING	RIGHT WING
1	541 BB and 541 DB	641 BB and 641 DB
2	541 FB and 541 GB-2	641 FB and 641 GB-2
R 3	561 BB	661 BB
4	561 CB	661 CB
Asymmetry Brake	571 AB	671 AB

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A and C (Ref. 29-11-00).

(4) Extend flaps as required to extend vane actuator (Ref. 27-51-00).

(5) Disconnect aft end of vane actuators from flap attach fitting at inboard and outboard ends of flap (Ref. 27-51-42).

(6) Secure vane in the fully retracted (forward) position.

(7) Fully extend flaps (Ref. 27-51-00).

(8) Shut off hydraulic systems A and C and tag Flight Engineer/Second Officers hydraulic system panel, zone 215, and the hydraulic service panel, zone 147.

(9) Turn off electrical power if no longer required (Ref. 24-41-00).

(10) Install sling lifting adapters (three places). Attach sling and take up slack without applying lifting force to flap.

NOTE: The three sling attach points incorporate 1/4-inch flush screws installed in nut plates. There are two attach points in the leading edge, one on each end approximately five inches aft of leading edge and four inches from end of flap. The third attach point is located approximately ten inches forward of trailing edge and mid-span.

The weight of the flaps are as follows: No. 1 flap, 365 pounds; No. 2 flap, 388 pounds; No. 3 flap, 305 pounds; and No. 4 flap 218 pounds.

(11) Remove flap torque box fairing (Ref. Para. 4).

(12) Remove attach bolt assembly from flap fail-safe linkage (Ref. Fig. 401).

NOTE: If replacement flap does not have fitting installed on flap rib, remove the fitting for installation on replacement flap.

CR NOTE: Inspect clevis assy for wear per component wear
CR limits chart (27-51-00, Page 606).

CR Replace assy. if wear exceeds specified limits.

CR With all minimum specifications present, assy.
CR is still available to be returned to service.

(13) Disconnect outboard end of flap as follows (Ref. Fig. 402):

(a) Remove bolt that secures pin in flap outboard swing link assembly. Remove pin that secures swing link to torque box. Move carriage assembly aft to disengage swing link from torque box. Tag shim with its location; shim will be reinstalled when installing replacement flap. Manually move carriage assembly, with swing link attached, to full aft position in flap rib tracks and secure.

(b) Remove two flap actuator fitting bolts that secure forward outboard yoke fitting to outboard flap rib. Manually move outboard end of flap aft to

disengage flap rib from yoke. Use care not to damage shims. Tag shims with their location; shims will be reinstalled when installing replacement flap.

NOTE: If flap actuator fitting bolts on flaps 1, 2, or 3 show signs of corrosion, repair and salvage bolts in accordance with procedures in the Structure Repair Manual 57-00-00.

(14) Disconnect inboard end of flap as follows (Ref. Fig. 402).

(a) Remove nut and splined retainer that secures flap attach fitting to ballscrew carriage yoke fitting. Note and record location and number of shims. Retain shims for reinstallation.

(b) Remove pin that secures inboard aft end swing link to torque box. Maneuver swing link free of torque box clevis fitting. Tag shim with its location; shims will be reinstalled when installing replacement flap.

(c) Remove cotter pin, nut and bolt that secures vane actuator fitting to yoke.

(15) Slide flap off yoke. Note and record location and number of shims. Retain shims for reinstallation. Maneuver flap away from aircraft and lower to a suitable support. Remove sling from flap.

(16) Remove flap swing link and carriage from tracks on flap rib at each end of flap as follows (Ref. Fig. 402):

(a) Remove roller cross (frog) from each end of carriage body. (Do not remove rollers from cross.) Rotate cross horizontal to tracks and remove from between tracks.

(b) Remove carriage body, with swing link attached, from between tracks. Tag carriage body to insure it is reinstalled in the same location on replacement flap.

NOTE: The flap swing link carriage frogs (roller crosses) are safetied with a special tab washer. If a tab washer is found with the tab broken off, (the tab engages a hole in the frog), the tab washer need not be replaced as long as the lock-wire is intact. The tab is for alignment only. A

broken tab washer should be replaced when the frog or carriage is removed. It should be noted that a broken tab washer indicates a lack of lubrication of the carriage body monoball bearing.

B. Installation

(1) Verify that hydraulic systems A and C are shut off and that warning tags are installed on the hydraulic panels.

(2) Verify that the fail-safe fitting is installed on flap rib [Ref. Step 3A(12)].

(3) Install a flap carriage assembly, with swing link attached, on the tracks at each end rib of the flap as follows (Ref. Fig. 402):

NOTE: Previously removed carriages with swing link shall be used. Install on replacement flap in same relative position so that swing links are not interchanged.

(a) Insert carriage body, with flap swing link attached, between tracks on flap end rib. Verify that arrows on carriage body point up.

(b) Insert roller crosses horizontally between tracks with grease fittings outside. Rotate to a vertical position and attach to carriage body.

NOTE: Roller crosses must be installed with the large rollers riding on the lower track.

Install tab washer so that tangs engage slots in body trunnion and tab engages hole in roller cross. Verify that eccentric bolt hole in trunnion matches hole in tab washer. Secure roller cross to body with bolt. Torque bolt 60 to 65 lb inch and lock-wire bolt to tab washer.

(c) Move carriage assembly along tracks as far as possible in the fore and aft direction. Adjust rollers on both the forward and aft carriage crosses to fit tightest position in track with
R only slight drag when moved by hand (50 pounds
R maximum).

R (d) Maximum clearance permissible at any position
R along travel is 0.025 inch measured at one roller

of each roller cross with other rollers resting against track.

NOTE: Adjust rollers by loosening the lubricator barrel, to disengage serrated washers, and rotating the eccentric inner race of the roller.

NOTE: On aircraft 001-031 WITHOUT SB57-119, upper and lower roller pairs should be adjusted equal amounts. Point the grease fittings away from the center of the carriage. Ensure that serrated locking washer tangs are properly engaged in roller slots. Tighten the lubricator barrel and lock wire.

NOTE: On aircraft 001-031 WITH SB57-119 AND 032-999, only small upper roller with lubricator barrel can be adjusted. Point the grease fitting away from the center of the carriage. Ensure that serrated locking washer tangs are properly engaged in roller slots. Tighten the lubricator barrel and lock wire.

(4) Install sling lifting adapters (three places). Attach sling and operate hoists to position flap at approximately the angle of full extension.

(5) Carefully hoist flap into position on wing.

(6) Attach swing link at aft inboard end of flap first as follows:

(a) Apply a light film of grease to flap swing link clevis fitting on torque box and to swing link mounting pin (Ref. 12-23-20).

(b) Reinstall laminated shims removed in Step 3A(14)(b) on bottom of swing link. Align holes in torque box and swing link with BF92 bullet and attach swing link to torque box with mounting pin.

NOTE: If original shim is damaged or unavailable, peel new laminated shim to obtain 0.00 to 0.01 inch gap between torque box and swing link.

(c) Verify swing link swings on torque box without binding.

CAUTION: USE CARE WHEN INSTALLING COATED SWING LINK PINS TO PREVENT DAMAGE TO COATING. IF COATING CHIPS, RETURN PIN TO SHOP FOR RECOATING.

(d) Install pin retaining bolt through swing link and pin; secure with washer and nut.

(7) Rotate yoke pivot arm on forward inboard end of flap and slide onto inboard carriage yoke and install shims in original position. Shim number and distribution must match distribution and number of shims on outboard yoke fitting of that flap. Secure with splined retainer, nut and cotter pin.

NOTE: Normally shims are positioned three on each side of swing fitting. Shims can be shifted to center flap between torque boxes and provide equal gaps between the flap and inboard and outboard torque boxes. Distribution of shims on inboard and outboard yokes of the same flap must be identical.

(8) Disconnect sling from aft center lifting adapter.

(9) Attach forward outboard end of flap to ball screw carriage yoke fitting as follows:

(a) Position end of flap in yoke fitting(Ref. Fig. 402).

(b) On flap No. 1 and 2, reinstall shims removed in Step 3A(13)(b) as follows:

- Install two nonlaminated shims above and two nonlaminated shims below flap rib.

- Install one laminated shim between the lowest nonlaminated shim and yoke fitting. If original laminated shim is damaged or unavailable, peel new laminated shim for a snug fit.

(b) On flap No. 3, reinstall shims removed in Step 3A(13)(b) as follows:

- Install one nonlaminated shim above and one nonlaminated shim below flap rib.

(b) On flap No. 4, reinstall shims removed in Step 3A(13)(b) as follows:

- Install one nonlaminated shim above and one nonlaminated shim below flap rib.

- Install one laminated shim between upper nonlaminated shim and flap rib and install one laminated shim between lower nonlaminated shim and yoke fitting. If original laminated shims are damaged or unavailable, peel new laminated shims to approximately equal thickness to provide a snug fit.

(c) Apply MIL-C-16173 corrosion preventive compound to the two actuator fitting bolts (Ref. 20-00-03).

(d) On flap No. 1 and 4, secure flap to fitting with the actuator fitting bolts; use BF91 bullet to align shims.

(d) On flap No. 2, reinstall one laminated washer removed in Step 3A(13)(b) on each actuator fitting bolt. If original laminated washers are damaged or unavailable, peel new laminated washer to thickness required for proper engagement of cotter pin in nut. Secure flap to fitting with bolts; use BF91 bullet to align shims.

(d) On flap No. 3, reinstall one laminated washer removed in Step 3A(13)(b) on each actuator fitting bolt. Install bolts through yoke fitting, shims and flap rib. Install the second laminated washer removed in Step 3A(13)(b), plain washer and nut. Install nut and cotter pin. If original laminated washers are damaged or unavailable, peel new washers to approximately equal thickness required for proper engagement of cotter pin in nut.

(10) Attach swing link at aft outboard end of flap [Ref. Step 3B(6)].

(11) Install bolt to connect flap fail-safe linkage between flaps (Ref. Fig. 401).

(12) Remove sling and hoist.

(13) Install flap torquebox fairing (Ref. Para. 4).

(14) Retract flaps as required to connect vane actuators (Ref. 27-51-42) to each end of flap.

CAUTION: VERIFY THAT VANE ACTUATOR IS FULLY EXTENDED (STRAIGHT). RETRACTING FLAPS WITH A FOLDED VANE ACTUATOR WILL DAMAGE THE VANE ACTUATOR CAM AND ROLLER.

(15) Check rigging of flap (Ref. 27-51-00).

(16) Replace all access covers removed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAVETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(17) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(18) Cycle flaps from full up to full down and back to full up for several cycles. Verify that flap operation is normal.

(19) Turn off hydraulic power if no longer required (Ref. 29-11-00).

4. Flap Torque box Fairing - Removal/Installation

A. Removal

(1) Remove upper & lower seal strips (torquebox 2 only)

(2) Remove fairing assemblies to gain access to upper & lower struts

NOTE: Mark location of each access fairing assembly if more than one torquebox fairing assembly is removed. Each fairing panel is individually trimmed & drilled to a rig fit.

(3) Disconnect aft end of upper & lower adjustment struts by removing cotter pins, nuts, washers, and bolts. Do not change adjusted length of strut.

(4) While a man supports inboard torquebox fairing assembly, remove cotter pins, nuts, washers, and bolts from upper and lower hinge points. Note and record position of any spacers or shims.

(5) Lower torquebox fairing assembly.

(6) Repeat Step 4A(4) for outboard torquebox fairing assy.

B. Installation

(1) Lift outboard torquebox fairing assembly to its respective hinge points and secure with bolts, washers, and nuts at upper and lower hinges. All shims and washers must be replaced in same position as removed.

(2) Repeat Step 4B(1) with inboard torquebox fairing assembly.

(3) Connect aft end of upper and lower struts to attach points with bolts, washers, and nuts.

(4) Test fit lower access fairing assemblies. If adjustment struts were not changed, torque box fairing assembly should be correctly rigged and screwholes should align. If not, see Paragraph 4C.

(5) Secure upper and lower struts with cotter pins.

(6) Install lower than upper access fairing assemblies.

(7) Install upper and lower seal strips (torquebox 2 only).

C. Torquebox Fairing Adjustment

(1) To align fairing access panels on torquebox No. 2, accomplish following:

NOTE: If screwholes on one lower fairing access panel can be aligned, then only adjust the remaining access panel for alignment.

(a) Disconnect aft end of upper and lower outboard adjustment struts.

(b) Manually pivot outboard torquebox fairing until screwholes align with access fairing panel.

(c) Hold fairing panel in place with 4 screws.

(d) Remove lockwire from locknuts at aft end of disconnected struts.

(e) Lengthen or shorten struts as necessary to connect struts at their appropriate attach points.

(f) Secure struts with bolts, washers, and nuts. Safety with cotter pin.

(g) Tighten locknuts and safety with lockwire.

(h) Remove outboard fairing access panel. (To gain access to inboard strut for adjustment.)

(i) Repeat Steps 4C(1)(a) - 4C(1)(g) for inboard fairing access panel and inboard struts.

(j) Install remaining screws on inboard fairing access panel and install outboard fairing access panel.

(k) Install upper fairing access panel.

(l) Install upper and lower seal strips.

(2) To align fairing access panels on torquebox No. 5, accomplish following:

NOTE: If screwholes on one lower fairing access panel can be aligned, then only adjust the remaining access panel for alignment.

(a) Disconnect aft end of upper and lower outboard adjustment struts.

(b) Manually pivot outboard torquebox fairing assembly until screwholes align with fairing access panel.

(c) Hold fairing access panel in place with 4 screws.

(d) Remove lockwire from locknut at aft end of upper outboard strut.

(e) Remove aft clip from turnbuckle of lower outboard strut.

(f) Lengthen or shorten struts as necessary to connect struts to their appropriate attach points.

(g) Secure struts with bolts, washers, and nuts. Safety with cotter pin.

(h) Tighten locknut on upper outboard strut and safety with lockwire.

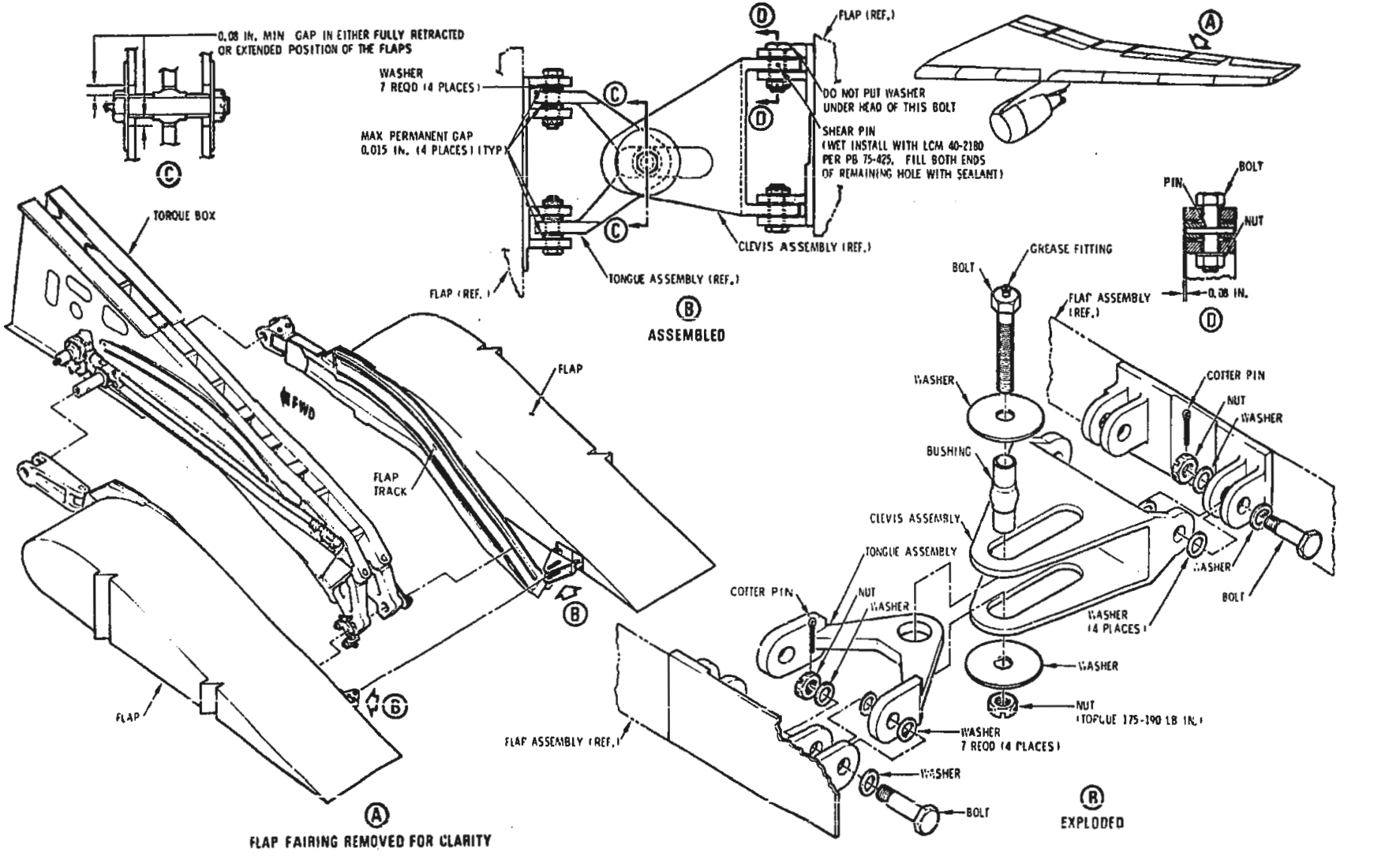
(i) Install lock-clip on lower outboard strut.

(j) Remove outboard fairing access panel assembly. (To gain access to inboard strut for adjustment if necessary.)

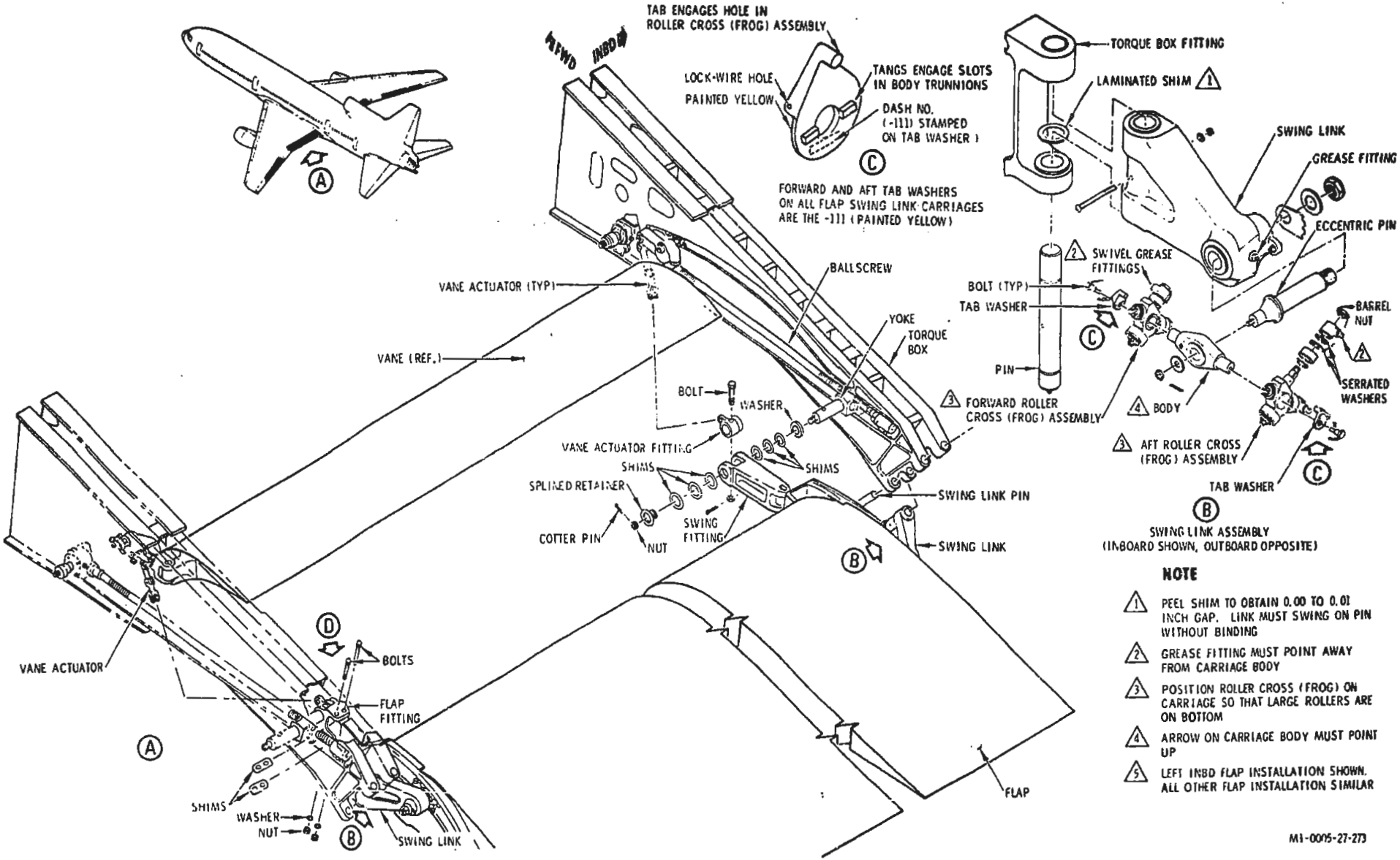
(k) Repeat Steps 4C(2)(a) - 4C(2)(i) for inboard fairing access panel and inboard struts.

(l) Install remaining screws on inboard fairing access panel and install outboard fairing access panel.

(m) Install upper fairing access panel.



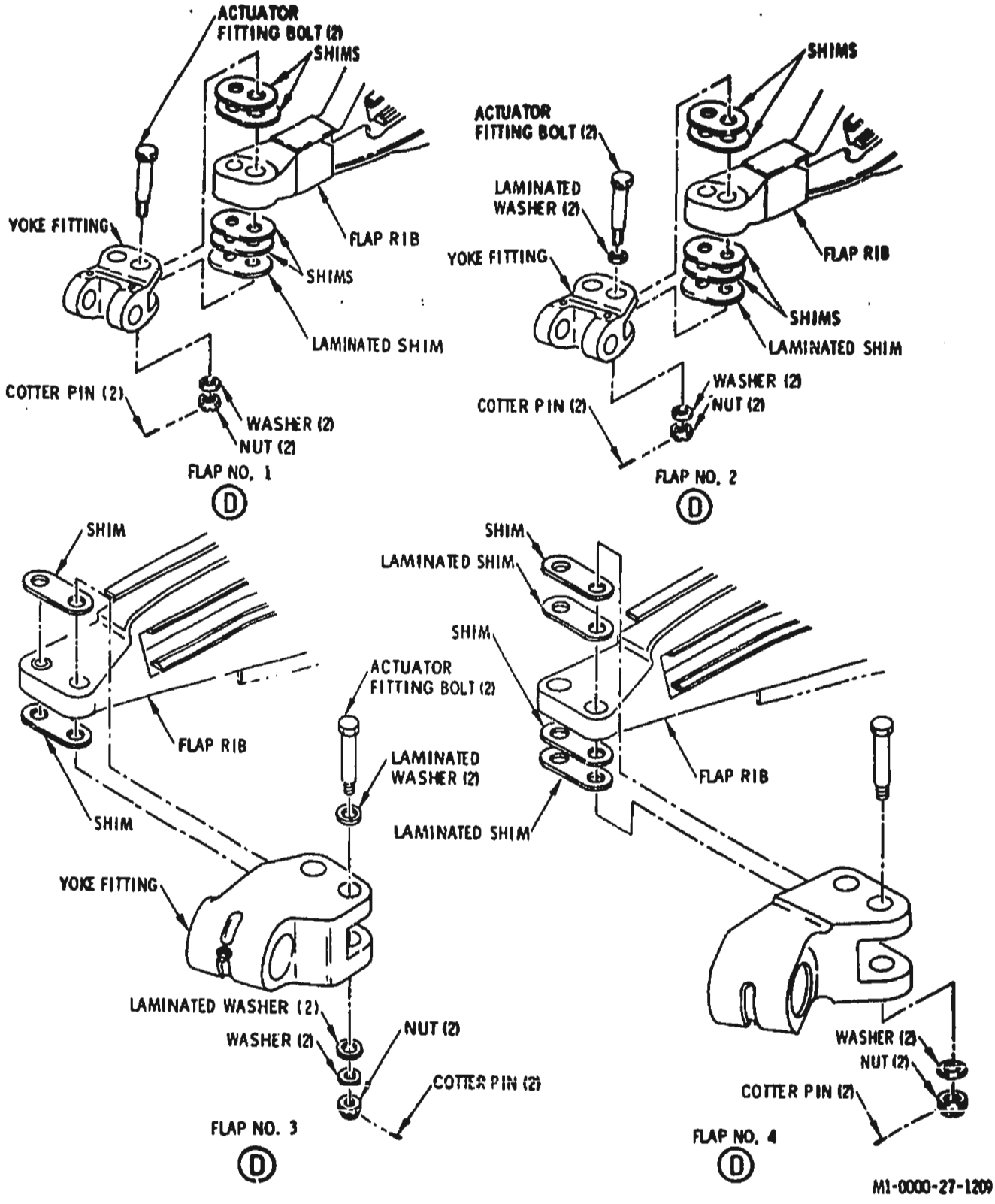
Flap Fail-Safe Linkage
Figure 401



R Wing Flap - Removal and Installation
R Figure 402 (Sheet 1)

EFFECTIVITY: ALL

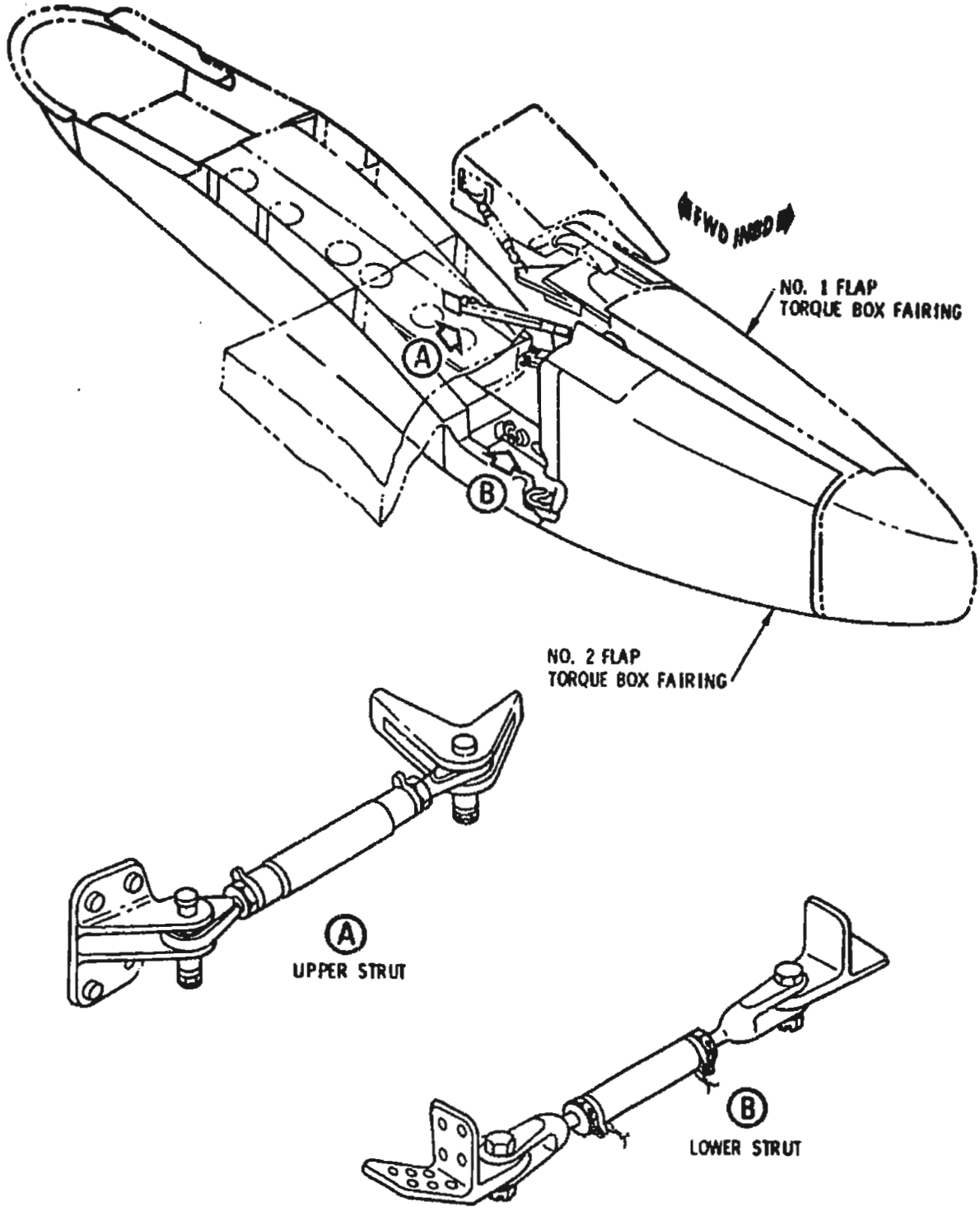
001B



R Wing Flap - Removal and Installation
R Figure 402 (Sheet 2)

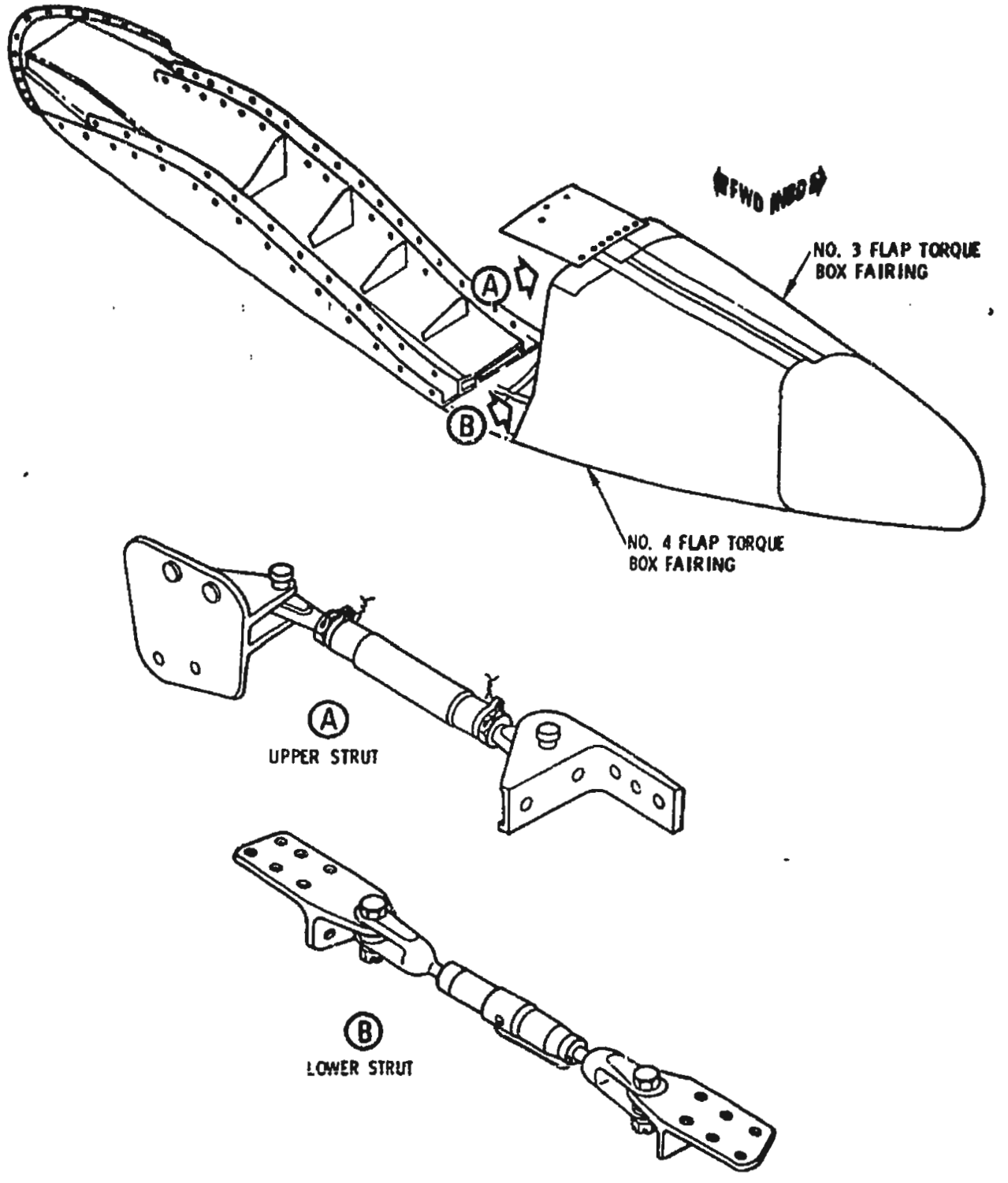
EFFECTIVITY: ALL

001B



M1-0001-27-586

Flap Torquebox Fairing - Torquebox No. 2 - Removal and Installation
Figure 403 (Sheet 1)



M1-0001-27-881

Flap Torquebox Fairing - Torquebox No. 5 - Removal and Installation
Figure 403 (Sheet 2)

R TORQUE BOX MOUNTED FLAP TRACKS - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Sealing Compound, Low Adhesion, C-40-769 Type II (Product
R Research Co., PR 1301BT-K, or equivalent)

R 2. Referenced Procedures

R 20-51-04 Environmental Sealing of Model L1011 Airplane - PB75-425D

R 27-51-26 Flap Carriage Ballscrew Actuator - Removal and Installation

R 2. Removal/Installation

R A. Removal (Ref. Fig. 401)

R (1) On end of flap where flap track will be replaced, disconnect flap from ballscrew actuator yoke and remove ballscrew actuator from torque box in accordance with removal procedures in 27-51-26. (Disregard last step which requires removal of yoke from ballscrew.)

R (2) Remove bolts attaching flap track to the torque box track support and remove track.

R NOTE: The flap track is installed with faying surface sealant. Use care and soft materials to pry track from the torque box.

R (3) Thoroughly clean old sealant from the track support mounting surface of the torque box.

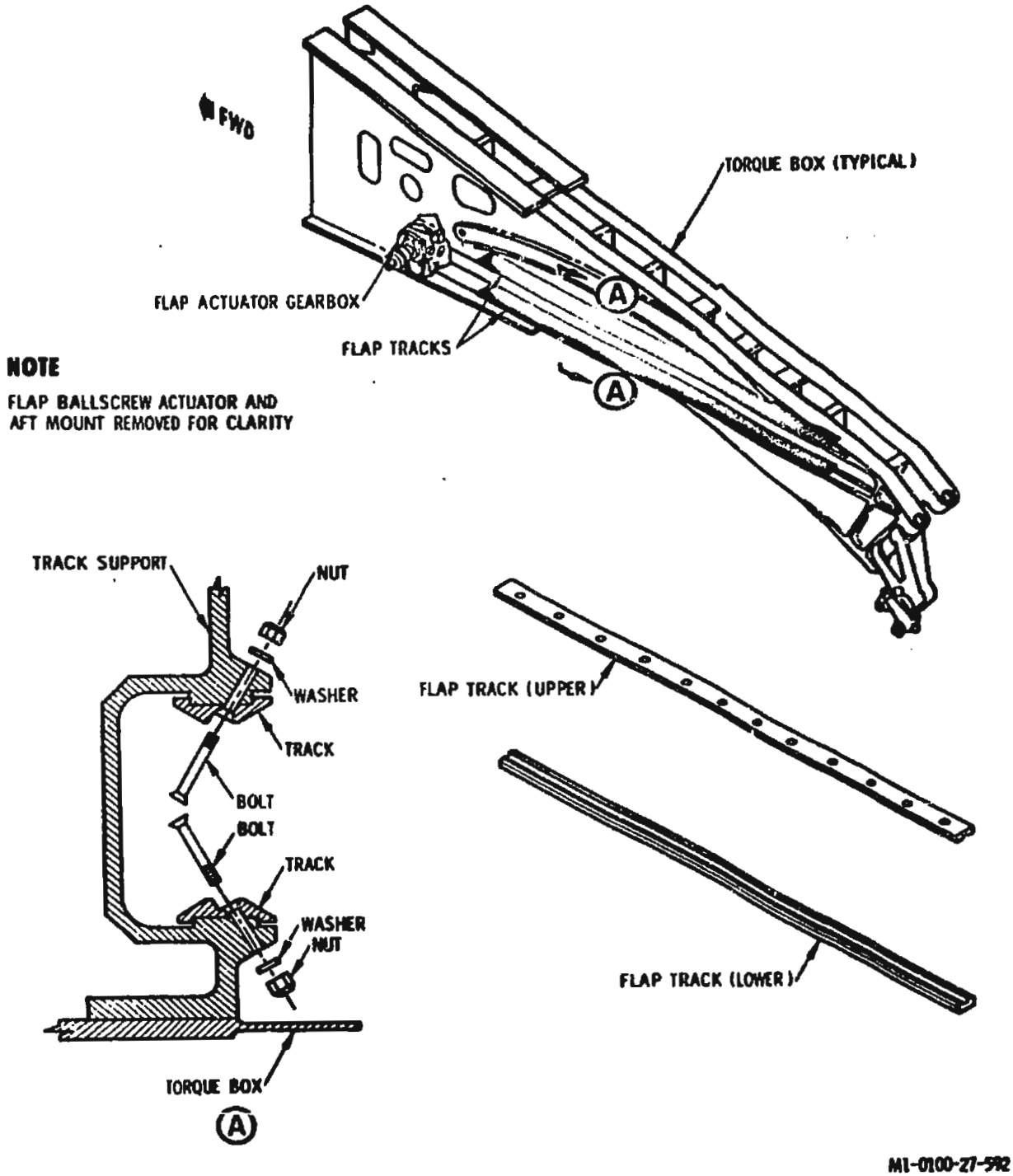
R B. Installation (Ref. Fig. 401)

R NOTE: Verify that all old sealant is removed from the track support mounting surface. Old sealant left on surface could result in local tight spots in carriage roller operation and make carriage roller adjustment difficult.

R (1) Install track using sealant on faying surfaces and on bolts (Ref. 20-51-04). (Use release agent on track faying surfaces.)

R NOTE: If possible, use C-40-769 Type II sealant to provide longer sealant set-up time. When applying faying surface sealant, verify that sealant is applied evenly to ensure that installed tracks will be parallel.

R (2) Install ballscrew actuator on the torque box and connect the flap to the ballscrew actuator in accordance with installation procedures in 27-51-26. (Ignore step installing yoke to ballscrew nut as yoke was not removed from ballscrew nut.)



R Torque Box Mounted Flap Tracks - Removal and Installation
R Figure 401

R FLAP MOUNTED FLAP TRACKS - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Sealing Compound, Low Adhesion, C-40-769 TYPE II (Product
R Research Co., PR 1301BT-K, or equivalent)

R 2. Referenced Procedures

R 20-51-04 Environmental Sealing of Model L-1011 Airplane -
R PB75-425D

R 27-51-35 Wing Flap - Removal and Installation

R 3. Removal/Installation

R A. Removal (Ref. Fig. 401)

R (1) Remove wing flap from aircraft in accordance with
R removal procedure in 27-51-35.

R (2) Place flap on suitable support and protect with pads.

R NOTE: Remove swing link and carriage only from end
R where track will be replaced.

R (3) Remove bolts attaching flap track to the track support.
R Remove flap track from flap.

R NOTE: The flap track is installed with faying surface
R sealant. Use care and soft materials to pry
R track from the track support.

R (4) Thoroughly clean old sealant from the track support
R mounting surface on the flap end rib.

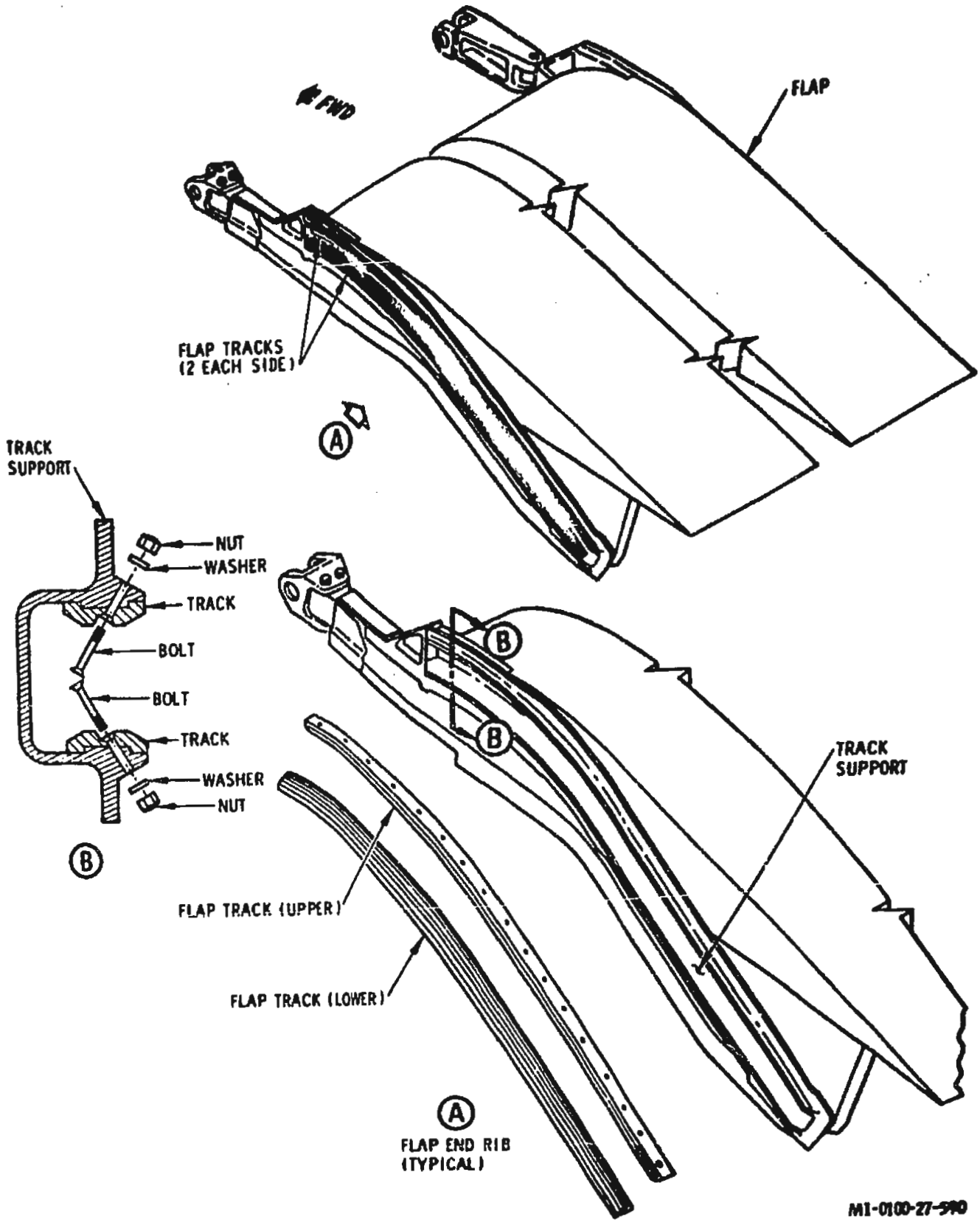
R B. Installation (Ref. Fig. 401)

R NOTE: Verify that all old sealant is removed from the track
R support mounting surface. Old sealant left on
R mounting surface could result in local tight spots in
R carriage roller operation and make carriage roller
R adjustment difficult.

R (1) Install track using sealant on faying surfaces and on
R bolts (Ref. 20-51-04). (Use release agent on track
R faying surfaces.)

R NOTE: If possible, use C-40-769 Type II to provide
R longer sealant set-up time. When applying
R faying surface sealant, verify that sealant is
R applied evenly to ensure parallel tracks.

R (3) Install swing link and carriage on flap and install
R flap on aircraft in accordance with installation
R procedure in 27-51-35.



R R Flap Mounted Flap Track - Removal and Installation
Figure 401

R R MB EFFECTIVITY: ALL

FLAP SWING LINK CARRIAGE ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Lock-Wire, QQ-W-390, TEMP A, 0.032 Diameter, or equivalent

Grease, MIL-G-23827A, or equivalent

2. Referenced Procedures

12-23-20	Flap, Vane, and Spoiler Lubrication
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic systems A and C (Ref. 29-11-00).

(3) Fully extend flaps (Ref. 27-51-00).

(4) Turn off hydraulic systems A and C (Ref. 29-11-00).

(5) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

(6) Support trailing edge of flap panel with maintenance stand and pads.

R R R R (7) Disconnect swing link from torque box by removing swing link pin retaining bolt and swing link pin. Do not permit carriage assembly and swing link to run to end of flap track (Ref. Fig. 401).

(8) Remove roller cross from each end of carriage body. (Do not remove rollers from cross.) Turn crosses flat and remove from tracks. (Body can now be removed from tracks.)

NOTE: The flap swing link carriage frogs (roller crosses) are safetied with a special tab washer. If a tab washer is found with the tab broken off (the tab engages a hole in the frog), the tab washer need not be replaced as long as the lock-wire is intact. The tab is for alignment only. A broken tab washer should be replaced when the frog or carriage is removed. It should be noted that a broken tab washer indicates a lack of lubrication of the carriage body monoball bearing.

(9) Remove nut and locking device that secures carriage body to the eccentric pin on the swing link.

B. Installation

(1) Verify hydraulic systems A and C are shut off and warning tags are installed on the hydraulic panels.

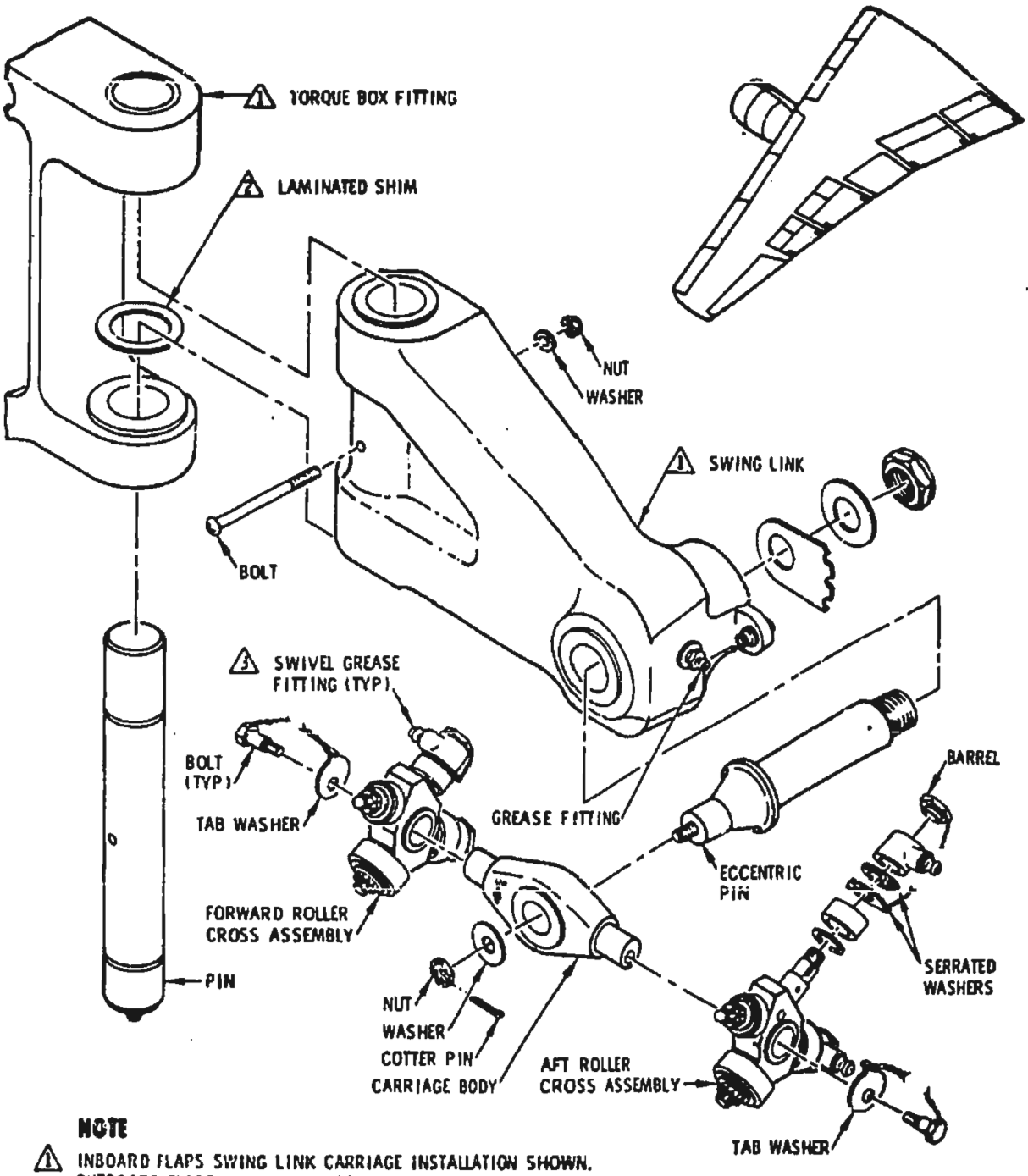
(2) Assemble flap aft support carriage assembly to the eccentric pin on the swing link. Safety nut with cotter pin.

(3) Remove bearing cross from each end of carriage assembly. (Do not remove rollers from bearing crosses.)

(4) Insert carriage body between tracks on flap end rib with arrows pointing up.

(5) Insert cross assemblies horizontally between tracks with grease fittings outside the tracks. Rotate to a vertical position with large rollers on lower track.

(6) Install tab washer so tangs engage slots in body trunnion and tab engages hole in roller cross. Verify eccentric bolt hole in trunnion matches hole in tab washer. Secure roller cross to body with bolt and lock-wire to tab washer. Verify monoball bearing in carriage body has free movement: eccentric pivot pin can move freely up and down, fore and aft.



NOTE

1. INBOARD FLAPS SWING LINK CARRIAGE INSTALLATION SHOWN. OUTBOARD FLAPS SWING LINK CARRIAGE INSTALLATION SIMILAR
2. PEEL SHIM TO OBTAIN 0.000 - 0.010 INCH GAP. LINK MUST SWING ABOUT PIN WITHOUT BINDING
3. INSTALL OUTSIDE OF FLAP TRACK POINTING AWAY FROM CARRIAGE BODY.

HA 0663
M1-0101-27-320

R R Flap Swing Link Carriage
Figure 401

R (7) On aircraft 001-031 without SB57-119,
R adjust both roller crosses as follows:

R (a) Loosen lubricator barrels and disengage serrated
R washers.

R (b) Rotate eccentric inner race of upper and lower
R roller pairs equal amounts to tightest position in
R tract without creating excessive drag when moving
R carriage by hand (50-pound maximum drag allowed).
R Maximum clearance allowed at any position along
R travel is 0.025 inch measured at one roller of
R each roller cross with other rollers resting
R against track.

R (c) Point lube fittings away from center of carriage.

R (d) Ensure that serrated locking washer tangs are
R properly engaged in roller slots.

R (e) Torque lubricator barrels to 40 to 60 pound-inches
R and install lockwire.

R (7) On aircraft 001-031 with SB57-119 and 032-999,
R adjust both roller crosses as follows:

R (a) Loosen dome nut and disengage serrated washers of
R smaller upper rollers.

R (b) Rotate eccentric inner race of rollers to tightest
R position in tract without creating excessive drag
R when moving carriage by hand (50-pound maximum
R drag allowed). Maximum clearance allowed at any
position along travel is 0.025 inch measured at
one roller of each roller cross with other rollers
resting against track.

(c) Ensure that serrated locking washer tangs are
properly engaged in roller slots.

R (d) Torque dome nut to 40 to 60 pound-inches and
install lockwire.

(8) Lubricate rollers (Ref. 12-23-20).

(9) Attach swing link to fitting on torque box with swing link pin. Secure pin with retaining bolt.

CAUTION: USE CARE WHEN INSTALLING COATED SWING LINK PINS TO PREVENT DAMAGE TO COATING. IF COATING CHIPS, RETURN PIN TO SHOP FOR RECOATING.

C C C NOTE: Do not use any lubrication on coated pins. Grease can attract dust and grit which can damage the coating.

C C C C (9A) If a coated pin is installed in the outboard flaps swing links, remove MS 15001 Grease Fitting from torque box and install NAS 5404U3 Screw with PR 1422 class A2 or equivalent sealant.

(10) Remove support from under flap.

(11) Remove warning tags from hydraulic panels (Ref. 29-11-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

PITCH TRIM IS SET AT ZERO DEGREES.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(12) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(13) Cycle flaps from full up to full down and back to full up for several cycles. Verify flap operation is normal.

(14) Turn off hydraulic power (Ref. 29-11-00).

FLAP VANE - REMOVAL AND INSTALLATION

1. General

This procedure is applicable to all eight vanes.

2. Equipment and Materials

Lubricant, MIL-G-23827A, Aeroshell 7, no equivalent

R Shim Stock, Steel, 301 CRES, half hard

3. Referenced Procedures

12-23-00	Flight Controls Lubrication
20-00-08	Installation of Metal Foil Rub Strips, PB79-479B
24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-00	Flap Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

THE PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic systems A, B and C (Ref. 29-11-00).

(3) Operate wing flaps to the fully extended position.

NOTE: Vanes are numbered the same as the flaps, with No. 1 being the most inboard.

(4) For replacement of outboard vanes (vanes 3 and 4), the spoilers must be raised to provide clearance for removal of the vane link pivot pin. Spoilers can be manually raised by disconnecting the spoiler actuator from the spoiler and blocking the spoiler in extended position, or they can be safely raised hydraulically as follows:

(a) For Vane No. 3, position speedbrake lever full aft to extend spoilers. Install spoiler actuator locks on Spoilers 3 and 4.

(b) For Vane No. 4, fully retract flaps to couple speedbrake system to spoilers 5 and 6. Position speedbrake lever full aft to extend spoilers. Install spoiler actuator lock on spoilers 5 and 6. Then pull circuit breakers SPOILER DWELL DC and AC (CB1-B7 and B8) to prevent stalling dwell actuators when flaps are extended. Fully extend flaps.

(5) Tag flap control handle.

(6) Turn off all hydraulic power.

WARNING: WHEN HYDRAULIC POWER IS TURNED OFF, DLC SERVO WILL DRIVE THE SPOILER CONTROL SYSTEM TO FULL DOWN. THE NEXT TIME HYDRAULIC POWER IS TURNED ON, SPOILERS WILL FULLY RETRACT.

(7) Tag the Flight Engineer/Second Officers HYDRAULIC SYSTEM panel, zone 215, and the HYDRAULIC SERVICE PANEL, zone 147.

(8) Turn off electrical power if not required.

(9) At the inboard and outboard vane carriage fittings, remove the lube fitting, washer, nut, and washer from bottom of vane link pivot pins (Ref. Fig. 401).

(10) For inboard vanes (Vanes 1 and 2), remove the vane actuator-to-flap fitting attaching bolt at both the inboard and outboard ends of vane assembly. Move vane assembly forward to provide clearance for removal of the vane link pivot pin.

NOTE: Vane weights are as follows: No. 1 - 83 lbs; No. 2 - 97 lbs; No. 3 - 116 lbs; No. 4 - 62 lbs. Use two men to support vane during removal or, if necessary, use a sling and hoist.

(11) While supporting the vane assembly, drift out the vane link pivot pin from the lower side (2 places).

(12) Move vane rearward to disengage from vane carriage fitting and carefully lower to cart. If necessary use micarta to pry vane from vane carriage fitting.

B. Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00) AND THAT FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147, ARE TAGGED.

(1) Verify that flap control handle is tagged in full extend position.

(2) With the wing flaps fully extended, raise vane in position for installation and engage vane fittings into vane carriage fittings.

(3) Coat vane link pivot pin with MIL-G-23827A grease.

(4) Install vane link pivot pin from top of vane (2 places). Use bullet to align holes.

(5) Check clearance between vane fittings on both ends of vane and vane carriage fittings (Ref. Fig. 401). If clearance exceeds .045 inch, shim to .010 inch. Fabricate shims from shim stock (Ref. Fig. 402). Maximum clearance with shims installed is .030 inch.

(6) Install washer and nut at bottom of vane link pivot pins. Tighten nut to a snug fit (no vertical movement of bolt). Do not overtorque.

(7) Install safety washer and lube fitting at bottom of vane link pivot pins. Tighten lube fitting to give a snug fit, then tighten to a torque of 15 to 25 pound inches.

NOTE: If lube fitting has tapered threads, the safety washer must be loose. If lube fitting is seated on washer, replace lube fitting or replace washer with a thin (1/64 inch thick) washer.

R
R
If lube fitting has straight threads, the fitting must seat on washer.

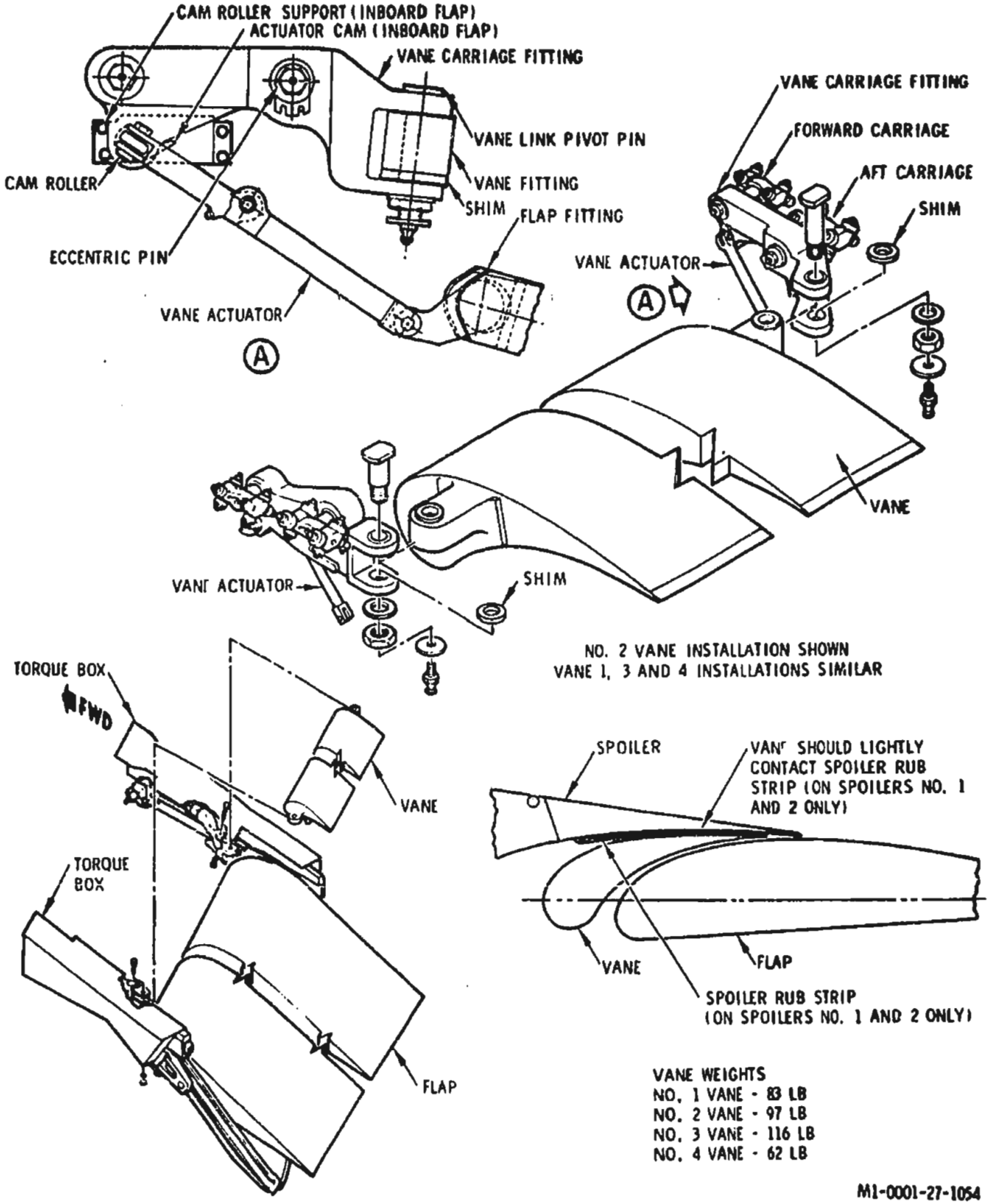
(8) On vane 1 or 2, position vane assembly so that vane actuator-to-flap fitting attaching bolts can be reinstalled.

(9) Lubricate vane link pivot pins (Ref. 12-23-00).

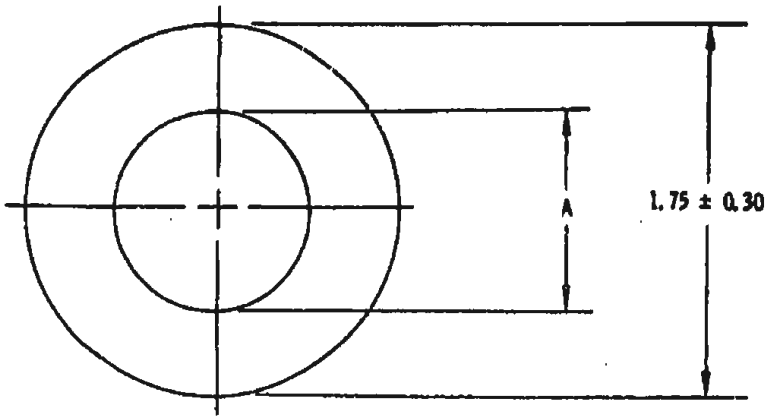
(10) Remove tags from hydraulic control panels.

(11) Remove tag from flap control handle.

(12) Check vane rigging (Ref. 27-51-00 Adjustment/Test, Paragraph 5F).



Flap Vane - Removal and Installation
Figure 401



VANE/LOCATION	DIMENSION A
1 INBOARD	0.784 ± 0.03
1 OUTBOARD	0.909 ± 0.03
2 INBOARD	1.096 ± 0.03
2 OUTBOARD	0.971 ± 0.03
3 INBOARD	0.909 ± 0.03
3 OUTBOARD	0.971 ± 0.03
4 INBOARD	0.909 ± 0.03
4 OUTBOARD	1.236 ± 0.03

FABRICATE SHIM FROM SHIM STOCK, STEEL, 301 CRES, HALF HARD THICKNESS AS REQUIRED

M1-0000-27-1207

R Flap Vane Fitting Shim Fabrication
R Figure 402

R EFFECTIVITY: ALL
R
001B

R # FLAP VANE TRACKS - REMOVAL AND INSTALLATION

1. Equipment and Materials

Sealing Compound, Low Adhesion, C-40-769, Type II (Product Research Co., PR 1301BT-K, or equivalent)

2. Referenced Procedures

R R	20-51-04	Environmental Sealing of Model L1011 Airplane - PB75-425D
	27-51-47	Vane Carriage Assembly - Removal and Installation

3. Removal/Installation

A. Removal (Ref. Fig. 401)

(1) Disconnect vane from vane carriage and remove vane carriage from vane tracks in accordance with removal procedures in 27-51-47.

(2) Remove bolts attaching vane track to the track support. Remove vane track from torque box.

NOTE: The vane track is installed with faying surface sealant. Use care and soft materials to pry CR track from the track support. If a shim is CR installed under the track, note the location and CR retain the shim. Vane carriage adjustment CR tolerances may require re-use of the existing CR shim, or installation of a shim of different CR thickness.

(3) Thoroughly clean old sealant from the track support mounting surface of the torque box.

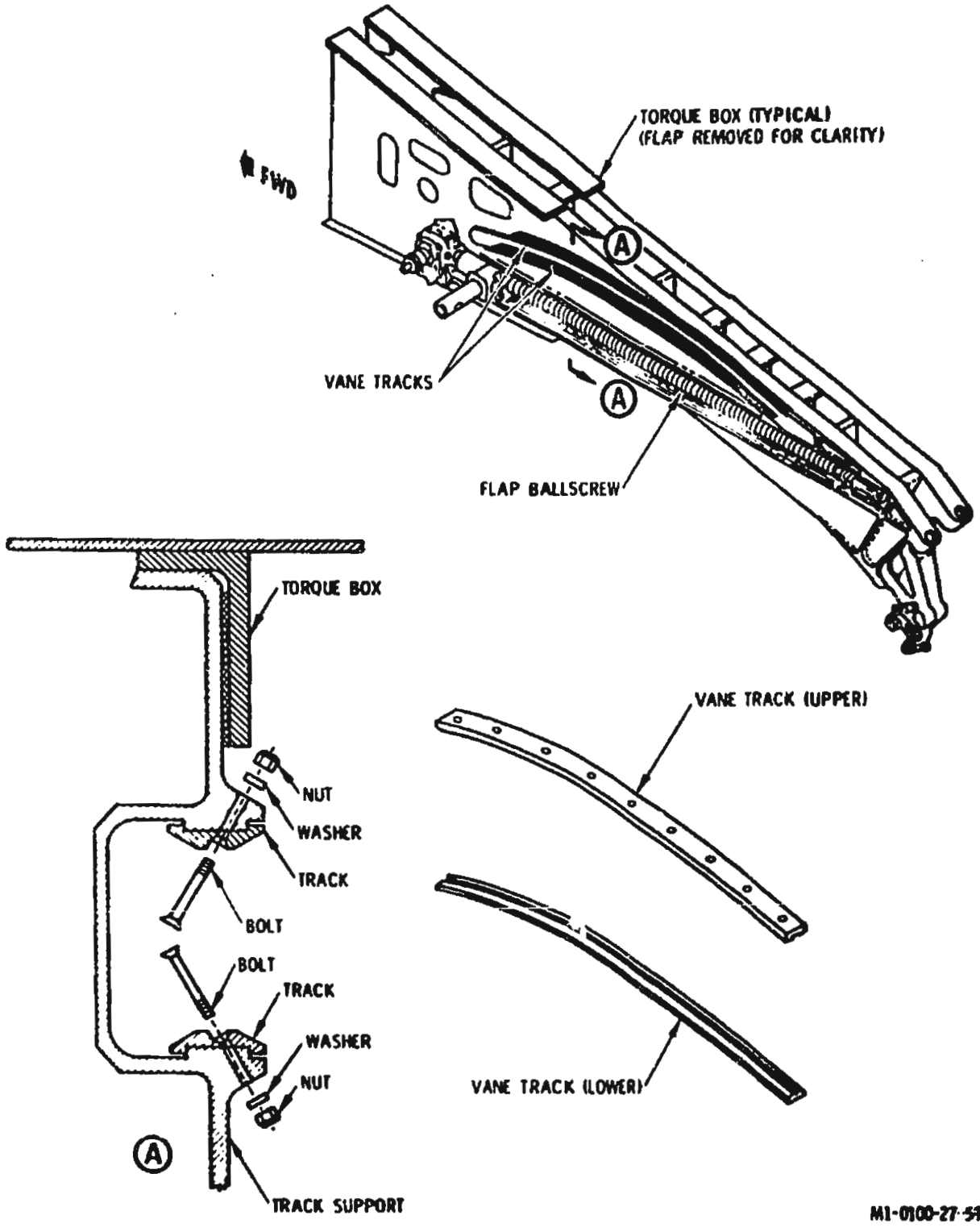
B. Installation (Ref. Fig. 401)

NOTE: Verify that all old sealant is removed from the track support mounting surface. Old sealant left on surface could result in local tight spots in carriage roller operation and make carriage roller adjustment difficult.

(1) Install track using sealant on faying surfaces and on bolts (Ref. 20-51-04). (Use release agent on track faying surfaces.)

NOTE: If possible, use C-40-769 Type II to provide longer sealant set-up time. When applying faying surface sealant, verify that sealant is applied evenly to ensure that installed tracks will be parallel.

CR CR (2) Install and adjust vane carriages per 27-51-47. Assure maximum permissable clearance is not exceeded.



R R Vane Track - Removal and Installation
Figure 401

R R EFFECTIVITY: ALL

001B

FLAP VANE CARRIAGE ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Grease, MIL-G-23827A, or equivalent

LH7559-3 Nut

RME 9868-5 Nut

AN960C516L Washer

MS24665-153 Cotter Pin

MS24665-155 Cotter Pin

C QQ W-390, TEMP A 0.020 or larger Diameter Lock-wire.

MIL-C-16173 Grade 4 Corrosion Preventive Compound

MIL-C-6529 Corrosion Preventive Compound

2. Referenced Procedures

	12-23-20	External Power/Ground Service System - Maintenance Practices
	20-12-01	Application of Corrosion Preventive Materials - LCP78-1128B
	20-51-04	Environmental Sealing of Model L-1011 Airplane - PB75-425D
R	27-51-00	Trailing Edge Flap System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

NOTE: The flap swing link carriage roller crosses and the vane carriage roller crosses (frogs) are safetied with a special tab washer. If a tab washer is found with the tab broken off (the tab engages a hole in the roller cross), the tab washer need not be replaced as long as the lock-wire is intact. The tab is for alignment purposes only. A broken tab washer should be replaced when the roller cross or carriage is removed. It should be noted that a broken tab washer indicates a lack of

lubrication of the particular carriage body monoball bearing.

A. Removal

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic systems A and C (Ref. 29-11-00).

(3) Fully extend flaps.

(4) Turn off hydraulic systems A and C (Ref. 29-11-00).

(5) Install warning tags on Flight Engineer/Second Officers hydraulic systems panel, zone 215, and on hydraulic service panel, zone 147.

(6) Disconnect vane actuator as follows:

NOTE: Perform either Step 3A(6)(a) or Step 3A(6)(b), depending on location of vane carriage that is to be removed.

(a) At vane track No. 1, 3, 5 or 7 (inboard end of vane panels) disconnect forward end of vane actuator. Leave aft end attached to flap.

(b) At vane track No. 2, 4, 6 or 8 (outboard end of vane panels) disconnect aft end of vane actuator. Leave forward end attached to link (or fitting) on the vane.

(7) Remove pin that attaches vane link (or fitting) to vane panel.

(a) Rest end of vane panel on top of flap panel (use pad).

(8) Move carriages, with link (or fitting) attached forward on tracks for accessibility.

(9) At track Nos. 1, 2, 3, 4, 5 or 7 disassemble and remove carriage as follows:

(a) Mark eccentric pin and link (or fitting) for reinstallation reference.

(b) Remove bolt that attaches index plate and aft carriage eccentric pin to link (or fitting).

(c) Remove bolt that attaches forward carriage pin to link (or fitting).

(d) Pull link (or fitting) from the two carriage pins. (Pulling link, or fitting, from two carriage pins may be difficult as forward carriage pin is installed with sealing compound.)

NOTE: Forward or aft carriage assembly is disassembled and removed from tracks per Steps 3A(9)(c) through 3A(9)(f) below.

(e) Remove bolts that secure roller crosses (one at each end of carriage assembly) to carriage body.

(f) Rotate roller crosses 90 degrees, fore and aft, and remove from between tracks. Do not remove rollers from crosses.

(g) Remove carriage body from between tracks.

(h) Remove mounting pin from carriage body.

NOTE: Aft carriage assembly has an eccentric pin. Forward carriage assembly has a concentric pin.

(10) At track No. 6 or No. 8, disassemble and remove carriage as follows:

(a) Remove bolt that attaches aft roller cross to aft carriage assembly.

(b) Rotate roller cross 90 degrees fore and aft and remove from between tracks.

(c) Mark eccentric pin and link for reinstallation reference.

(d) Remove bolt and index plate from forward eccentric pin.

(e) Swing link away from tracks and disengage from eccentric pin to free forward carriage assembly.

(f) Separate carriage assemblies.

(g) Remove bolt that attaches forward roller cross to aft carriage.

(h) Rotate roller cross 90 degrees fore and aft and remove from between tracks.

(i) Remove aft carriage body, with swing link attached, from between tracks.

(j) Remove aft carriage body from concentric pin in swing link. Do not remove pin from link.

(k) Remove bolts that secure roller crosses (one at each end of forward carriage assembly) to carriage body.

(l) Rotate roller crosses 90 degrees, fore and aft, and remove from between tracks. Do not remove rollers from crosses.

(m) Remove forward carriage body from between tracks.

(n) Remove eccentric pin from carriage body.

B. Installation

NOTE: Vane No. 1 inboard and No. 2, 3 and 4 outboard Vane Carriage Assemblies incorporate swing links.

R (1) On vane carriage assemblies that incorporate swing links,
R measure total gap between flanges of bushings at swing
R link/vane fitting pivot (Ref. Fig. 402). Clearance in
R operational use must not exceed 0.030 inch. If
R shimming is required, install laminated shim washer to
R provide 0.000 to 0.010 inch clearance. Link must swing
R about pivot pin without binding.

R (2) Verify that warning tags are installed on Flight Engineer/Second Officers hydraulic systems panel, zone 215, and on the hydraulic service panel, zone 147.

R (3) At flap tracks No. 1, 2, 3, 4, 5, or 7, assemble and install vane carriages as follows:

(a) Attach mounting pin to carriage body (Ref. Fig. 401, Sheet 1, View B).

(b) Insert mounting pin into monoball.

NOTE: Aft carriage assembly has an eccentric pin and the forward carriage assembly has a concentric pin.

CAUTION: CHECK TO SEE THAT INSIDE DIAMETER OF MONOBALL SNUGLY FITS THE MOUNTING PIN. MONOBALLS HAVE IDENTICAL OUTSIDE DIAMETERS, AND TWO DIFFERENT INSIDE DIAMETERS ARE USED IN THE VANE INSTALLATION. AN INCORRECT MONOBALL WILL RESULT IN EXCESSIVE PLAY BETWEEN PIN AND MONOBALL.

ON AIRCRAFT 001-031,
THE SMALL DIAMETER MONOBALL (P/N 1608937-101) IS INSTALL ON FORWARD CARRIAGE AND THE LARGE DIAMETER MONOBALL (P/N 1608937-103) IS INSTALLED ON THE AFT CARRIAGE.

ON AIRCRAFT 032-999,
LARGE DIAMETER MONOBALL (P/N 1608937-103) ARE INSTALLED ON BOTH FORWARD AND AFT CARRIAGES.

(c) Verify that monoball installation slots in carriage body are facing out (Ref. Fig. 401, Sheet 1, View C).

(d) On aircraft 001-031 without SB57-117, install spacer, washer and self-locking nut. Torque nut to 110 to 125 pound-inches. Verify following.

- That carriage mounting pin has a minimum of 0.031 (1/32) inch threads extending through self-locking nut (Ref. Fig. 401, Sheet 1, View D).

- That self-locking nut requires torque to overcome self-locking feature, if not, install new nut.

NOTE: If minimum threads do not extend through self-locking nut, then remove spacer and replace with AN960C516L washer.

(d) On aircraft 001-031 with SB57-117 and 032-999, install washer and nut. Torque to 110 to 125 pound-inches and install cotter pin.

(e) Remove roller crosses (frog assemblies) from carriage body.

NOTE: Do not remove rollers from roller crosses.

(f) Insert carriage body between vane tracks with arrows on body pointing up (Ref. Fig. 401, Sheet 1, View C).

(g) On aircraft 001-031 without SB57-119, insert roller crosses horizontally into tracks with grease fittings outside and facing as noted in Figure 401 (Sheet 1) grease fitting orientation chart for the respective carriage assembly.

(g) On aircraft 001-031 with SB57-119 and 032-999, insert roller crosses into tracks.

NOTE: Roller crosses have self-lubricating rollers and consequently no grease fittings.

(h) Rotate roller crosses to a vertical position and place carriage body onto roller crosses.

NOTE: The large rollers ride on the lower track on forward carriage and on the upper track of aft carriage.

- Install tab washers so that tangs engage slot in the body trunion and tab engages hole in roller crosses.

NOTE: Verify that bolt hole in body trunion matches hole in tab washer.

- Secure roller crosses to carriage body with bolt.
- Torque bolt 60 to 65 lb inches.
- Lock-wire bolt to tab washer.

(i) Adjust rollers in accordance with paragraph C.

(j) On aircraft 001-031, apply MIL-C-16173 corrosion preventive compound (Ref. 20-51-04) to concentric (forward) carriage mounting pin.

(k) Apply MIL-C-6529 corrosion preventive compound (Ref. 20-12-01) to eccentric (aft) carriage mounting pin.

NOTE: Aircraft with stainless steel eccentric (aft) carriage mounting pins do not require the corrosion preventive compound to be applied to their eccentric pins. Stainless steel and non-stainless steel eccentric pins are interchangeable.

(l) Install vane carriage fitting on concentric pin attached to forward carriage assembly and eccentric pin attached to aft carriage assembly.

- Align marks on eccentric pin and relative carriage fitting [accomplished in Step 3A(9)(a)].
- Install index plate, washer, and stud on aft carriage eccentric and forward concentric pins.
- Lock-wire stud to index plate.
- Install lube fittings (if required).

R (4) At flap tracks No. 6 or No. 8 assemble and install vane carriages as follows:

(a) Install forward carriage assembly on tracks in
R accordance with Steps 3B(3)(a) through 3B(3)(i) above.

(Exception: Aft carriage assembly has a concentric pin; forward carriage assembly has an eccentric pin.)

(b) Remove roller crosses from aft carriage body and install carriage body on concentric pin in swing link with spacer (or washer) and nut.

(c) Verify that concentric pin has free movement on monoball bearing in carriage body.

NOTE: On aircraft with SB57-103, installation of wide roller bearings, on the No. 4 vane, forward carriage, forward top roller on the No. 8 track, adjust the roller to its highest eccentric point. When tightening the hex fastener on grease fitting, verify a flat of the hex fastener

is parallel to the wing. If flat of hex still contacts wing upper skin during vane travel, the flat may be chamfered to eliminate contact.

NOTE: On aircraft 001-031 without SB57-117, verify that concentric pin threads extend through the self-locking nut a minimum of 0.031 (1/32) inch. If not, remove spacer and install AN960C516L washer. Verify that self-locking nut requires torque to overcome self-locking feature; if not replace nut. Verify that monaball installation slots in the carriage body are facing out.

CAUTION: MONOBALLS WITH IDENTICAL OUTSIDE DIAMETERS AND TWO DIFFERENT INSIDE DIAMETERS ARE USED IN THE VANE INSTALLATION. AN INCORRECT MONOBALL WILL RESULT IN EXCESSIVE PLAY BETWEEN PIN AND MONOBALL.

ON AIRCRAFT 001-031 WITHOUT SB57-119, THE SMALL DIAMETER MONOBALL (P/N 1608937-101) IS INSTALLED ON THE FORWARD CARRIAGE AND THE LARGE DIAMETER MONOBALL (P/N 1608937-103) IS INSTALLED ON THE AFT CARRIAGE.

ON AIRCRAFT 001-031 WITH SB57-119 AND 032-999, THE LARGE DIAMETER MONOBALL (P/N 1608937-103) IS INSTALLED ON BOTH FORWARD AND AFT CARRIAGE.

(d) Position aft carriage body, with swing link attached, between tracks.

(e) Install forward roller cross on aft carriage body.

(f) Install tab washer so that tangs engage slots in body trunnion and tab engages hole in roller cross.

(g) Verify that eccentric bolt hole in trunnion matches hole in tab washer.

(h) Secure roller cross to body with bolt.

(i) Torque bolt 60 to 65 lb. inch and lock-wire bolt to tab washer.

(j) Apply corrosion preventive compound (Ref. 20-12-01) to eccentric (forward) carriage mounting pin.

(k) Rotate swing link assembly and engage eccentric pin.

R (l) Align marks on eccentric pin and link [accomplished in Step 3A(10)(c)].

(m) Install index plate and stud.

(n) Install aft roller cross on aft carriage assembly per Step (d).

R (o) Adjust rollers in accordance with paragraph 3C.

(p) Verify that all locking devices (cotter pins or lockwire) are installed.

R (5) Install pin that attaches vane link (or fitting) to vane.

R (6) At track No. 1, 3, 5, or 7 attach forward end of vane actuator to vane link (or fitting).

R (7) At track No. 2, 4, 6 or 8 attach aft end of vane actuator to flap fitting.

CAUTION: VERIFY THAT THE VANE ACTUATOR IS FULLY EXTENDED (STRAIGHT). RETRACTING FLAPS WITH A FOLDED VANE ACTUATOR WILL DAMAGE THE VANE ACTUATOR CAM AND ROLLER.

R (8) Lubricate grease fittings at points disassembled for the removal and installation of carriage assemblies (Ref. 12-23-20).

On aircraft that have incorporated SB57-119, roller crosses have self lubricating bearings, and do not have grease fittings.

R (9) Perform a rigging check of the vanes and adjust, as required (Ref. 27-51-00, Adjustment and Test, Para. 5F).

R (10) Operate flaps from full up to full down and back to full up for several cycles. Verify normal operation of the flap, vane, and vane actuators.

R (11) Turn off hydraulic power if no longer required (Ref. 29-11-00).

C. Adjustment of Rollers

(1) Adjust rollers on both forward and aft carriage crosses to fit tightest position in track with some slight drag when moved by hand (30 pounds maximum is permissible).

(2) Maximum clearance permissible at any position along travel is 0.060 inch measured at one roller of each roller cross with each other rollers resting against tracks.

(3) On aircraft 001-031 without SB57-119, adjust rollers by loosening the lubricator barrel, to disengage serrated washers, and rotating the eccentric inner race of roller.

(a) Upper and lower roller pairs should be adjusted in equal amounts.

(b) Install grease fittings oriented properly [Ref. Fig. 401 (Sheet 1)].

(c) Ensure that serrated locking washer tangs are properly engaged in roller slots.

CAUTION: TO AVOID SHEARING OFF LOCKING WASHER TANGS, RESTRAIN LUBRICATOR SWIVEL FROM ROTATING WHILE TIGHTENING BARREL.

(d) Torque lubricator barrel to 40 to 60 pound-inches and install lock-wire.

(3) On aircraft 001-031 with SB57-119 and 032-999, adjust rollers by loosening dome nut to disengage serrated washers, and rotating the eccentric inner race of roller.

(a) Only forward carriage lower and aft carriage upper rollers are adjustable

(b) Ensure that serrated locking washer tangs are properly engage in roller slots.

(c) Torque dome nut to 40 to 60 pound-inches and install lockwire.

△6 TAB WASHER USAGE TABLE

CARRIAGE	WASHER	LEFT HAND WING								RIGHT HAND WING							
		NO. 4		NO. 3		NO. 2		NO. 1		NO. 1		NO. 2		NO. 3		NO. 4	
		OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD
FORWARD	FWD	GREEN	←													→	GREEN
	AFT	GREEN	←													→	GREEN
AFT	FWD	GREEN	GRN	GREEN	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	GRN	GRN	GREEN
	AFT	GREEN	GRN	GREEN	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	GRN	GRN	GREEN

ROLLER GREASE FITTING ORIENTATION

VANE TRACK NO.	FORWARD CARRIAGE		AFT CARRIAGE	
	FORWARD FITTINGS POINT DIRECT	AFT FITTINGS POINT DIRECT	FORWARD FITTINGS POINT DIRECT	AFT FITTINGS POINT DIRECT
1, 2, 3, 4, 5	FORWARD	AFT	FORWARD	AFT
6, 7	FORWARD	FORWARD	FORWARD	AFT
8	FORWARD	FORWARD	AFT (UPPER) FWD (LOWER)	AFT

NOTE

1 [X] NUMBERS IDENTIFY VANES

2 (X) NUMBERS REFER TO VANE TRACK INSTALLATIONS ON TORQUE BOXES

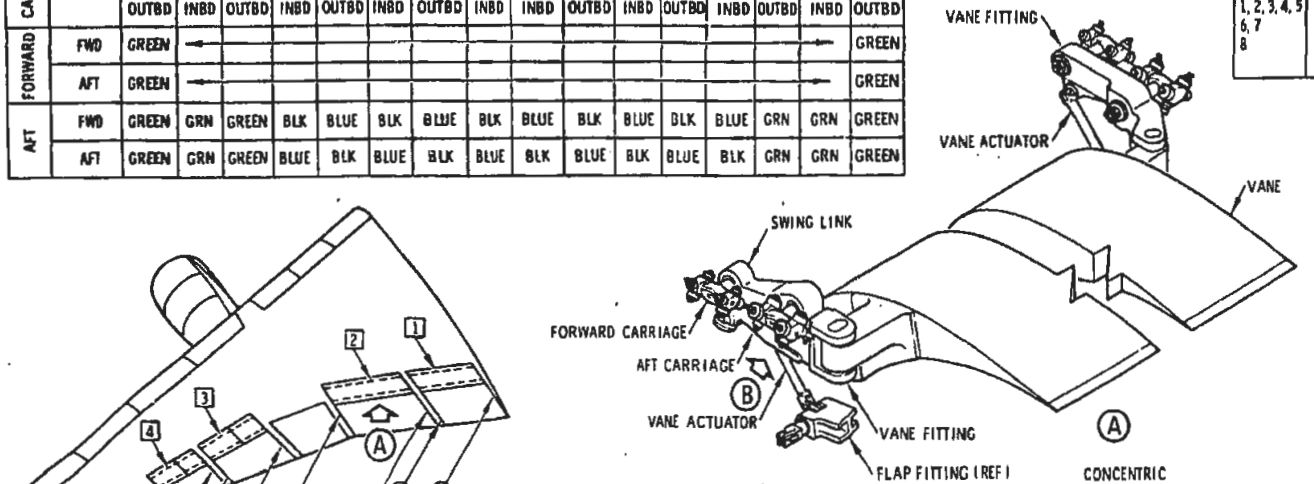
△3 ASSEMBLE ROLLER CROSS ON CARRIAGE BODY SO THAT LARGE ROLLERS ON THE FORWARD CARRIAGE RIDE ON THE LOWER TRACK AND THE LARGE ROLLERS ON THE AFT CARRIAGE RIDE ON THE UPPER TRACK. ROLLERS WITH GREASE FITTINGS MUST BE TOWARD VANE PANEL

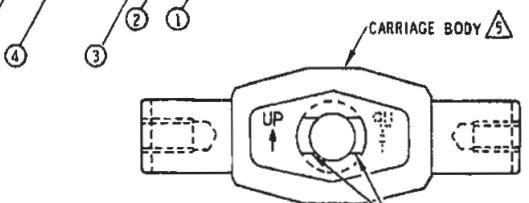
△4 ORIENT GREASE FITTINGS ON ROLLER CROSSES AS NOTED ON CHART (ABOVE)

△5 ARROW ON CARRIAGE BODY MUST POINT UP AND MONOBALL INSTALLATION SLOTS MUST FACE VANE

△6 DASH NO. STAMPED ON WASHER AND WASHER PAINTED PER USAGE AND INTERCHANGEABILITY TABLES

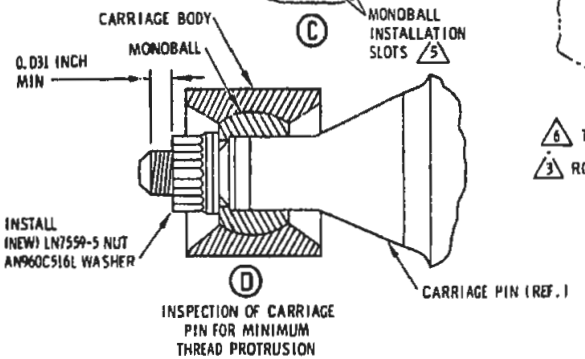
△7 IF THREAD PROTRUSION LESS THAN 0.031 INCH, REPLACE SPACER WITH WASHER

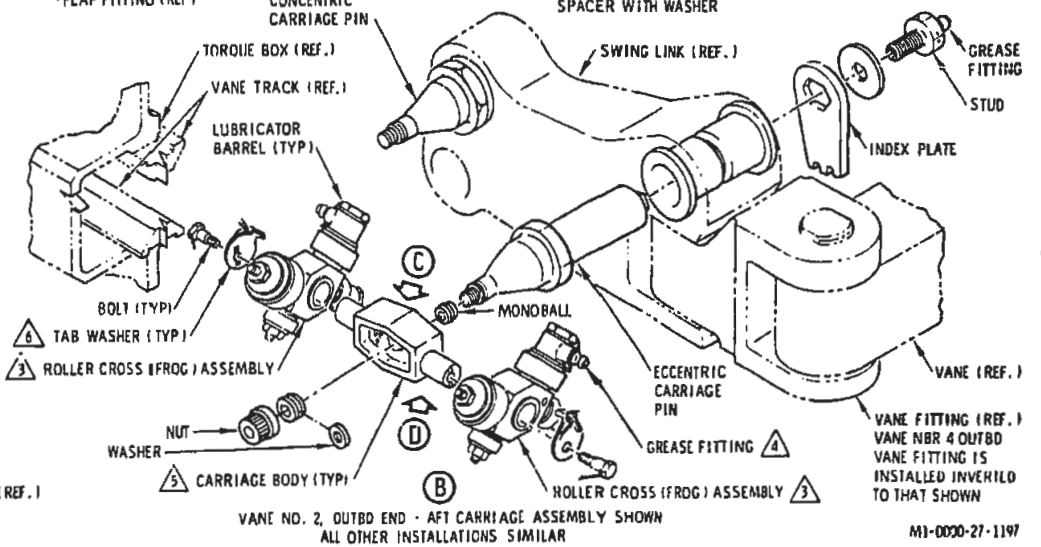




△6 TAB WASHER INTERCHANGEABILITY TABLE

COLOR CODE	PN 1573693	PN 1535320
GREEN	-101	-107
BLACK	-103	-109
BLUE	-104	-110
YELLOW	-105	-111





M1-0030-27-1197

CR Flap Vane Carriage - Removal and Installation
CR Figure 401 (Sheet 1)

EFFECTIVITY: 001-031 WITHOUT SB57-117 AND WITHOUT SB57-119

001B

△6 TAB WASHER USAGE TABLE

CARRIAGE	WASHER	LEFT HAND WING								RIGHT HAND WING							
		NO. 4		NO. 3		NO. 2		NO. 1		NO. 1		NO. 2		NO. 3		NO. 4	
		OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD
FORWARD	FWD	GREEN	→														GREEN
	AFT	GREEN	←														GREEN
AFT	FWD	GREEN	GRN	GREEN	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	GRN	GRN	GREEN
	AFT	GREEN	GRN	GREEN	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	GRN	GRN	GREEN

ROLLER GREASE FITTING ORIENTATION

VANE TRACK NO.	FORWARD CARRIAGE		AFT CARRIAGE	
	FORWARD FITTINGS POINT DIRECT	AFT FITTINGS POINT DIRECT	FORWARD FITTINGS POINT DIRECT	AFT FITTINGS POINT DIRECT
1, 2, 3, 4, 5	FORWARD	AFT	FORWARD	AFT
6, 7	FORWARD	FORWARD	FORWARD	AFT
8	FORWARD	FORWARD	AFT (UPPER) FWD (LOWER)	AFT

NOTE

1 [X] NUMBERS IDENTIFY VANES

2 (X) NUMBERS REFER TO VANE TRACK INSTALLATIONS ON TORQUE BOXES

△3 ASSEMBLE ROLLER CROSS ON CARRIAGE BODY SO THAT LARGE ROLLERS ON THE FORWARD CARRIAGE RIDE ON THE LOWER TRACK AND THE LARGE ROLLERS ON THE AFT CARRIAGE RIDE ON THE UPPER TRACK. ROLLERS WITH GREASE FITTINGS MUST BE TOWARD VANE PANEL.

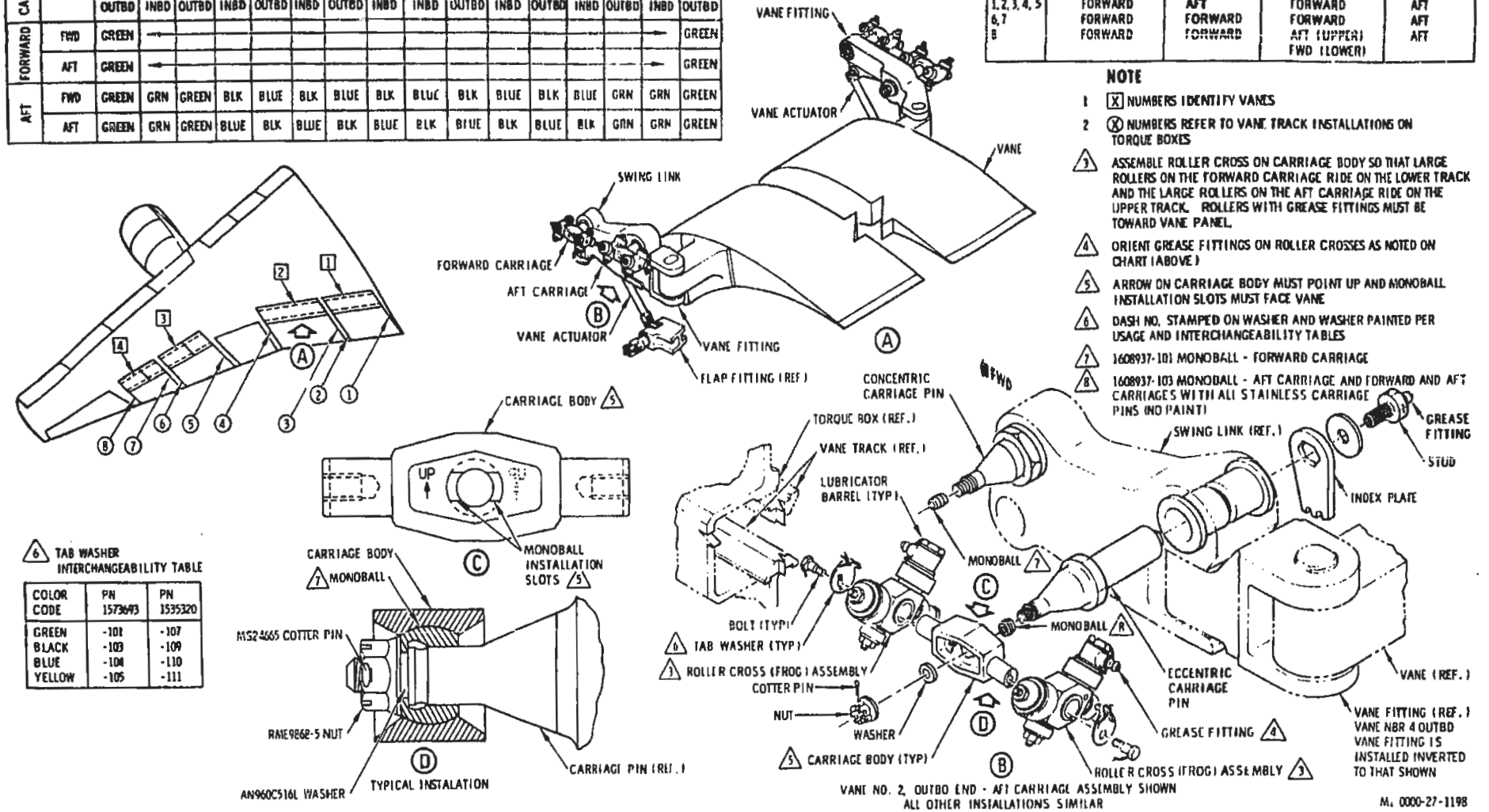
△4 ORIENT GREASE FITTINGS ON ROLLER CROSSES AS NOTED ON CHART (ABOVE)

△5 ARROW ON CARRIAGE BODY MUST POINT UP AND MONOBALL INSTALLATION SLOTS MUST FACE VANE

△6 DASH NO. STAMPED ON WASHER AND WASHER PAINTED PER USAGE AND INTERCHANGEABILITY TABLES

△7 1608937-101 MONOBALL - FORWARD CARRIAGE

△8 1608937-103 MONOBALL - AFT CARRIAGE AND FORWARD AND AFT CARRIAGES WITH ALL STAINLESS CARRIAGE PINS (NO PAINT)



VANE NO. 2, OUTBD END - AFT CARRIAGE ASSEMBLY SHOWN
ALL OTHER INSTALLATIONS SIMILAR

M. 0000-27-1198

△6 TAB WASHER INTERCHANGEABILITY TABLE

COLOR CODE	PN 1573693	PN 1535320
GREEN	-101	-107
BLACK	-103	-109
BLUE	-104	-110
YELLOW	-105	-111

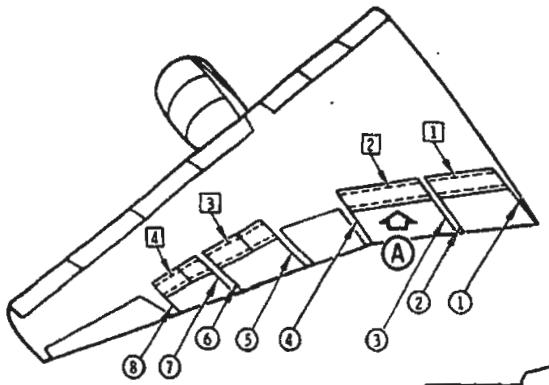
CR Flap Vane Carriage - Removal and Installation
CR Figure 401 (Sheet 1)

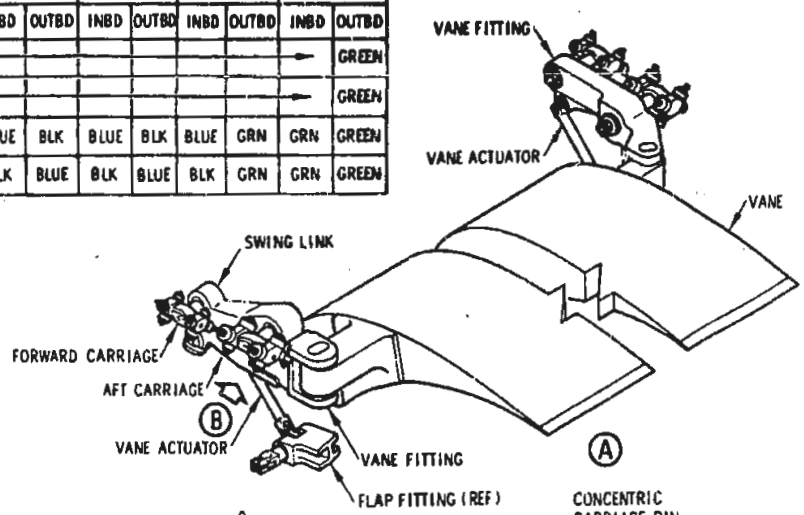
EFFECTIVITY: 001-031 WITH SB57-117 WITHOUT SB57-119

001B

5 TAB WASHER USAGE TABLE

CARRIAGE	WASHER	LEFT HAND WING								RIGHT HAND WING							
		NO. 4		NO. 3		NO. 2		NO. 1		NO. 1		NO. 2		NO. 3		NO. 4	
		OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD	INBD	OUTBD
FORWARD	FWD	GREEN	←													→	GREEN
	AFT	GREEN	←													→	GREEN
AFT	FWD	GREEN	GRN	GREEN	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	GRN	GRN	GREEN
	AFT	GREEN	GRN	GREEN	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	BLUE	BLK	GRN	GRN	GREEN



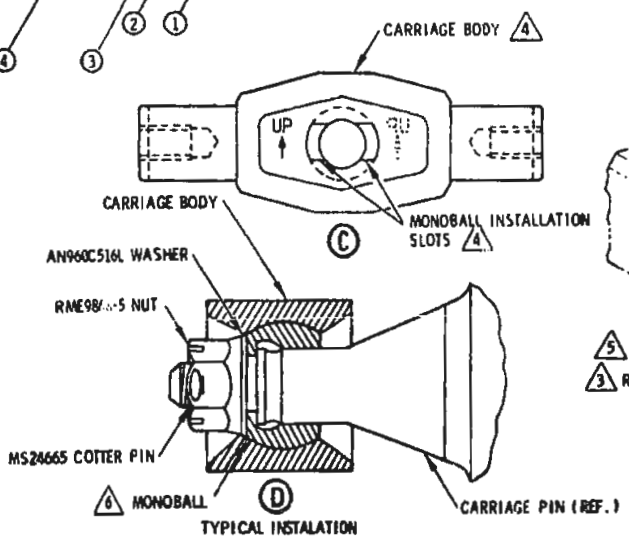


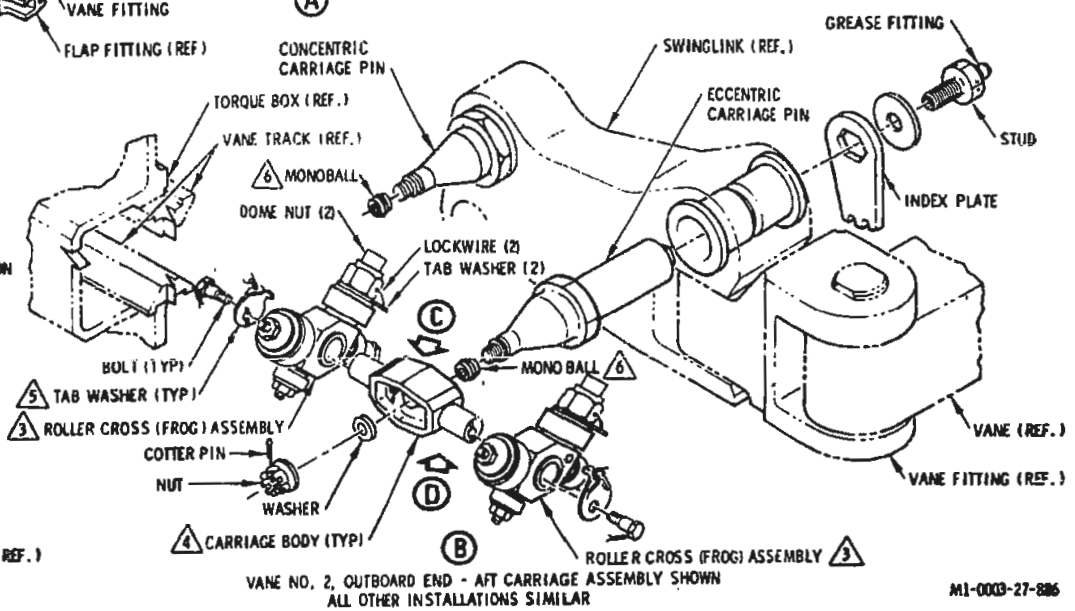
NOTE

1. [X] NUMBERS IDENTIFY VANES
2. (X) NUMBERS REFER TO VANE TRACK INSTALLATIONS ON TORQUE BOXES
3. ASSEMBLE ROLLER CROSS ON CARRIAGE BODY SO THAT LARGE ROLLERS ON THE FORWARD CARRIAGE RIDE ON THE LOWER TRACK AND THE LARGE ROLLERS ON THE AFT CARRIAGE RIDE ON THE UPPER TRACK. ROLLERS WITH DOME NUTS MUST BE TOWARD VANE PANEL
4. ARROW ON CARRIAGE BODY MUST POINT UP AND MONOBALL INSTALLATION SLOTS MUST FACE VANE
5. DASH NO. STAMPED ON WASHER AND WASHER PAINTED PER USAGE AND INTERCHANGEABILITY TABLES
6. 1608937-103 MONOBALL - FORWARD CARRIAGE AND AFT CARRIAGE WITH ALL STAINLESS CARRIAGE PINS (NO PAINT)

5 TAB WASHER INTERCHANGEABILITY TABLE

COLOR CODE	PN 1573693	PN 1535320
GREEN	-101	-107
BLACK	-103	-109
BLUE	-104	-110
YELLOW	-105	-111





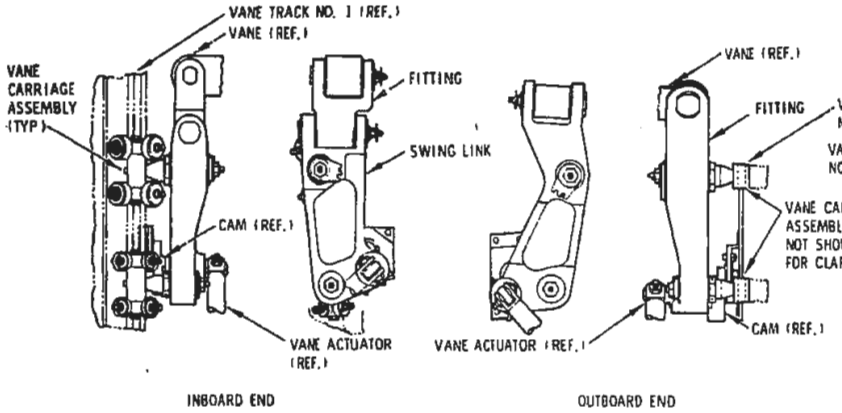
VANE NO. 2, OUTBOARD END - AFT CARRIAGE ASSEMBLY SHOWN
ALL OTHER INSTALLATIONS SIMILAR

M1-0003-27-886

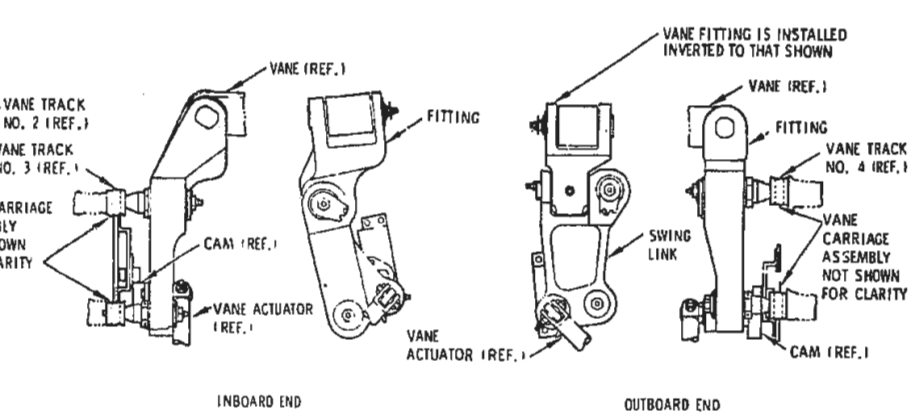
Flap Vane Carriage - Removal and Installation
Figure 401 (Sheet 1)

R EFFECTIVITY: 001-031 WITH SB57-117 AND SB57-119
R AND 032-999
001B

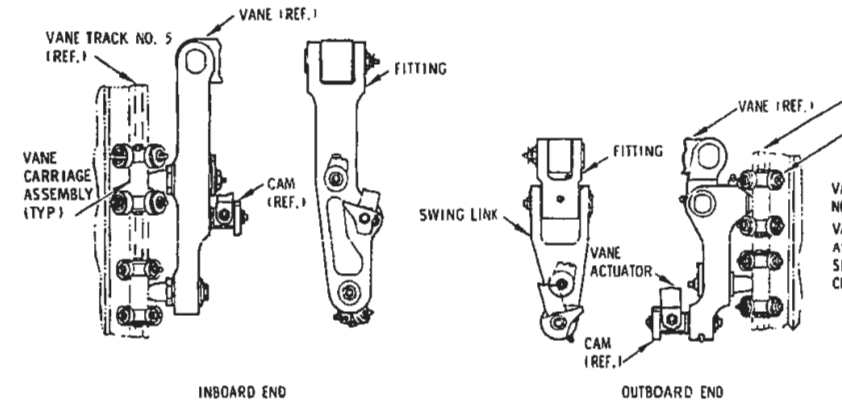
VANE NO. 1



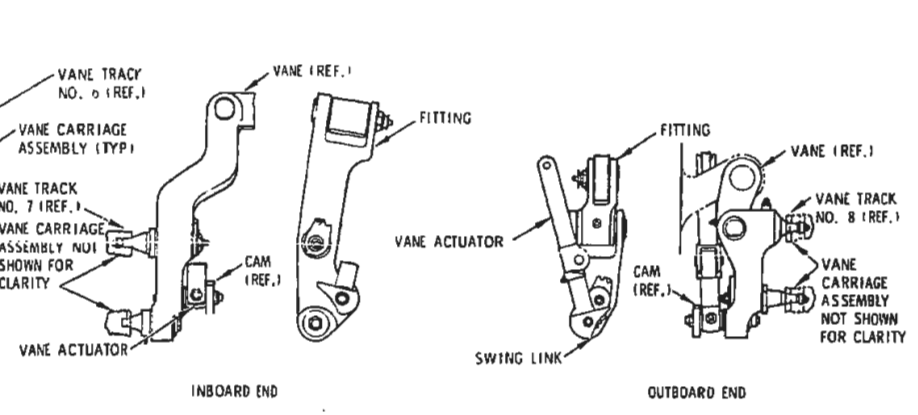
VANE NO. 2



VANE NO. 3



VANE NO. 4

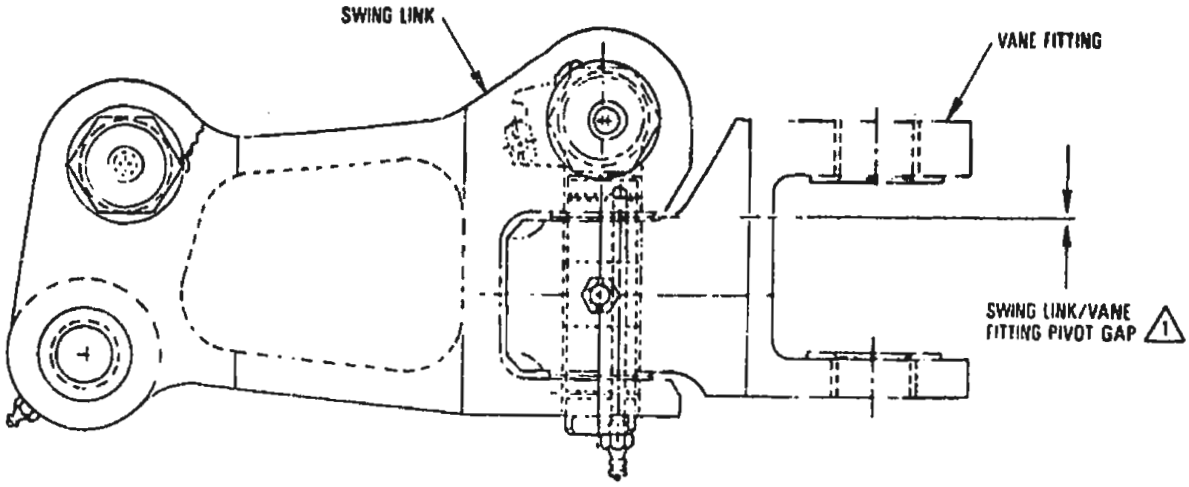


MI-0000-27-1199

CR Flap Vane Carriage - Removal and Installation
CR Figure 401 (Sheet 2)

EFFECTIVITY: ALL

001B



TYPICAL

NOTE

1 MAX GAP IN OPERATIONAL USE IS 0.030 INCH. IF SHIMMING IS REQUIRED, INSTALL LAMINATED SHIM WASHER TO OBTAIN 0.000 TO 0.010 GAP. LINK MUST SWING ABOUT PIVOT PIN WITHOUT BINDING

M1-0000-27-1266

R Flap Vane Fitting/Swing Link Shim Installation
R Figure 402

R EFFECTIVITY: ALL
R
001B

R FLAP VANE ACTUATOR
R REMOVAL AND INSTALLATION

R 1. General

R The flap vane actuator is a folding mechanical link between the
R flap and the vane. There is one vane actuator installed at each
R end of each vane (16 total).

R 2. Equipment and Materials

R Cotter pin MS 24665-153

R Cotter pin MS 24665-300

R 3. Referenced Procedures

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Removal/Installation

R A. Removal

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (1) Turn on hydraulic system A and/or C (Ref. 29-11-00).

R NOTE: Do not operate flaps with electric hydraulic
R pumps. Use ATMs, PTU or other high flow rate
R hydraulic sources.

R WARNING: VERIFY FLAP AND SLAT TRAVEL AREAS ARE CLEAR BEFORE
R OPERATING FLAPS AND SLATS.

(2) Fully extend flaps.

(3) Turn off hydraulic systems A and C (Ref. 29-11-00).

(4) Tag flap handle against movement.

(5) On vanes 3 and 4 only,
Remove nut retaining vane actuator cam and remove cam (Ref. Fig. 401).

R (6) On flap yoke end, remove bolt retainer then remove
R nuts, washers and bolts from both ends of vane actuator (Ref. Fig. 401) and retain for reinstallation.

(7) Remove vane actuator. Retain bushings and bearings for reinstallation.

NOTE: On forward end, actuator must be moved toward center of vane to disengage from vane cam spindle.

B. Installation

(1) Verify flaps are fully extended and vane is full aft.

(2) Verify vane cam spindle (in vane carriage) and vane cam are oriented with cam in the actuator extended position (Ref. Fig. 401).

NOTE: On vanes 3 and 4 only,
temporarily install cam on vane cam spindle to verify spindle orientation, then remove cam.

(3) Attach forward end of actuator (short link) to vane cam spindle. Verify bushings and bearing are in place. Hinge must be on top so actuator will fold downward. Torque nut and install cotter pin.

(4) Attach aft end of actuator to flap yoke fitting. Insert bolt with grease fitting away from track. Verify bushings and bearing are in place. Torque nut and install cotter pin.

R (5) Install bolt retainers on vane actuator/flap yoke pivot
R bolt.

(6) On vanes 3 and 4 only,
install cam on end of vane cam spindle and install nut. Torque nut and install cotter pin.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

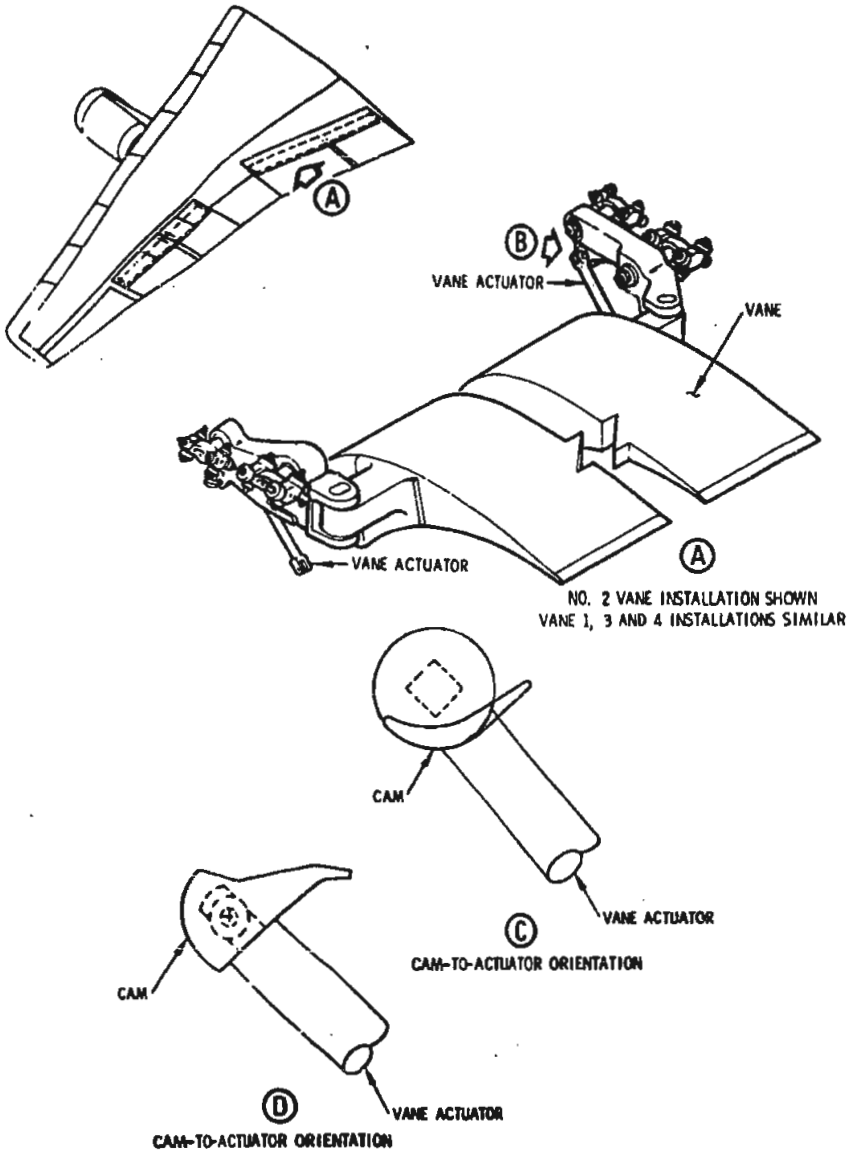
R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

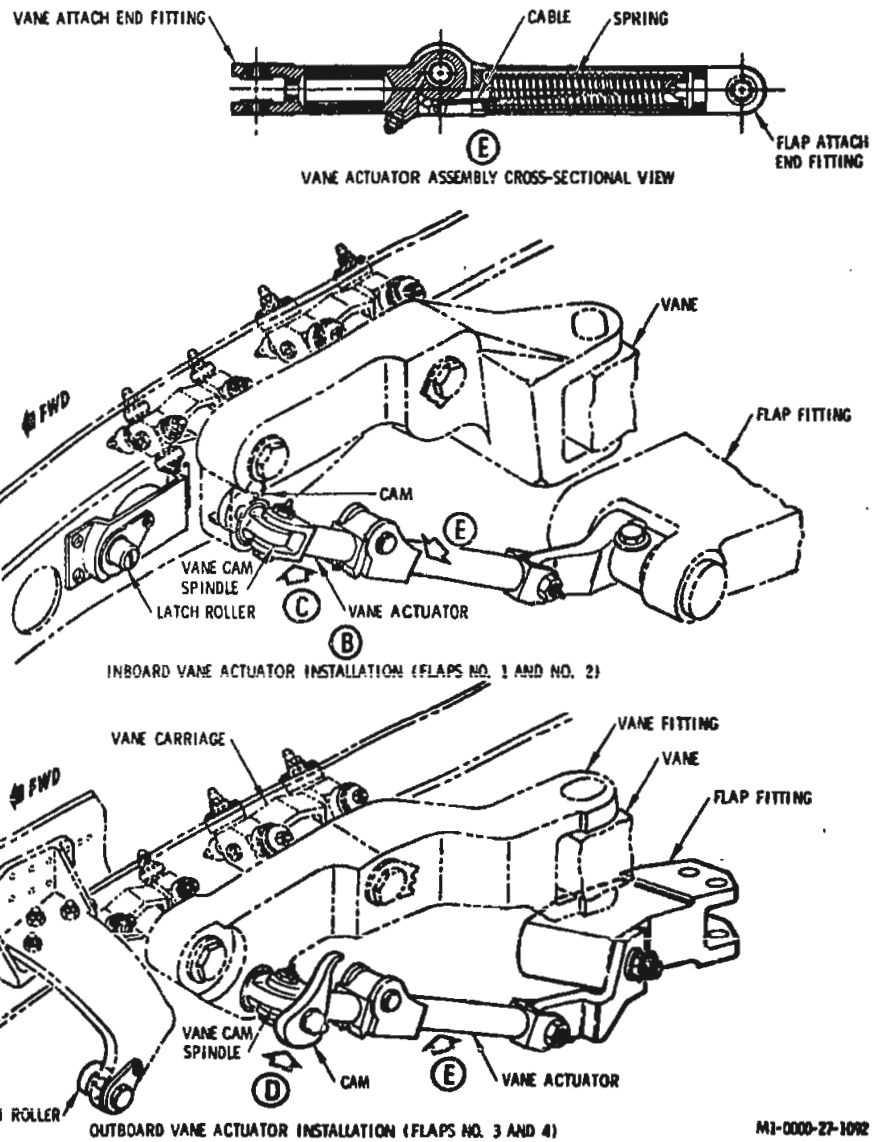
R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (7) Turn on hydraulic systems A and/or C (Ref. 29-11-00).

R WARNING: VERIFY FLAP AND SLAT TRAVEL AREAS ARE CLEAR BEFORE
R OPERATING FLAPS AND SLATS.

R (8) Operate flaps up and down several times to verify
R smooth operation of vane and vane actuator.





M1-0000-27-1012

R Flap Vane Actuator - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

FLAP VANE ACTUATOR - APPROVED REPAIRS

1. General

On aircraft that have excessive rotational free play movement of the vane cam spindle, the vane cam to roller adjustment may be difficult to obtain, (Ref. 27-51-00). This repair will reduce the rotational free play to acceptable levels. The gap between the vane cam spindle protrusions and the vane actuator link is measured and equal size shims are added to the top and bottom surfaces of the vane actuator link clevis to reduce the rotational free play of the vane cam spindle.

2. Equipment and Materials

CR Shim material, steel, 301 1/2 H or harder CRES, 0.005 ±0.001,
CR 0.012 ± 0.002, 0.016 ±0.002, 0.020 ± 0.003, 0.025 ± 0.003, 0.032
CR ± 0.004 inch thickness. 302 1/2 H or harder steel may also be
CR used.

Cotter pin, MS 24655-153

Solvent, Methyl-ethyl-ketone (MEK), or equivalent

Adhesive, P/N 3543A/B, 3M Co., or equivalent. 3M 3535 and LCM 40-1218 Type 1 Tank Sealant are approved equivalents

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-00	Flap Control System - Maintenance Practices
27-51-00	Flap Control System - Adjustment and Test
29-11-00	Hydraulic Power System

4. Approved Repairs

A. Shim fabrication and installation

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on Hydraulic systems A and C (Ref. 29-11-00).

(3) Fully extend flaps (Ref. 27-51-00).

(4) Turn off hydraulic systems A and C (Ref. 29-11-00).

(5) Install warning tags on Flight Engineer/Second Officers hydraulic systems panel, zone 215, and on the hydraulic service panel, zone 147.

(6) Measure total gap between upper and lower forward lugs on the vane cam spindle and the inner surface of the vane actuator link (Ref. Fig. 801).

(7) Determine shim thickness required from table 1 below to reduce total gap to 0.010 inch. Equal size shims must be added to the top and bottom surfaces of the vane actuator clevis. Individual shim thickness should be equal to or less than one half total gap.

Vane Actuator Link Shims
Table 1

CR CR CR Lockheed Part Number	TWA Part Number	Thickness	Thickness Tolerance
CR 57154-12	B02875-1	0.012 inch	± 0.002 inch
CR 57154-16	B02875-2	0.016 inch	± 0.002 inch
CR 57154-20	B02875-3	0.020 inch	± 0.003 inch
CR 57154-25	B02875-4	0.025 inch	± 0.003 inch
CR 57154-32	B02875-5	0.032 inch	± 0.004 inch

CR Vane Actuator Link Shims (Cont)
CR Table 1

Lockheed Part Number	TWA Part Number	Thickness	Thickness Tolerance
N/A	B02875-6	0.005 inch	± 0.001 inch

CAUTION: SHIMS MAY NOT BE LAMINATED OR BONDED TOGETHER, BUT MUST BE A SINGLE ELEMENT.

CR (8) Fabricate shims from appropriate thickness of 301 CRES 1/2 hard or 302 1/2 hard or harder sheet steel (Ref. Fig. 801).

(9) Remove vane actuator from vane and flap fittings. Retain all parts except cotter pins.

(10) Clean the inner surface of the vane actuator link yoke with MEK or equivalent solvent and lint free cloth. Ensure all dirt is removed. Allow to air dry.

CAUTION: ADHESIVE POT LIFE IS LIMITED TO APPROXIMATELY ONE MINUTE.

(11) Mix a small amount of P/N 3543 A/B adhesive, or equivalent, using furnished instructions.

(12) Apply adhesive to inner surfaces of vane actuator yoke, being careful not to allow adhesive to enter bore of bushing.

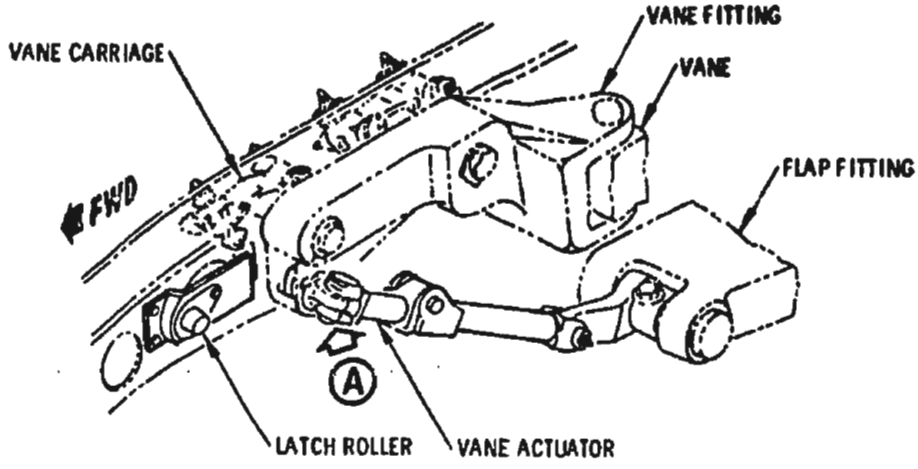
(13) Position prefabricated shims so hole in shim surrounds bushing.

(14) Reinstall vane actuator in vane and flap fittings using original hardware.

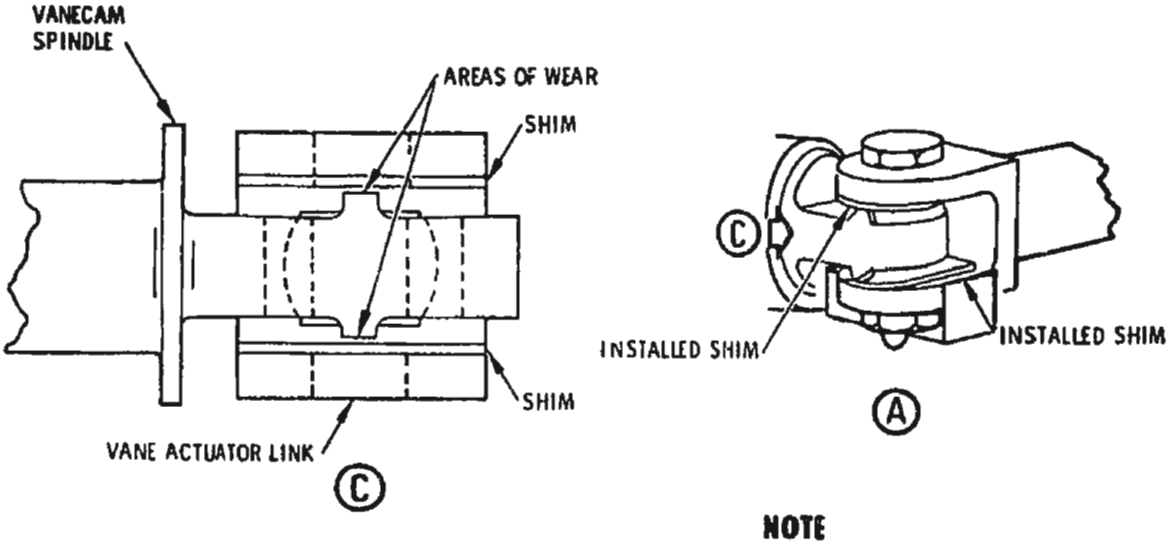
NOTE: Install vanecam spindle to vane actuator attach bolt with bolt head and zerk fitting down.

(15) Install cotter pins P/N MS 24655-153.

(16) Verify clearance between cam and roller is between 0.02 and 0.06 inch. If not, adjust cam roller [Ref. 27-51-00, 501 paragraph 5F(6)].

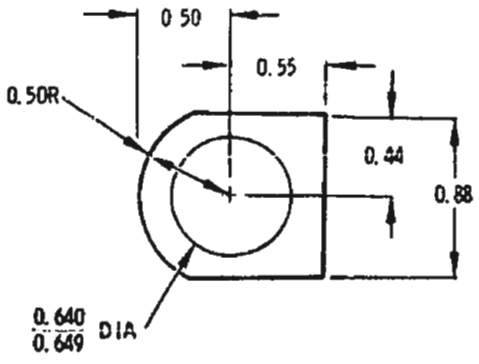


TYPICAL VANE ACTUATOR INSTALLATION



NOTE

SHIMS ON TOP AND BOTTOM SURFACE OF VANE ACTUATOR LINK MUST BE OF EQUAL THICKNESS.



VANE ACTUATOR SPINDLE SHIM

M1-0002-27-922

CR Flap Vane Actuator Spindle Shim Installation - APPROVED REPAIR
CR Figure 801

EFFECTIVITY: ALL

001B

FLAP ASYMMETRY COMPARATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-51-00	Flap Control System - Fault Isolation
	29-11-00	Hydraulic Power Systems - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 211, verify that FLAP CONTROLS circuit breakers No. 2 ASYM BK - TE FLAP (J11) and LOCK LIGHT - TE FLAP (J13) are open and tagged.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breaker No. 1 ASYM BRAKE - TE FLAP (H21) is open and tagged.

(2) In the mid electrical service center, zone 137, disconnect electrical connectors from the comparator (2 places). The comparator is located on the right side of the aft bulkhead.

(3) Remove screws (4 places) attaching comparator to structure.

(4) Remove comparator.

B. Installation

(1) Verify circuit breakers listed in Step A(1) are open and tagged.

(2) Place the comparator in its normal mounting position.

(3) Install screws (4 places) attaching the comparator to structure.

(4) Connect electrical connectors to the comparator.

(5) Remove tags and close circuit breakers opened in Step 1A(1).

(6) Turn on electrical power (Ref. 24-41-00).

R (7) Check FLAP ASYM DET FAULT light as follows:

R (a) Open circuit breaker No. 1 ASYM BRAKE - TE FLAP
R (CB2-H21). Verify that FLAP ASYM DET FAULT Light
R on FE/SO annunciator panel comes on.

R (b) If light does not come on, check light circuit
R (Ref. electrical schematic, 27-51-00 Fault
R Isolation). If light circuit OK, replace
R asymmetry comparator.

R (c) Close circuit breaker; light must go off.

R (d) Perform Steps (a) through (c) with circuit breaker
R NO. 2 ASYM BK - TE FLAP (CB1-J11).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: PRIOR TO GROUND OPERATION OF WING FLAPS, OBSERVE FOLLOWING TO PREVENT SPOILER SELECTOR ACTUATOR STALL: AILERONS FAIRED ±10 DEGREES; SPEEDBRAKE LEVER WITHIN 2 INCHES OF FULL FORWARD.

(8) Turn on hydraulic system A and C (Ref. 29-11-00).

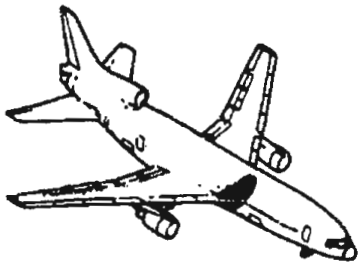
NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(9) Cycle flaps by positioning flap handle from 0 to full flaps and back to 0. Repeat at least two times to verify normal flap system operation.

R (10) Verify that FLAP ASYM DET FAULT light on FE/SO
R annunciator panel does not come on. If light comes on,
R see 27-51-00 Fault Isolation.

(11) Turn off hydraulic power (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 24-41-00).



FAULT ISOLATION PROCEDURE

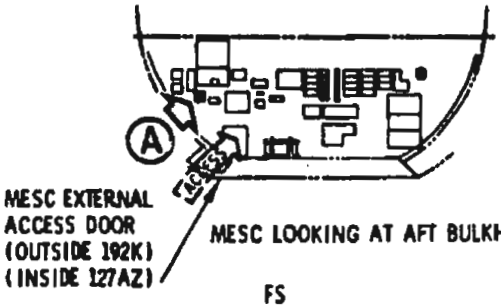
1. EXTEND THE FLAPS AND SLATS. IF A FAULT ISOLATION CHAN IND LIGHT FLASHES ON AND OFF WHILE THEY ARE IN MOTION, NOTE THE FLASHING CHANNEL AND RESET THE COMPARATOR BY CYCLING THE CIRCUIT BREAKERS IN ACCORDANCE WITH THE MAINTENANCE MANUAL. IF NO LIGHTS FLASH OR IF THE ASYM DET FAULT LIGHT COMES BACK ON AFTER RESET, SEE STEP 5.

CAUTION:
DEPRESSING OR RELEASING THE TROUBLE TEST SWITCH WHILE THE FLAPS OR SLATS ARE MOVING MAY CAUSE THE SYSTEM TO LOCK UP.

2. DEPRESS AND HOLD THE LEFT WING TROUBLE TEST SWITCH AND RETRACT THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE LEFT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
3. DEPRESS AND HOLD THE RIGHT WING TROUBLE TEST SWITCH AND EXTEND THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE RIGHT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
4. IF IN STEP 2 AND 3 THE SAME CHAN IND LIGHT AS STEP 1 FLASHES, REPLACE THE ASYMMETRY COMPARATOR.
5. IF NO CHAN IND LIGHTS FLASH INDICATING NORMAL COMPARATOR AND TRANSDUCERS, OR IF RESETTING THE CIRCUIT BREAKERS DO NOT CLEAR ASYM DET FAULT LIGHT, REFER TO MAINTENANCE MANUAL CHAPTER 27-51 FLAPS FOR 27-51 SLATS, FAULT ISOLATION SECTION FOR ISOLATION TO SHUT OFF VALVES, BRAKE SOLENOIDS, 28 VOLT SUPPLIES, OR COMPARATOR.

NOTE: IF THE FLAP/SLAT SYSTEMS AND THE ASYMMETRY COMPARATOR INDICATIONS ARE NORMAL BUT THE COCKPIT INDICATION IS ABNORMAL, REFER TO THE ILCS TEST IN THE MAINTENANCE MANUAL CHAPTER 33-17-00, PAGE 501.

(DECAL FOR -115 COMPARATOR)



FAULT ISOLATION PROCEDURE

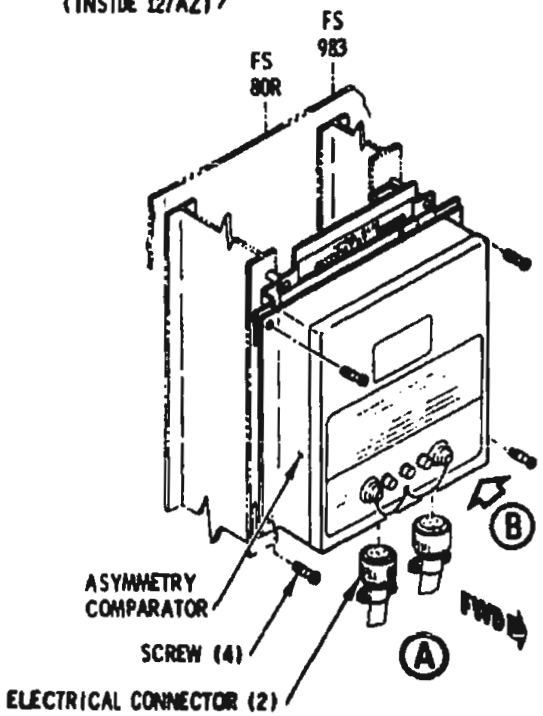
WITH FLAPS/SLATS MOVING, FULLY DEPRESS LEFT WING TROUBLE TEST SWITCH, WHILE CHAN IND IS OFF AND HOLD FOR AT LEAST FIVE SECONDS. RELEASE ONLY WHEN CHAN IND OFF. REPEAT WITH RIGHT WING TROUBLE TEST SWITCH.

CAUTION: PRESSING EITHER TROUBLE TEST SWITCH WHILE THE CHAN IND IS ON WILL CAUSE ASYMMETRY LOCKUP

IF THE LIGHTED CHAN IND EXTINGUISHES AND ANOTHER CHAN IND ILLUMINATES FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THE SWITCH CAUSING THE CHANGE.

IF CHAN IND DOES NOT CHANGE POSITION FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE THE COMPARATOR 672835.

(DECAL FOR -111 COMPARATOR)



FAULT ISOLATION PROCEDURE

WITH FLAPS / SLATS MOVING, PRESS AND HOLD LEFT WING THEN RIGHT WING TEST SWITCH FOR AT LEAST FIVE SECONDS EACH.

IF CHANNEL INDICATOR CHANGES POSITION FOR EITHER SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THAT SWITCH CAUSING CHANGE.

ALL OTHER COMBINATIONS OF FAILURES INDICATE A FAULTY COMPARATOR 672835

(DECAL SHOWN FOR -109 COMPARATOR)

B

M1-0003-27-229

R
R

Flap Asymmetry Comparator - Removal and Installation
Figure 401

EFFECTIVITY: ALL

FLAP ASYMMETRY BRAKE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lubricant, MIL-G-23827, Grease, Aircraft General, or equivalent

Lubricant, MIL-G-21164, or equivalent

Sealing Compound, MIL-S-8660B (Dow Corning DC4), or equivalent

Silicone Sealant, RTV-108

Cotter Pin, MS24665-134, or equivalent

Cleaner, TT-M-261B (Methyl-Ethyl Ketone), or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	24-41-00	External Power/Ground Service System - Maintenace Practices
	27-51-00	Flap Control System - Adjustment and Test
R R	27-52-01	Flap Position Transmitter - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) Verify hydraulic systems A and C are shut off (Ref. 29-11-00).

(2) Tag Flight Engineer/Second Officers hydraulic system panel, zone 215, and hydraulic service panel, zone 147.

(3) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 2 ASYM BK - TE FLAP (J11).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker NO. 1 ASYM BRAKE - TE FLAP (H21).

R (4) Verify flap control handle is in the 0-degree detent position.

(5) Remove wing exterior access panel 571AB (left wing) or 671AB (right wing) (Ref. 6-40-00).

(6) Remove screws retaining rotary transducer to brake
R assembly. Remove and support rotary transducer (Ref.
R Fig. 401).

R (7) Disconnect electrical connector from the flap position
R transmitter.

(8) Disconnect electrical connector from the solenoid assembly.

CAUTION: IF BRAKE IS JAMMED, TORQUE TUBE MAY BE LOADED AND CAUSE SPRING-BACK WHEN TORQUE TUBE OR BRAKE IS DISCONNECTED. TO REDUCE SPRING-BACK, TRIP BRAKE BY PULLING OUT RESET KNOB BEFORE DISCONNECTING TORQUE TUBE.

(9) Remove smaller diameter universal joint bolt. Secure end of shaft to wing structure.

(10) Remove asymmetry brake mounting bolts and remove asymmetry brake.

B. Installation

R (1) Verify circuit breakers opened in Step 3A(3) are open and tagged.

R (2) Verify flaps are in full up position.

(3) Position asymmetry brake in wing and attach with bolts.

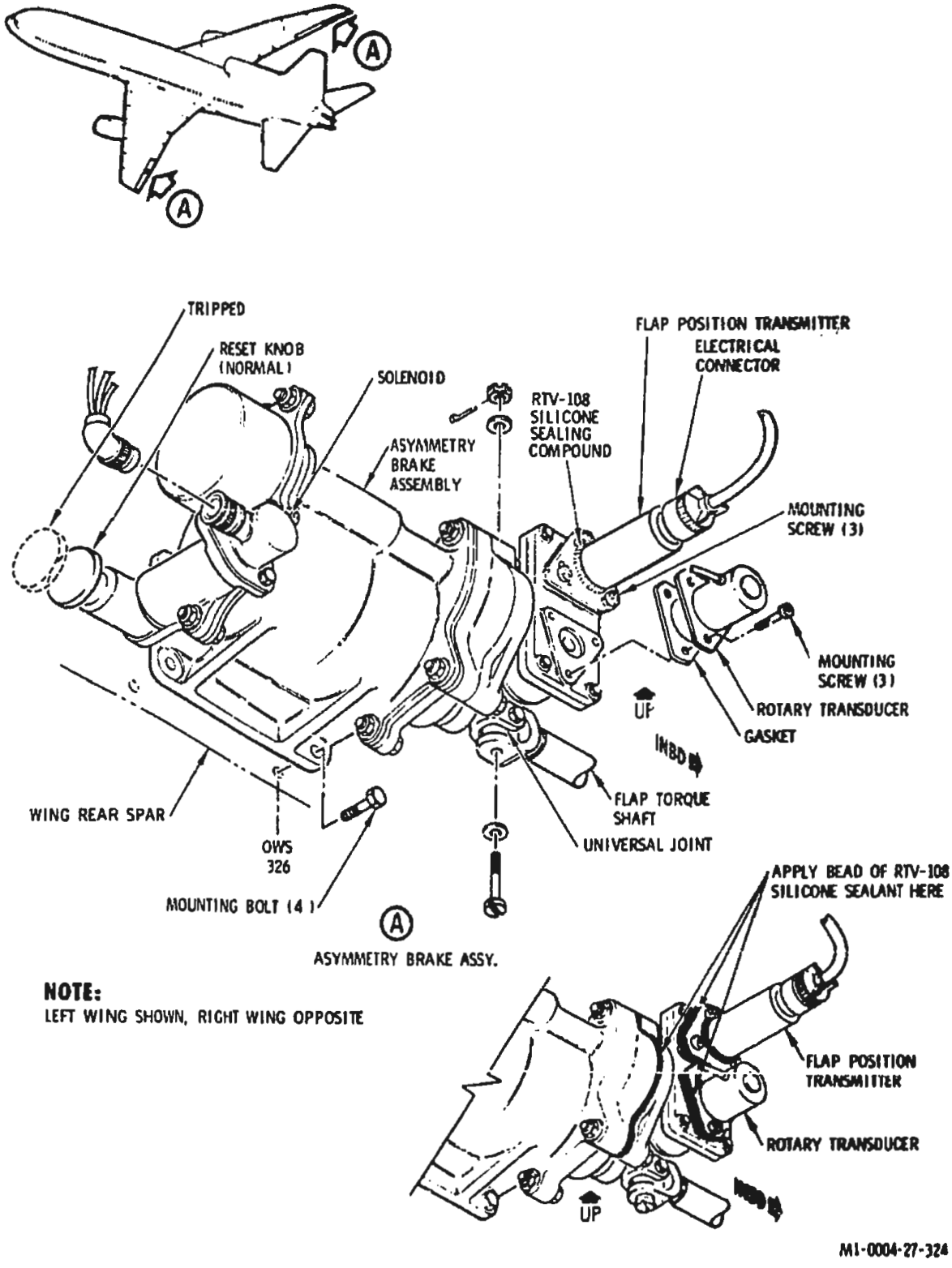
R NOTE: Verify torque shaft universal joint is connected to flap gearbox spline shaft on inboard end before connecting torque shaft to the asymmetry brake.

(4) Coat the connecting bolt for outboard torque shaft universal joint with lubricant.

(5) Attach universal joint to clevis on flap asymmetry brake input shaft with bolt, washer, and nut.

(6) Torque nut 30 to 40 lb inch.

(7) Install cotter pin.



R Flap Asymmetry Brake - Removal and Installation
R Figure 401

(8) Wipe off excess lubricant.

(9) Connect electrical connector to solenoid assembly.

R (10) Connect electrical connector to the flap position
R transmitter.

R NOTE: Verify that mating joint between transmitter
R mounting flange and housing is sealed with
R RTV-108 silicone sealing compound (Ref. Fig.
R 401).

R Instructions for Removal and Installation of the
R flap position transmitter, adjustment of the
R flap position transmitter and sealing the flap
R position transmitter mounting flange are
R contained in the Maintenance Manual 27-52-01.

(11) On rotary transducers 672834-111 and 113 only, completely fill cavity of brake assembly into which rotary transducer mounts with MIL-S-8660B sealing compound (Dow Corning DC4); verify that cavity does not contain any moisture prior to filling with sealing compound.

NOTE: If a (oil-filled) rotary transducer (672834-115 or higher) is being installed on an asymmetry brake that contains sealing compound in the rotary transducer mounting cavity, completely remove the sealing compound. Use cotton tip swabs and TT-M-261B cleaner. (A light coating of sealing compound remaining on surfaces is acceptable.)

(12) Position transducer, with gasket, on asymmetry brake assembly reducer, and insert transducer shaft into splined hole in reducer. Verify that any excess sealing compound is squeezed out of the brake assembly cavity by the transducer in order to allow the transducer mounting flange to seat on the brake assembly.

NOTE: If tri-wing screws are used, replace with NAS1351-3H-6P socket-head cap screws, or equivalent.

(13) Secure transducer with washer and screws; lock-wire screws. No adjustment of transducer is required.

(14) Apply a bead of RTV-108 silicone compound around perimeter of the asymmetry rotary transducer mounting

flange and a bead around mating surface of reducer housing to asymmetry brake (Ref. Fig. 401).

(15) Remove tags and close circuit breakers opened in Step 3A(3).

(16) Remove hydraulic panel tags installed in Step 3A(2).

(17) Perform Flap Assymmetry Dectector System Operational Test (Ref. 27-51-00).

FLAP ASYMMETRY BRAKE - ADJUSTMENT AND TEST

1. General

CR This section provides the procedures to preform a torque test of the flap asymmetry brake. An operational test of the flap asymmetry detector system is covered in 27-51-00, Adjustment and Test, Para. 4C.

2. Equipment and Materials

Flap Asymmetry Brake Adapter Wrench - G/ITEL 27-51-164

Silicone Sealant, RTV-108

Torque Wrench, 1000 pound-inch.

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-50	Flap Asymmetry Brake - Removal and Installation
27-51-51	Flap Asymmetry Rotary Transducer - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Adjustment/Test

A. Functional Test

(1) Verify that hydraulic systems A and C are shut off and hydraulic control panels tagged.

(2) Remove access panels under both flap asymmetry brakes: 571AB, left wing; 671AB, right wing (Ref. 6-40-00).

(3) Turn on electrical power (Ref. 24-41-00).

(4) Verify that following circuit breakers are closed: NO. 2 ASYM BK - TE FLAP (CB1-J11) and NO. 1 ASYM BRAKE - TE FLAP (CB2-H21).

CR CR CR (5) Set left and right asymmetry brakes by pulling out on each reset knob. This engages the brake for the following torque check.

R (6) Uncouple torque shaft from yoke at left asymmetry brake by removing small-diameter bolt from universal coupling (Ref. Fig. 501).

CAUTION: DO NOT ALLOW ASYMMETRY BRAKE SHAFT TO ROTATE WITH RESPECT TO TORQUE SHAFT OR FLAP POSITION TRANSMITTER WILL BE OUT OF RIG.

NOTE: Small-diameter bolt goes through large-diameter bolt of universal coupling. Do not attempt to remove large-diameter bolt. Do not lose special teflon-faced washers that are installed between yoke and crossblock.

R (7) Install torque wrench adapter in universal yoke on asymmetry brake input shaft (Ref. Fig. 501).

R (8) Connect 1000 pound-inch torque wrench to adapter. Apply a minimum of 650 pound-inches torque, in either direction, to brake input shaft. There must be no rotation of brake shaft. If brake slips (shaft rotates), replace asymmetry brake (Ref. 27-51-50, Removal and Installation).

R (9) Remve torque wrench and adapter.

R (10) Reconnect universal; verify that teflon-faced washers are installed between yoke and crossblock with teflon against crossblock. Install small-diameter bolt, washers, and nut in universal. Install cotter pin.

R (11) Repeat Steps 4A(6) through 4A(10) for right asymmetry brake.

R (12) Reset asymmetry brakes as follows:

(a) Open following circuit breakers for 5 seconds and then close: NO. 2 ASYM BK - TE FLAP (CB1-J11) and NO. 1 ASYM BRAKE - TE FLAP (CB2-H21). (This resets the asymmetry comparator.)

(b) Reset both asymmetry brakes by pushing in on reset knob.

R (13) Verify that following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1, zone 210:

FLAP CONTROLS

NO. 2 ASYM BK - LE SLAT and TE FLAP (J10, J11)

LOCK LIGHT - LE SLAT and TE FLAP (J12, J13)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE - TE FLAP and LE SLAT (H21, H22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel:

POSN IND - TE FLAP and LE SLAT (K16, K17)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (14) Remove tags from hydraulic control panels.

R (15) Turn on hydraulic systems A and C (Ref. 29-11-00).

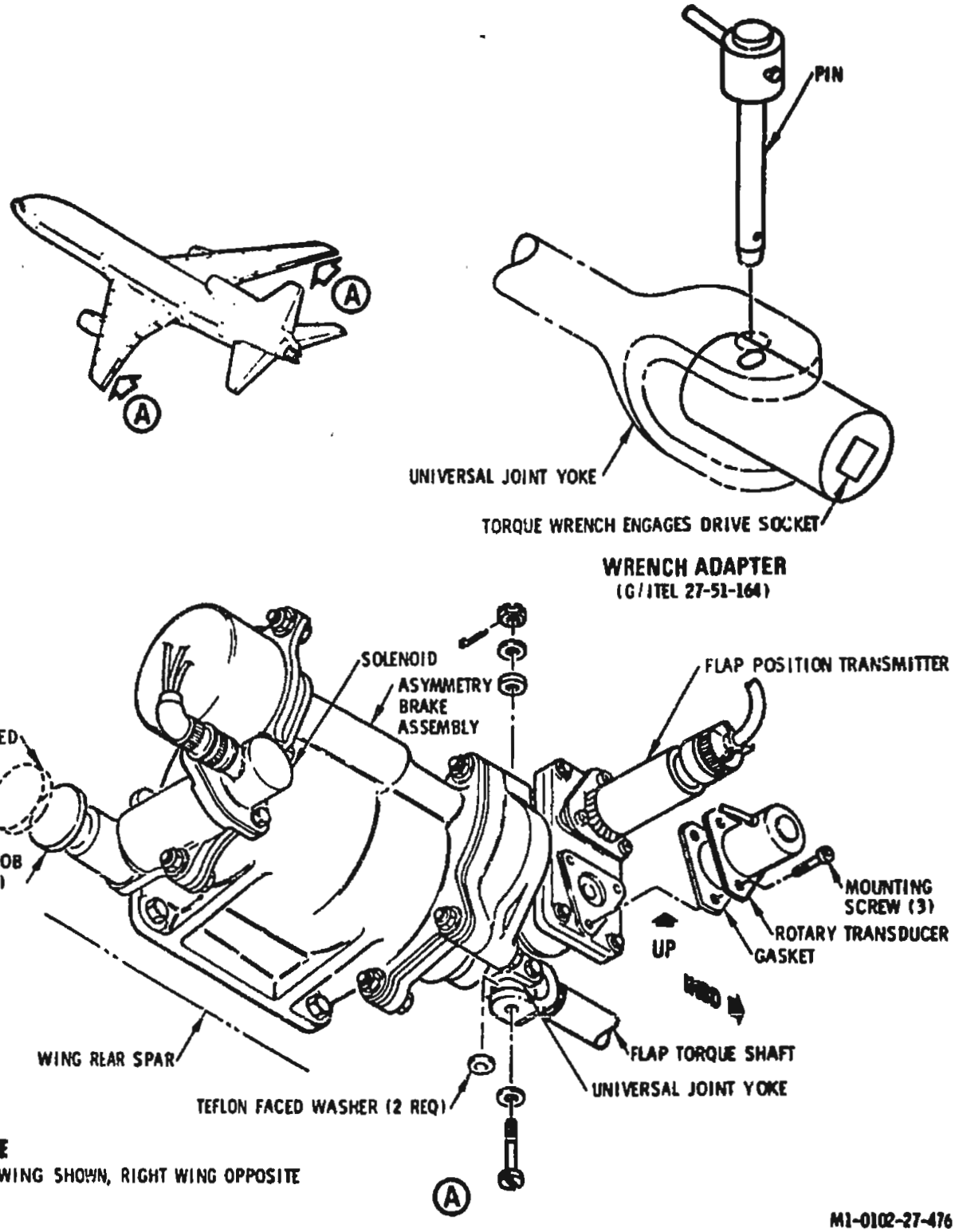
NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

R (16) Cycle flaps from full up to full down and back to full up. Verify that flap operation is normal and that FLAP ASYM DET FAULT light on FE/SO annunciator panel does not come on.

R (17) Turn off electrical power if no longer required (Ref. 24-41-00).

R (18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

R (19) Install access panels under asymmetry brakes.



R R Flap Asymmetry Brake - Adjustment and Test
Figure 501

R EFFECTIVITY: ALL

R R 001B

FLAP ASYMMETRY ROTARY TRANSDUCER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

Sealing Compound, MIL-S-8660B (Dow Corning DC4), or equivalent

Silicone Sealant, RTV-108

Cleaner, TT-M-261B (Methyl-Ethyl Ketone), or equivalent

Cleaner, Trichloroethane 1,1,1, or equivalent

2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-00	Trailing Edge Flap System - Fault Isolation
27-51-00	Trailing Edge Flap System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal (Ref. Fig. 401)

R R R R WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Shut off hydraulic systems A and C (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(3) Open and tag the following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: NO. 2 ASYM BK - TE FLAP (J11) and LOCK LIGHT - TE FLAP (J13).

(b) On Flight Engineer/Second Officers overhead circuit breakers panel CB2, zone 215: NO. 1 ASYM BRAKE - TE FLAP (H21).

(4) Open the following applicable access panel:

For left flap asymmetry rotary transducer: 571AB

For right flap asymmetry rotary transducer: 671AB

(5) Disconnect transducer electrical cable connector.

(6) Remove screws securing transducer (Ref. Fig. 401).

B. Installation (Ref. Fig. 401)

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

R (1) Connect rotary transducer electrical harness.

R (2) Verify that circuit breakers opened in Step 3A(3) are R closed.

R (3) Turn on electrical power (Ref. 24-41-00).

R (4) Check rotary transducer as follows:

R (a) Turn shaft of rotary transducer in either R direction.

R (b) Verify that both left and right asymmetry brakes R have actuated and the FLAP/SLAT LOCK light on R FE/SO annunciator panel comes on.

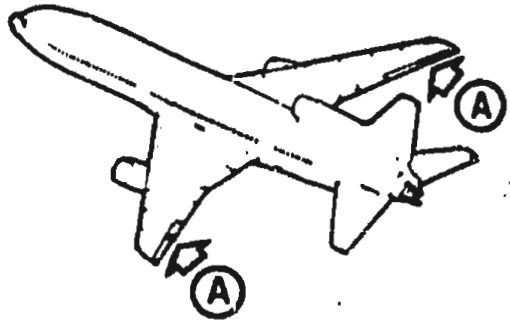
R (5) Reset asymmetry comparator by opening following circuit R breakers for 5 seconds and then closing: NO. 2 ASYM BK R - TE FLAP (CB1-J11), and NO. 1 ASYM BARKE - TE FLAP R (CB2-H21).

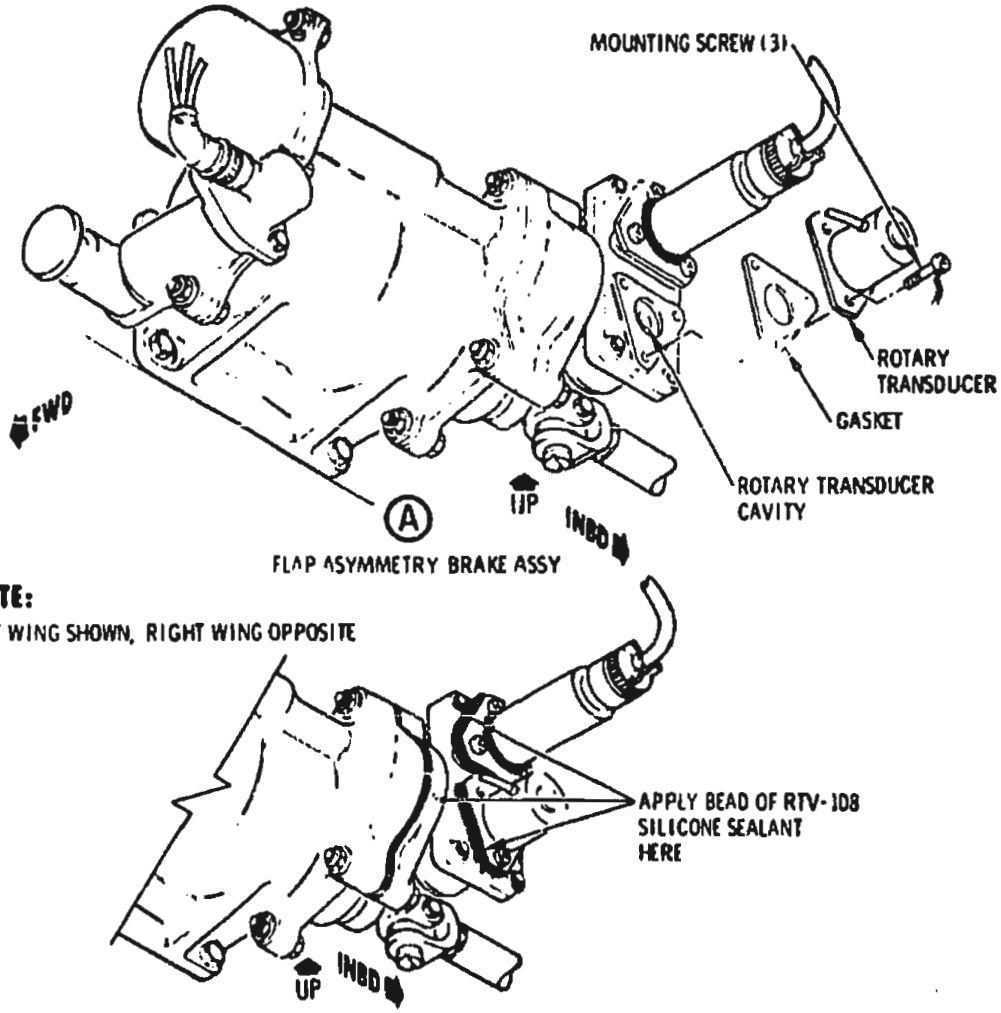
R (6) Reset both asymmetry brakes.

R (7) Completely fill roatry transducer mounting cavity on R brake with MILL-S-8660B sealing compound.

R (8) Position transducer on asymmetry brake assembly, and R insert transducer shaft into splined hole in brake R assembly. Verify that gasket is installed between R transducer and brake.

R NOTE: If the latest (oil-filled) rotary transducer R (672834-115 or 117) is being installed on an





R Flap Asymmetry Rotary Transducer - Removal and Installation
R Figure 401

asymmetry brake that contains sealing compound in the rotary transducer mounting cavity, completely remove the sealing compound. Use cotton tip swabs and TT-M-261B cleaner. (A light coating of sealing compound remaining on surfaces is acceptable).

(9) Secure transducer with washers and screws. Lock-wire screws.

NOTE: If tri-wing screws are used, replace with NAS1351-3H-6P socket-head cap screws, or equivalent.

(10) Using clean rags and Trichloroethane 1,1,1 Cleaner, clean the area around the perimeter of the mated rotary transducer mounting flange. Apply a bead of RTV-108 silicone sealing compound around perimeter of transducer mounting flange to seal mating surfaces
R (Ref. Fig. 401).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (11) Remove warning tags from hydraulic control panels.

R (12) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

R (13) Cycle flaps from full up to full down and return to full up for several cycles. Verify that flap operation is normal. Verify that FLAP ASYM DET FAULT light on FE/SO annunciator panel does not come on. If light comes on, see Fault Isolation, Figure 104 (Ref. 27-51-00).

R (14) Shut off hydraulic systems A and C if no longer required (Ref. 29-11-00).

R (15) Close access panels 571AB and 671AB.

FLAP HANDLE ACTUATED SWITCHES - ADJUSTMENT AND TEST

1. Equipment and Materials

Throttle and Flap Switch Test Set PN T-6017-TCT, or equivalent

28V dc power source

2. Referenced Procedures

29-11-00 Hydraulic Power System - Maintenance Practices

3. Adjustment/Test

R A. Flap Handle Actuated Switches

(1) Tag the flap handle to prevent flap handle movement during procedure.

(2) Open and tag the following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210:

FCES - COMPUTERS - AC & L AOA (B5)

LANDING GEAR - WARN HORN (L12)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB3, zone 215:

ENG OUT IND (R7)

(3) Open access door 112AB to forward electronic service center.

(4) At flap switch assembly, remove bolt connecting flap forward cable quadrant pushrod to the flap switch assembly (Ref. Fig. 501).

(5) Disconnect the switch assembly electrical connector.

(6) Connect test set plug to 28V dc source.

(7) Connect test set harness to the flap switch electrical connector.

(8) Check switch adjustment by manually positioning cams to required degree setting and checking for proper light sequence per chart on Fig. 501.

NOTE: If a test set is not available, use continuity tester or ohmmeter and check pin continuity per chart on Fig. 501.

(9) If any switch does not meet chart requirements, adjust switch actuation point with adjusting screw. After a switch adjustment, check minimum thread engagement by verifying that adjusting screw is flush with or protruding above insert.

R (10) Reconnect pushrod to switch assembly lever. Verify
R pushrod adjustment: With flap handle in 0 detent.
R Switch assembly cam degree setting must be 0 (±0.5)
R degree. If not, adjust pushrod.

R (11) Verify that all hydraulic power is turned off
R (reference 29-11-00).

R (12) Remove tag from flap handle.

R (13) While one man views switch assembly, cycle flap handle
R from 0 to full flaps three times. Verify that switch
R assembly operates smoothly with no interference.

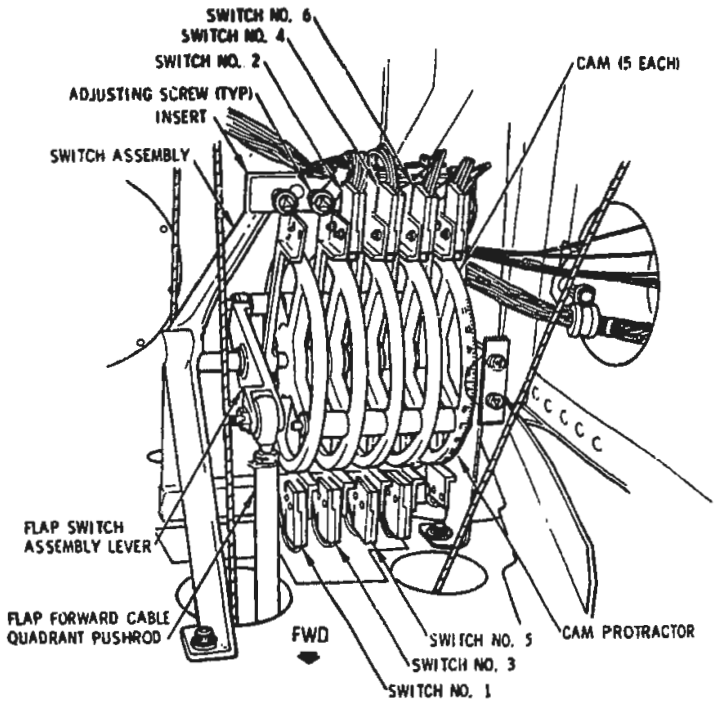
R (14) Move flap handle towards 33° detent. Verify switches 1
R thru 5 change from clear to amber lights prior to flap
R handle reaching the 33° detent position. Return flap
R handle to 0° position. Verify switches 1 thru 5 change
R from amber to clear lights.

R (15) Disconnect test set harness from switch assembly.

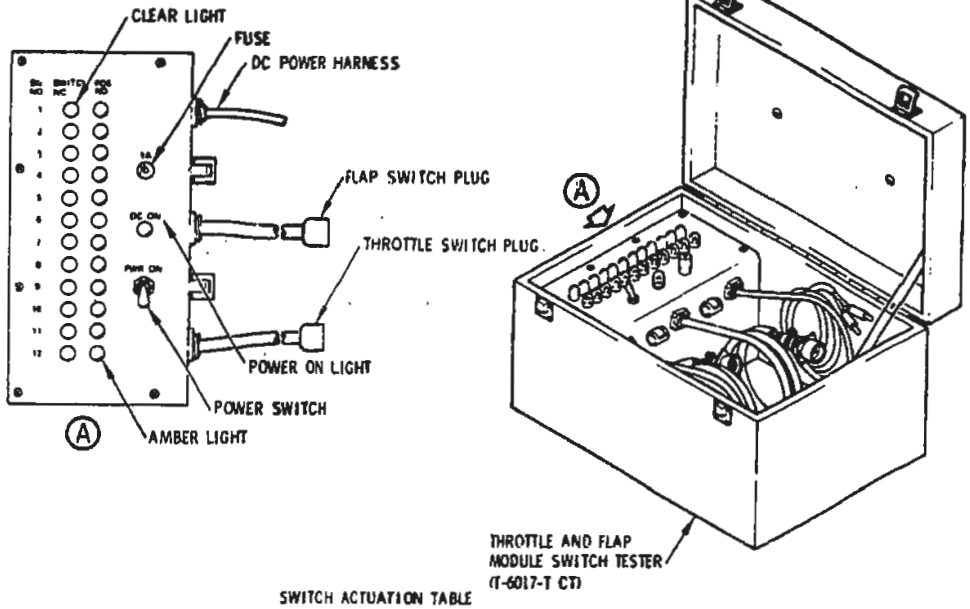
R (16) Reconnect switch assembly electrical connector to
R airplane electrical connector.

R (17) Close access door 112AB.

R (18) Remove tags and close circuit breakers opened in Step
R 3A(2).



VIEW LOOKING UP



SWITCH ACTUATION TABLE

SWITCH NO.	SWITCH FUNCTION	CAM ROTATION IN DEGREES (1)			PIN NO. CONTINUITY
		CLEAR LIGHT	TRANSITION AREA	AMBER LIGHT	
1	LNDG HORN	0 - 9.3	9.3 - 9.5	9.5 - 11.6	24 - 26
					24 - 25
2	DLC SYS 1A	0 - 9.3	9.3 - 9.5	9.5 - 11.6	2 - 20
					1 - 3
3	DLC SYS 1B	0 - 9.3	9.3 - 9.5	9.5 - 11.6	21 - 28
					28 - 29
4	DLC SYS 2A	0 - 9.3	9.3 - 9.5	9.5 - 11.6	13 - 3R
					4 - 12
5	DLC SYS 2B	0 - 9.3	9.3 - 9.5	9.5 - 11.6	30 - 39
					30 - 31
6	ENG OUT	0-3.3; 9.5-11.6	3.3-3.8; 9.3-9.5	3.8 - 9.3	5 - 40
					5 - 16

(1) EACH UNIT REPRESENTS 1°

M1-0102-27-103

R Flap Handle Actuated Switches - Adjustment and Test
R Figure 501

EFFECTIVITY: ALL

001B

FLAP PDU DIVERGENCE COMPARATOR - REMOVAL AND INSTALLATION

1. General

R The divergence comparator is part of the flap PDU and incorporates switches that sense when the PDU hydraulic spool valve position does not correspond to the relative positions of the PDU input levers and the output shafts. The switches are potted within the comparator assembly and cannot be replaced separately; the entire comparator assembly must be replaced.

2. Equipment and Materials

Comparator Reset Tool - Curtiss-Wright PN ST 7156, or equivalent

Rig pin - Curtiss-Wright PN ST 7138, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

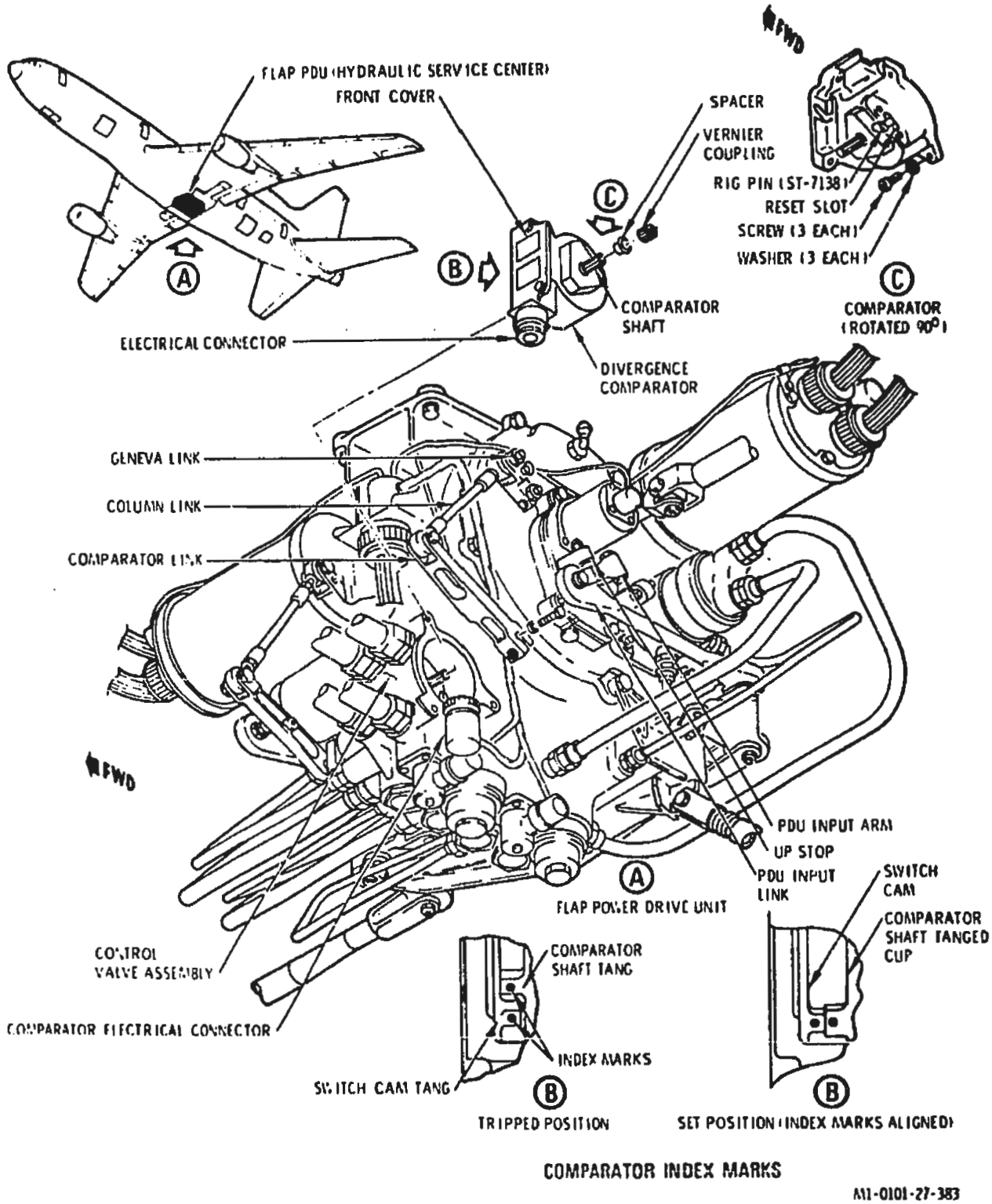
(1) Gain access to hydraulic service center through access door 147AB or 147BB (Ref. 6-40-00).

(2) On left side of PDU (comparator side) remove nuts, bolts and washers that attach both ends of column link [(at comparator link and geneva link) (Ref. Fig. 401)]. Remove column link. Do not change length adjustment of column link.

(3) Disconnect electrical connector from comparator assembly.

(4) Operate flaps to flap up position.

(5) Shut off hydraulic systems A and C and tag hydraulic control panels.



R Flap PDU Divergence Comparator - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

R (6) On both sides of flap PDU, lock-wire PDU input arms
R against up-stops (Ref. Fig. 401).

R (7) On both sides of PDU, remove nuts and bolts holding PDU
R input links to PDU input arms and swing input links out
R of the way.

R (8) Remove bolt, nut, and washer that clamp comparator link
R to comparator shaft. Remove bolt and washer securing
R comparator link to comparator shaft. Slide link off
R shaft. Remove vernier coupling and spacer from
R comparator shaft. Save parts for re-use.

R (9) Remove three bolts and washers attaching comparator to
R hydraulic control valve assembly. Remove comparator
R assembly.

R B. Installation

R (1) Verify that hydraulic systems A and C are shut off and
R hydraulic control panels are tagged.

R (2) Verify that both PDU input arms are lock-wired against
R up-stops.

R (3) Prepare replacement comparator for installation as
R follows:

R (a) Remove comparator front cover by removing two
R bolts and washers.

R (b) Remove comparator reset cover by removing two
R screws and washers.

R (c) Neutralize switch cam by rotating comparator shaft
R clockwise and counterclockwise from stop to stop
R (approx. 30 degrees) then move switch cam to
R center of travel.

R (4) Install comparator to control valve and attach with
R three bolts and washers.

R (5) Install comparator shaft spacer.

R (6) Install comparator link, with vernier coupling, on
R comparator shaft; position comparator link towards 5
R o'clock position.

R (7) Verify that comparator has been properly preloaded by
R inserting rig pin ST 7138 (0.187-inch diameter) through
R reset slot into hole in tanged cup on comparator shaft.

If hole does not align with reset slot, preload the comparator as follows:

(a) Depress switch cam toward control valve using ST 7156 or equivalent. Be careful not to damage switches. Rotate comparator link clockwise until hole in comparator shaft cup is located by rig pin or until comparator link rotation is stopped by external interference.

(b) If interference is encountered, allows switch cam to move against comparator shaft cup. Cam will then prevent comparator shaft cup from unwinding more than 30 degrees when torque is removed from comparator link.

(c) Remove comparator link (with or without vernier coupling) from comparator shaft. Reinstall comparator link on shaft at 5 o'clock position. Repeat Step (7).

NOTE: Total windup of comparator shaft to preload internal spring and align rigging holes in cup and in cam is approx. 200 degrees. Torque should not exceed 5 inch pounds.

(8) Install rig pin through holes in both tanged cup and switch cam while the index mark on tanged cup and switch cam are aligned.

(9) Install column link to geneva link of PDU and attach with bolt, washer and nut. Secure with cotter pin.

(10) Reposition comparator link on comparator shaft without vernier coupling so that end of link may be aligned with lower end of column link. Then insert vernier coupling by rotating vernier coupling until both internal and external splines are aligned to permit assembly.

(11) Check comparator setting as follows:

R CAUTION: IF COMPARATOR TRIPS, DO NOT MOVE INPUT ARMS
R WITHOUT RESETTING COMPARATOR OR INTERNAL
R DAMAGE MAY RESULT.

(a) Remove rig pin from comparator.

(b) Remove lockwire securing input arms to up-stops.

(c) Hold right side PDU input arm at up-stop and move left side PDU input arm toward down-stop.

Comparator should trip. Observe through access opening.

(d) Reset comparator by depressing cam toward valve (use tool ST 7138) while returning left side PDU input arm to up-stop.

(e) Hold left side PDU input arm at up-stop and move right side PDU input arm toward down-stop. Comparator should trip. Reset comparator.

(f) If comparator does not trip in both Steps (c) and (e), readjust comparator as outlined in Step (12). If comparator setting checks are satisfactory, proceed with Step (13).

(12) Adjustment of comparator setting:

(a) Reset comparator by depressing cam toward control valve and moving one input arm with respect to the other until the tanged cup and switch cam tangs are aligned. Insert comparator rig pin through both comparator shaft cup and switch cam.

(b) Move both input arms to up-stops.

(c) If comparator does not trip during Step (11)(c), remove nut, bolt and washer attaching column link to comparator link. Remove vernier coupling. Raise comparator link approximately 1/8 inch at junction to column link and reinsert vernier coupling.

NOTE: Smallest increment of angular change is accomplished by repositioning vernier clockwise or counterclockwise six teeth with respect to spline on comparator link.

(d) If comparator does not trip during Step (11)(e) remove nut, bolt and washer attaching column link to comparator link. Remove vernier coupling. Lower comparator link approximately 1/8 inch at junction to column link and reinsert vernier coupling.

(e) Recheck comparator setting in accordance with Step (11). Repeat adjustment if check of comparator setting is not satisfactory.

R CAUTION: IF COMPARATOR TRIPS, DO NOT MOVE INPUT
R ARMS WITHOUT RESETTING COMPARATOR OR
R INTERNAL DAMAGE MAY RESULT.

(13) Insert bolt, washer and nut through comparator link to clamp link to comparator shaft. Torque nut to 50 to 70 pound inches and install cotter pin.

(14) Install bolt and washer in end of comparator shaft. Torque bolt 50 to 70 pound inches and lock wire.

(15) Reconnect PDU input links to PDU input arms; torque nuts to 50 to 70 pound inches and install cotter pin.

(16) Install reset cover, with gasket, to comparator and attach with two screws and washers. Lock-wire screws.

(17) Install electrical connector to comparator electrical receptacle.

(18) Verify that following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1, zone 210:

FLAP CONTROLS

NO. 2 ASYM BK - TE FLAP (J11)

LOCK LIGHT - TE FLAP (J13)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: NO. 1 ASYM BRAKE - TE FLAP (H21).

(19) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(20) Turn on hydraulic systems A and C (Ref. 29-11-00).

(21) Cycle flaps from full up to full down and back to full up. Verify that flap operation is normal.

(22) Verify that comparator index marks are aligned (±0.060 inch).

(23) Install gasket and cover on front of comparator with two washers and bolts.

(24) Turn off hydraulic power (Ref. 29-11-00).

(25) Turn off electrical power (Ref. 24-41-00).

R FLAP/SLAT PROGRAMMER QUADRANT ASSEMBLY
R REMOVAL AND INSTALLATION

R 1. General

R This section provides the procedures for the removal and
R installation of the flap/slat programmer.

R 2. Equipment and Materials

R Cotter pin MS24665-149

R Cotter pin MS24665-151

R 3. Referenced Procedures

R	6-50-00	Interior Access Doors and Panels
R	27-51-00	Flap Control System - Adjustment and Test
R	27-51-04	Flap and Slat Control System Cable Break Detector - Removal and Installation
R	27-51-04	Flap and Slat Control System Cable Break Detection - Adjustment and Test
R	27-81-00	Leading Edge Slat Control System - Adjustment and Test
R	27-81-42	Slat Control Start-up Switch Assembly - Removal and Installation

R 4. Removal and Installation

R A. Removal

R (1) Tag flap handle against unauthorized movement.

R NOTE: The flap handle must be moved to allow access
R for several steps in this procedure.

R (2) Gain access to Mid Electrical Service Center (MESC)
R (Ref. 6-50-00).

R WARNING: VERIFY FLAP HANDLE IS TAGGED AGAINST MOVEMENT
R PRIOR TO PERFORMING MAINTENANCE IN CLOSE PROXIMITY
R TO THE FLAP/SLAT PROGRAMMER.

R (3) In MESC ceiling, remove Flap and Slat Control Cable Break Detector Switch assemblies (center and aft cable loops) (Ref. 27-51-04). Do not disconnect electrical wires. Stow switch assemblies so wires are not stressed (Ref. Fig. 401).

R NOTE: Flap/Slat Control Cable Break Detector Switch assembly (forward cable loop) should not be removed.

R (4) Remove Slat Control Start-up Switch Assembly (Ref. 27-81-42). Do not disconnect electrical wires. Stow switch so wires are not stressed.

R WARNING: VERIFY FLAP HANDLE IS TAGGED AGAINST MOVEMENT PRIOR TO PERFORMING MAINTENANCE IN CLOSE PROXIMITY TO THE FLAP/SLAT PROGRAMMER.

R VERIFY HYDRAULIC SYSTEMS A AND C ARE OFF PRIOR TO MOVING FLAP HANDLE.

R (5) Remove cotter pins that retain cable ends in quadrants (6 places). It may be necessary to move flap handle to gain access. Remove flap handle tag, reposition flap handle and reinstall tag as required.

R (6) Remove cable guard pins (6 places).

R (7) Gain access to, and loosen the following control cables:

R (a) Flap/Slat control cables (forward cable loop) under Forward Cargo Compartment ceiling access panels 125 HR and 125 KR (Ref. 6-50-00).

R (b) Slat control cables (center cable loop) in MESC, left side overhead.

R (c) Flap control cables (aft cable loop) under passenger cabin floor access panel 252 FB.

R (8) In MESC, disengage control cables from their respective quadrants.

R (9) Remove flap/slat programmer by removing nuts and washers from mounting bolts.

R NOTE: Both right and bottom left attach bolts are eye bolts that are connected to support rods. These rods need not be disturbed.

R B. Installation

R WARNING: VERIFY FLAP HANDLE IS TAGGED AGAINST MOVEMENT
R PRIOR TO PERFORMING MAINTENANCE IN CLOSE PROXIMITY
R TO THE FLAP/SLAT PROGRAMMER.

R VERIFY HYDRAULIC SYSTEMS A AND C ARE OFF.

R (1) Install flap/slat programmer in MESC ceiling. Both
R right and bottom left attach bolts are eye bolts that
R are connected to support rods and should already be
R installed.

R NOTE: Top left programmer attach bolt is a normal
R bolt, nut and washer installation.

R (2) Install control cables in their respective quadrants.
R It may be necessary to move flap handle to gain access.
R Remove flap handle tag, reposition flap handle and
R reinstall flap handle tag.

R (3) Install control cable retaining cotter pins in
R quadrants near each cable end.

R (4) Rig Flap/Slat and Flap control cables (Ref. 27-51-00)
R and Slat control cables (Ref. 27-81-00).

R NOTE: Flap/Slat control cables (forward cable loop)
R must be rigged first.

R Do not perform flap or slat system verification
R test at this time.

R (5) Install cable guard pins.

R (6) Install Slat Control Start-up Switch (Ref. 27-81-24).

R (7) Install Flap and Slat Control Cable Break Detector
R Switch assemblies (center and aft cable loops) (Ref.
R 27-51-04).

R (8) Remove flap handle tag.

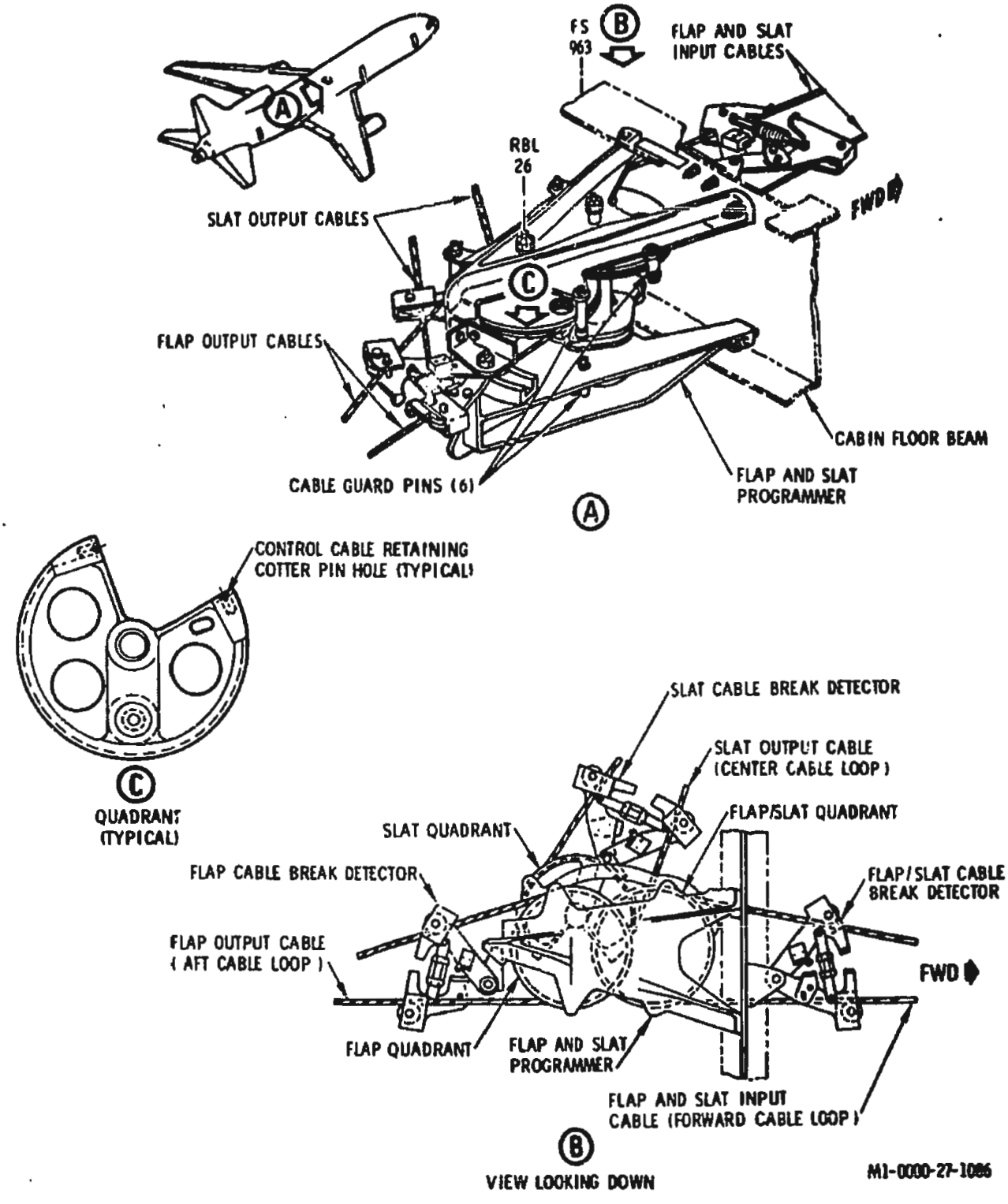
R (9) Perform the following tests:

R (a) Flap system verification test (Ref. 27-51-00).

R (b) Slat system verification test (Ref. 27-81-00).

R (c) Flap and Slat Control System Cable Break Detector
R - Adjustment and Test (Ref. 27-51-04).

R (d) Slat Control Start-up Switch Assembly (Operational
R Check portion of Installation procedure) (Ref.
R 27-81-42).



R Flap/Slat Programmer Quadrant Assembly - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

FLAP AND SLAT CONTROL CABLE BREAKAGE DETECTOR SWITCH REMOVAL AND INSTALLATION

1. General

The flap and slat control system consists of three cable loops: the forward, center, and aft loops. The forward and aft cable loops control the flaps; the forward and center cable loops control the slats. Each cable loop incorporates a cable breakage detector switch to detect slack or broken cables. This procedure covers all three cable loop switches.

2. Referenced Procedure

24-41-00 External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal (Ref. Fig. 401)

(1) Open and tag the following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: NO. 2 ASYM BK LE SLAT (J10) and NO. 2 ASYM BK TE FLAP (J11).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: NO. 1 ASYM BRAKE TE FLAP (H21) and NO. 1 ASYM BRAKE LE SLAT (H22).

(2) Gain access to mid electrical service center (MESC).

(3) Tag switch wires for identification and disconnect.

(4) Remove screws, washers, and nuts attaching switch to detector arm. Remove switch. Retain switch actuator for reinstallation.

B. Installation (Ref. Fig. 401)

(1) Install switch on detector arm with two screws, washers, and nuts. Verify that switch actuator is installed between switch and detector lever.

(2) Connect switch wires.

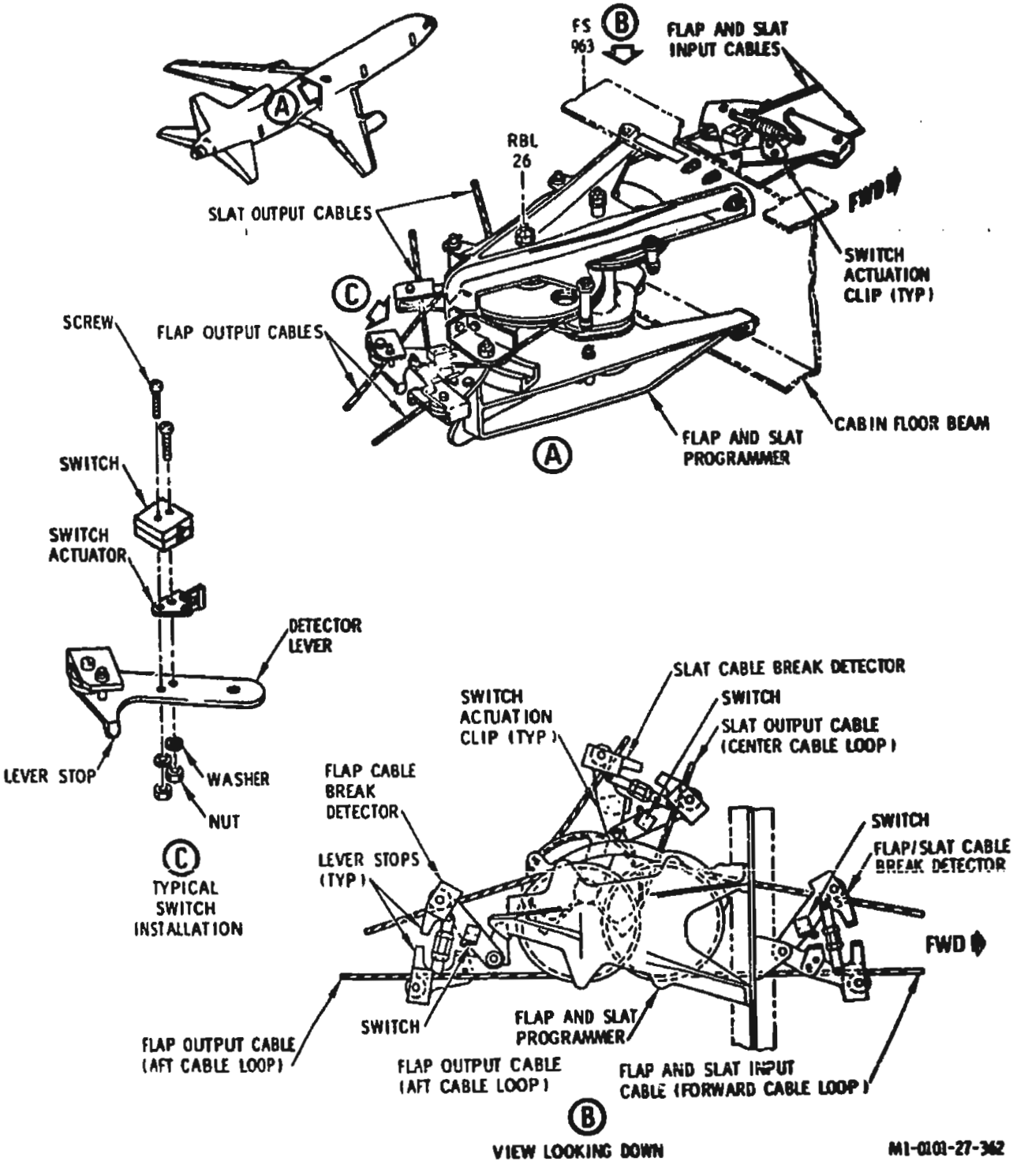
R (3) Check switch adjustment as follows:

R (a) Squeeze cables together until the stops on the brake detector levers contact each other. At this point, the switch must be actuated and the overtravel remaining between the switch actuator roller and the switch actuation clip must be 0.005 to 0.015 inch.

R (b) If switch adjustment is incorrect, loosen the switch actuation clip attach screws and adjust the clip to meet requirements of Step (a).

R (4) Check switch operation in accordance with Operational Test (Ref. 27-51-04, Flap and Slat Control System Cable Break Detector Adjustment and Test). (Accomplish only steps necessary to check affected cable loop.)

R (5) Turn off electrical power if no longer required (Ref. 24-41-00).



R Flap and Slat Control Cable Breakage Detector Switch
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL

)01B

R FLAP POWER DRIVE UNIT RELIEF VALVE - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or
R equivalent

R Container, one gallon (to catch spilled hydraulic fluid)

R 2. Referenced Procedures

R 24-41-00 External Power/Ground Systems - Maintenance
R Practices

R 29-11-00 Hydraulic Power Systems - Maintenance Practices

R 3. Removal/Installation

R WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS
R HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC
R SERVICE PANEL, ZONE 147.

R A. Removal

R (1) Gain access to hydraulic service center.

R (2) Remove lock-wire and remove relief valve (Ref. Fig.
R 401). Use container to catch hydraulic fluid.

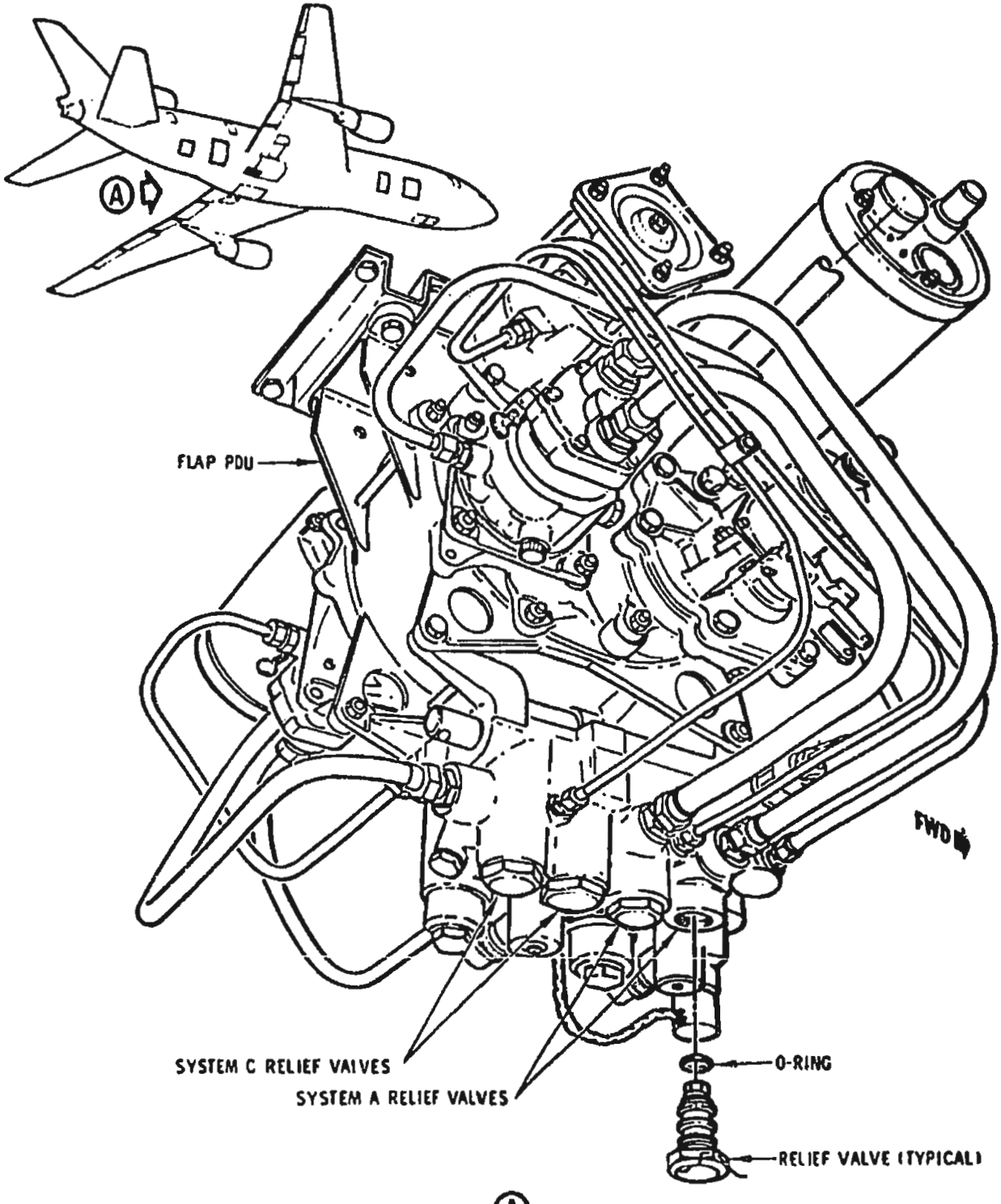
R NOTE: There are two relief valves for each hydraulic
R system. The forward two are for hydraulic
R system A; the aft two are for hydraulic system
R C.

R B. Installation

R (1) Lubricate O-ring on replacement relief valve with
R hydraulic fluid.

R (2) Install relief valve in PDU valve body. Tighten relief
R valve and lock-wire.

R EFFECTIVITY: ALL
R
001B



R Flap Power Drive Unit Relief Valve - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R ALL LANDING GEAR DOWNLOCK SAFETY PINS AND
R DOOR SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF
R ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (3) Turn on electrical power (Ref. 24-41-00).

R (4) Turn on hydraulic systems A and C (Ref. 29-11-00).

R (5) Cycle flaps from full up to full down and back to full
R up for several cycles to bleed the flap PDU.

R (6) Turn off hydraulic system A. Leave only system C on.

R (7) Cycle flaps through several full travel cycles. Verify
R that flap operation is normal.

R (8) Turn off hydraulic system C. Turn on system A.

R (9) Cycle flaps through several full travel cycles. Verify
R that flap operation is normal.

R (10) Check replacement relief valve for hydraulic leakage.

R (11) Turn off hydraulic power (Ref. 29-11-00).

R (12) Turn off electrical power (Ref. 24-41-00).

FLAP PDU START-UP SWITCH ASSEMBLY - REMOVAL AND INSTALLATION

1. General

There are two start-up switch assemblies on the flap PDU, one on the right side and one on the left side. The removal and installation procedures are identical for either switch assembly.

2. Equipment and Materials

Ohmmeter, test light, or equivalent continuity tester

Thickness gauges, one 0.06 inch thick and one 0.18 inch thick

R Lock-Wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or
R equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

R A. Removal

(1) Verify that hydraulic systems A and C are shut off and the hydraulic control panels tagged.

(2) Open and tag following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: NO. 2 ASYM BK LE SLAT (J11).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: NO. 1 ASYM BRAKE TE FLAP (H21).

(3) Open access door 147BB to gain access to hydraulic service center (Ref. 6-40-00).

(4) On flap PDU, remove electrical connector from start-up
R switch receptacle (Ref. Fig. 401).

(5) Remove and retain screws and washers attaching switch cover to PDU.

(6) Remove and retain switch cover with gasket.

NOTE: Cover is normally a loose fit but may be tight due to O-ring packing squeeze.

(7) Remove and retain screws and washer attaching connector mounting cap to the rods.

(8) Remove and retain two rods and washers attaching switch assembly to PDU.

(9) Remove switch assembly. (Switch assembly consists of switch, switch wiring, connector mounting cap, and electrical connector.)

B. Installation

(1) Install replacement switch assembly on PDU by engaging switch shaft in PDU drive receptacle.

R (2) Attach switch to PDU with two rods and one washer as
R follows:

R (a) Install washer under one rod (Ref. Fig. 401).

R (b) Install wire terminal lug under other rod.

R (c) Place rods through switch flange holes and screw
R rods into PDU.

(3) Attach connector mounting cap to rods with screws and
R washers and lock-wire screws.

(4) Check switch adjustment as outlined in Paragraph 5.

(5) Install switch cover with gasket to PDU with screws and
R washers and lock-wire screws.

(6) Connect electrical plug to switch connector.

(7) Close circuit breakers opened in Step 4A(2).

(8) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(10) With flaps fully retracted, verify that the PDU brake is applied (brake indicator rod flush with hex head).

R NOTE: Flap PDU brake is on right side of PDU (Ref. R Fig. 401).

R (11) Position flap handle so flaps fully extend.

R (12) Verify PDU brake is applied (brake rod flush with hex R head).

R (13) Position flap handle to 0 degrees to fully retract R flaps and verify normal system operation.

R (14) Turn off hydraulic power (Ref. 29-11-00).

R (15) Turn off electrical power (Ref. 24-41-00).

R 5. Start-up Switch Adjustment

NOTE: If only adjustment of the start-up switch is being accomplished, gain access to switch by disconnecting switch electrical connector, removing three cover

retaining screws and removing switch cover. (Cover may appear tight due to preformed O-ring squeeze.)

A. Start-up Switch No. 1 (Right Side of PDU)

R (1) Connect test light or continuity tester to pins 1 and 2 of switch receptacle.

(2) Position flap handle out of 0-degree detent to allow flap PDU input lever on right side to be moved 0.06 to
R 0.18 inch away from UP stop on PDU using thickness gauges.

(3) With flap PDU input lever 0.06 to 0.18 inch from UP stop, adjust switch as follows:

(a) If light is on, loosen lockscrew "A" and turn adjusting screw "A" CW until light goes off, then CCW until light goes on. Tighten lockscrew "A".

(b) If light is off, loosen lockscrew "A" and rotate adjusting screw "A" CCW until light goes on or until a resistance is felt. Tighten lockscrew "A". If light went on, perform Step (c) next. If resistance was felt loosen lockscrew "B" and rotate adjusting screw "B" CCW until a resistance is felt. Back off adjusting screw "B" 1/2 turn CW and tighten lockscrew. Repeat adjustment of
R adjusting screw "A" this step from beginning (Ref.
R Fig. 401).

(c) Loosen lockscrew "B" and rotate adjusting screw
R "B" CW until light goes off, then CCW 1/2 turn
R (Ref. Fig. 401). Tighten lockscrew "B".

NOTE: Assure both adjusting screws "A" and "B" are locked by the round head screws.

(4) Remove thickness gauge and place flap handle full up (0-degree detent). Check that light is on.

(5) Slowly move flap handle to 4-degree detent. Check that light goes off before 4-degree detent is reached.

(6) Move flap handle to full down. Check that light remains off. Return flap handle to full up.

(7) Remove test light.

B. Start-up Switch No. 2 (Left Side of PDU)

(1) Connect test light or continuity tester to pins 1 and 2 of switch receptacle.

(2) Position flap handle out of 0-degree detent to allow flap PDU input lever on left side of PDU to be moved 0.06 to 0.18 inch away from UP stop on PDU. Use thickness gauges.

(3) With flap PDU input lever 0.06 to 0.18 inch from UP stop, adjust switch as follows:

(a) If light is on, loosen lockscrew "B" and turn adjusting screw "B" CCW until light goes off, then CW until light goes on. Tighten lockscrew "B".

(b) If light is off, loosen lockscrew "B" and rotate adjusting screw "B" CW until light goes on or until a resistance is felt. Tighten lockscrew "B". If light went on perform Step (c) next. If resistance was felt loosen lockscrew "A" and rotate adjusting screw "A" CW until a resistance is felt. Back off adjusting screw "A" 1/2 turn CCW and tighten lockscrew. Repeat adjustment of adjusting screw "B" this step from beginning.

R (c) Loosen lockscrew "A" and rotate adjusting screw
R "A" CCW until light goes off, then CW 1/2 turn. Tighten lockscrew "A".

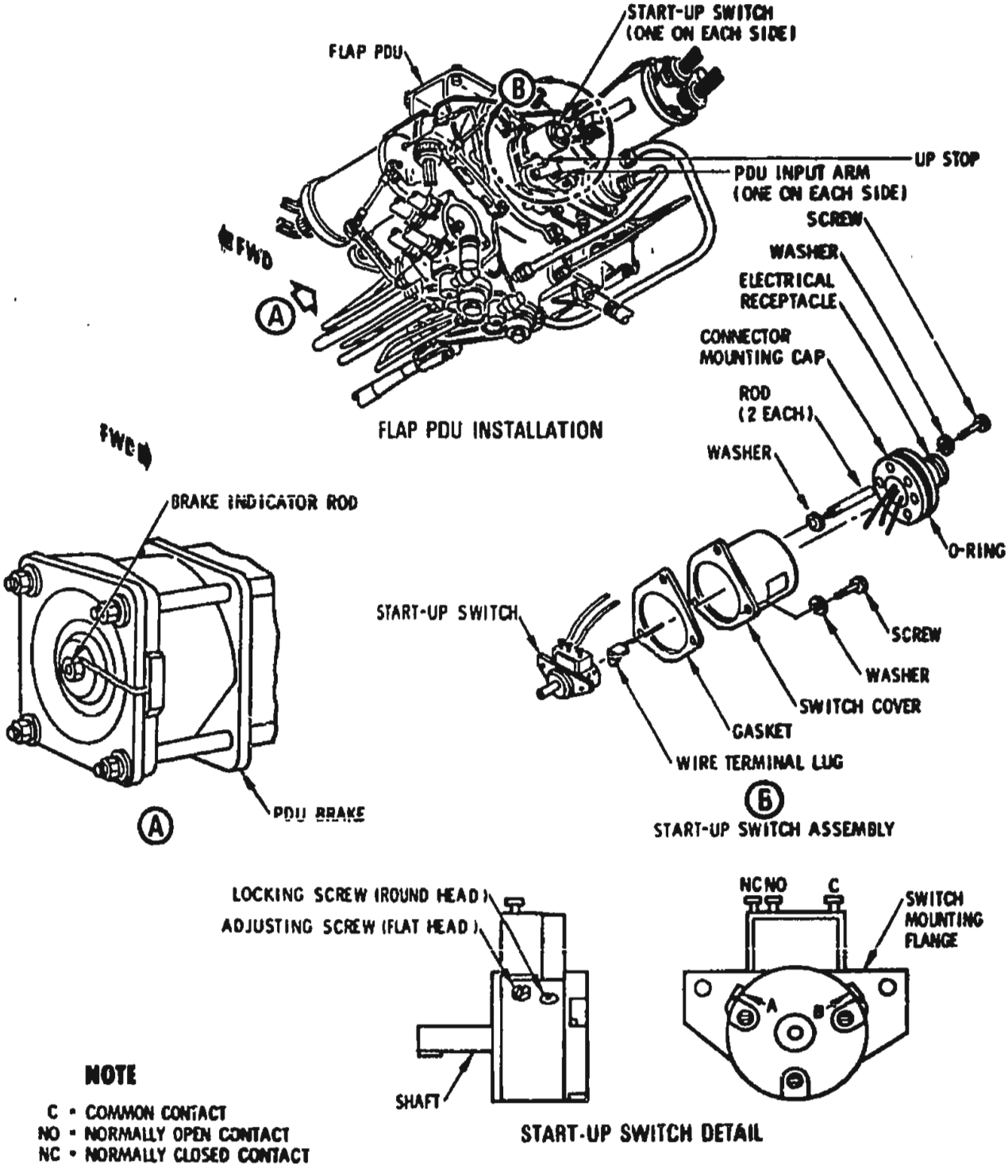
NOTE: Assure both adjusting screws "A" and "B" are locked by the round head screws.

(4) Remove thickness gauge and place flap handle full up (0-degree detent). Check that light is on.

(5) Slowly move flap handle to 4-degree detent. Check that light goes off before 4-degree detent is reached.

(6) Move flap handle to full down. Check that light remains off. Return flap handle to full up.

(7) Remove test light.



NOTE

C • COMMON CONTACT
NO • NORMALLY OPEN CONTACT
NC • NORMALLY CLOSED CONTACT

M1-0100-27-579

R R Flap PDU Start-up Switch - Removal and Installation
Figure 401

R R EFFECTIVITY: ALL

FLAP CARRIAGE BALLSCREW ACTUATOR FRONT MOUNT REMOVAL AND INSTALLATION

1. General

There are sixteen ballscrew actuators in the flap drive system (eight on each wing). A front mount is incorporated on each ballscrew actuator. The front mount is considered part of the ballscrew actuator assembly, however, the front mount can be replaced separately if necessary. The front mount does not contain an assembly part number. If ordering a front mount, the parts that make up the front mount will have to be ordered.

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-20	Flap, Vane, and Spoiler Lubrication
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

R A. Removal

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic system C (Ref. 29-11-00).

(2) Operate flaps to the fully extended position.

(3) Turn off hydraulic power (Ref. 29-11-00).

R WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(4) Removable panels for access to all ballscrew actuator front mounts are specified in Table 401. Open only the panels for access to a specific front mount (Ref. 6-40-00).

Access Panels for Ballscrew Actuator Front Mounts
Table 401

FLAP NO.	BALLSCREW	L WING PANEL	R WING PANEL
1	Inboard	541BB	641BB
1	Outboard	541DB	641DB
2	Inboard	541FB	641FB
2	Outboard	541GB-2	641GB-2
3	Inboard	561AB	661AB
3	Outboard	561BB	661BB
4	Inboard	561CB	661CB
4	Outboard	561CB	661CB

(5) On the forward end of the front mount, remove the bolt, washer and nut that attaches the quill shaft to the ballscrew actuator.

(6) Push rubber boot forward to expose quill shaft and move quill shaft forward into the gearbox and clear of the ballscrew shaft.

(7) Slide the retainer forward off of the ballscrew shaft and save for reinstallation.

(8) Remove the two forward bolts and loosen the aft bolt attaching the front mount to the torque box.

NOTE: The aft attach hole on the front mount is slotted.

(9) Slide the front mount forward to disengage from the aft mounting bolt and the ballscrew shaft. Remove the front mount.

NOTE: On the No. 1 ballscrew (the most inboard ballscrew), there is a spacer between the front mount and the torque box for each of the three

attach bolts. Retain the three spacers for reuse.

Do not rotate the ballscrew shaft to minimize the necessity for rerigging the ballscrew.

R B. *Installation*

(1) Verify that all hydraulic power is turned off (Ref. 29-11-00).

(2) Install the forward support on the ballscrew shaft and engage the forward support on its aft mounting bolt. Install the two forward mounting bolts and tighten all three bolts.

NOTE: On the No. 1 ballscrew (the most inboard ballscrew), a spacer is installed on each mounting bolt between the forward support and the torque box.

(3) Install the retainer on the ballscrew shaft and align retainer bolt hole with the ballscrew shaft bolt hole.

(4) Butterlube the quill shaft with grease, MIL-G-23827A or equivalent.

(5) With minimal rotation of the ballscrew shaft, mate quill shaft with ballscrew shaft. The quill shaft can be rotated to align bolt holes when pushed forward inside gearbox. Install quill shaft connecting bolt through the retainer, ballscrew shaft and quill shaft. Torque bolt 50 to 70 lb in.

CAUTION: THE QUILL SHAFT BOLT HOLE IS LARGER THAN BALLSCREW BOLT HOLES TO ASSURE THAT TORSIONAL LOADS WILL BE TRANSMITTED BY SPLINE AND NOT BY BOLT. THE QUILL SHAFT CAN BE COUPLED TO BALLSCREW IN TWO POSITIONS, 180 DEGREES APART. IN THE INCORRECT POSITION, CONNECTING BOLT HOLE ALIGNMENT IS OFF A HALF SPLINE. IF CONNECTING BOLT IS INSTALLED IN THIS CONDITION (PUSH FIT) THE BOLT CAN ABSORB TORTIONAL LOADS AND THE QUILL SHAFT CAN EVENTUALLY FAIL.

TO ENSURE CORRECT INSTALLATION, VERIFY THAT CONNECTING BOLT FITS EASILY THROUGH BALLSCREW AND THE QUILL SHAFT, AND THAT THE QUILL SHAFT CAN MOVE AXIALLY (FORE AND AFT) AT LEAST 0.040 INCH AFTER BOLT INSTALLATION.

NOTE: The vendor (Curtiss Wright) has designed a new bolt with an undersized shank to allow quill shaft to be installed either way (Curtiss Wright SB 27-01). If possible, replace old bolt (PN 179923-1 with 12-point external wrenching head) with new bolt (PN 180400-1 with hex head).

(6) Slide the rubber boot aft and engage the retainer.

(7) Lubricate rear support, carriage, yoke, and forward support (Ref. 12-23-20).

(8) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(10) Turn on electrical power (Ref. 24-41-00).

(11) Cycle flaps from full up to full down and back to full up at least two times. Verify that flaps and ballscrew actuator operate smoothly without binding.

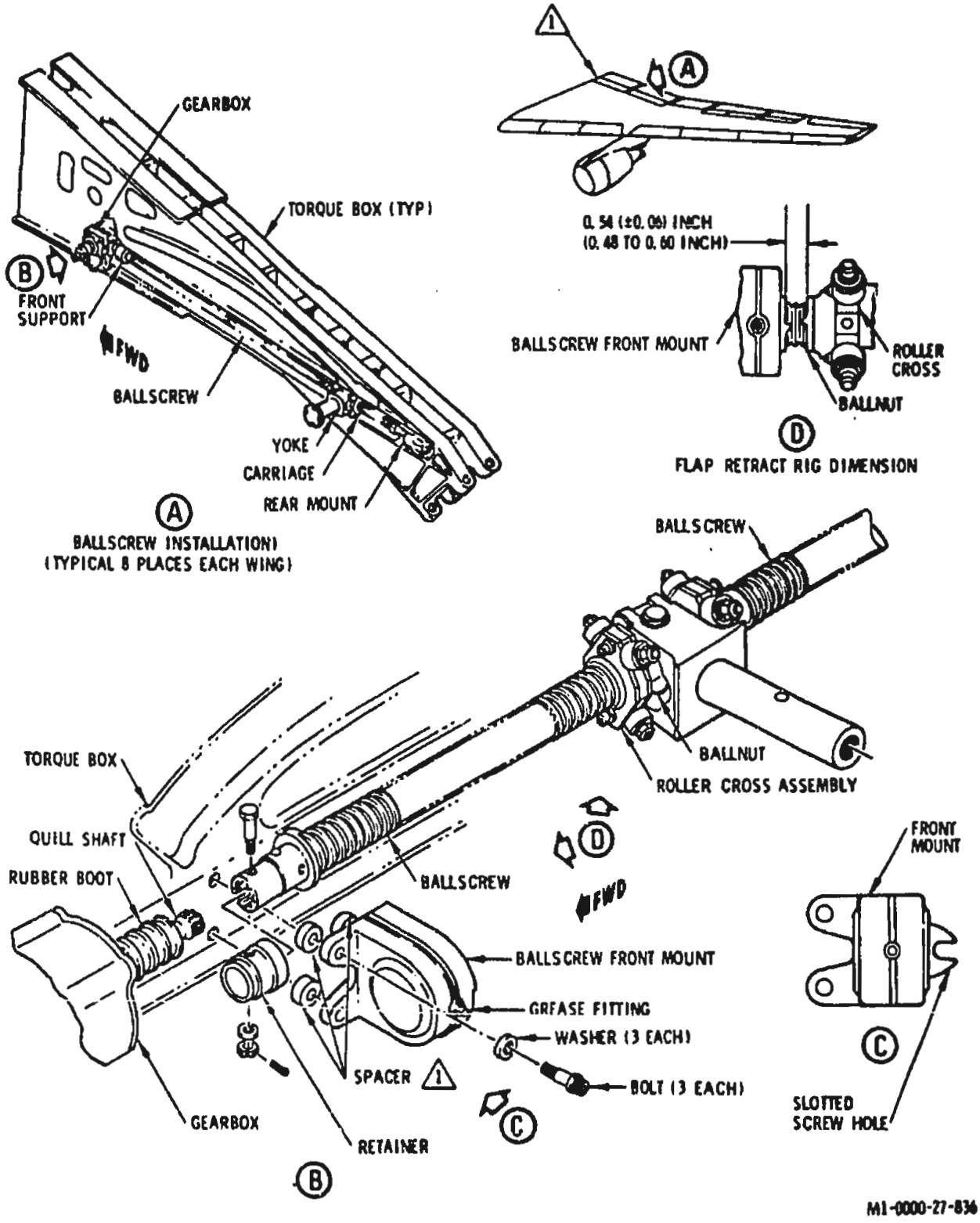
(12) With flaps in full up position, on ballscrew with replaced front mount, verify ballscrew flaps-up rigging adjustment: clearance between the flat on the forward face of the ballscrew carriage and the aft flat on the

R ballscrew front support stop must be 0.54 (±0.06) inch
R (0.48 to 0.60 inch)(Ref. Fig. 401). If clearance is incorrect, disconnect quill shaft from ballscrew, rotate ballscrew to obtain proper clearance and reconnect quill shaft to ballscrew.

(13) Close access panel.

(14) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(15) Turn off electrical power if no longer required (Ref. 24-41-00).



Flap Carriage Ballscrew Actuator Front Mount - Removal and Installation
Figure 401

FE/SO ANNUNCIATOR PANEL FLAP/SLAT LOCK LIGHT MAINTENANCE PRACTICES

1. General

The FLAP/SLAT LOCK annunciator light on the FE/SO annunciator panel comes on when the flap or slat asymmetry brakes are set. The flap position indicator and/or the slat position indicator may be used to determine which set of brakes are set.

NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MMEL.

2. Deactivation

A. Verify operation of the FLAP ASYM DET FAULT light, SLAT ASYM DET FAULT light, 14 slat position indicating lights, LE TRANS and LE EXT lights, and the slat degree gauge as follows:

(1) Verify that the following circuit breakers are closed:

(a) On the pilot's overhead circuit breaker panel CB1, zone 210:

NO. 2 ASYM BK - LE SLAT (J10) and TE FLAP (J11)

LOCK LIGHT - LE SLAT (J12) and TE FLAP (J13)

PROX SW PWR - NO. 1 (L10)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE - TE FLAP (H21) and LE SLAT (H22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

PROXIMITY SWITCH-2 AND 3 (H3, H4)

POSN IND - TE FLAP (K16)

POSN IND - LE SLAT (K17)

LE SLAT EXTEND LT (K18)

(2) Turn on electrical power (Ref. MM 24-41-00).

CAUTION: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREE.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A and C (Ref. MM 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(4) Verify that flap handle is at 0 degree.

(5) Test cable break detector on the flaps and slats forward control cables (forward cable loop) as follows:

(a) Move flap handle to the 4-degree position. The flaps and slats must start to extend. (Rotation of the slat torque tube in the mid-electrical service center (MESC) indicates slat operation).

(b) As soon as the slats start to extend, squeeze and hold the flap and slat cables just forward of the flap/slat cable break detector (in the MESC) to actuate the cable break detector switches (Ref. MM 27-51-04, Fig. 501). Verify that the flaps and slats stop moving and FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light on the FE/SO annunciator panel come on. Maintain squeeze pressure on cable.

(c) Shut off hydraulic system C.

(d) Open circuit breaker CB1-J10, NO. 2 ASYM BK LE SLAT. The flaps and slats must not move.

(e) Open circuit breaker CB2-H22, NO. 1 ASYM BRAKE LE SLAT. The flaps must start to move and the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light must go out. As soon as flap motion is verified, close CB2-H22. The flaps must stop and the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light must come on.

(f) Close circuit breaker CB1-J10.

(g) Open CB2-H22. Flaps and slats must not move.

(h) Open CB1-J10; the slats and flaps must start to move and the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light must go out. As soon as slat and flap motion is verified, close CB1-J10. Slat and flap motion must stop and FLAP ASYM DET FAULT and SLAT ASYM DET FAULT light must come on.

(i) Close circuit breaker CB2-H22.

(j) Turn on hydraulic system C and turn off hydraulic system A. Maintain squeeze pressure on cables to activate cable break detector switches.

(k) Repeat Steps 2A(5)(d) through 2A(5)(j).

(l) Release the flap/slat cables to deactivate the cable break detector switches.

(m) Position flap handle to the 0-degree position. The flaps and slats must retract to their full up position. Verify that the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light on the FE/SO annunciator panel go out.

(6) Position flap handle to the 4-degree detent. Verify following:

(a) LE TRANS light on flap position indicator comes on while slats are moving.

(b) Slat position indicator pointers on FE/SO slat monitor panel follows slat movement.

(c) LE TRANS light on flap position indicator goes off and LE EXT light comes on when slats fully extend.

(d) The 14 slat position indicating lights on FE/SO monitor panel come on when slats fully extend.

(e) Both tapes of the flap position indicator move to the 4-degree range mark limits.

(7) With flaps at 0 degree perform and/or verify the following:

(a) Latch in Slat Lock switch on FE/SO Slat Monitor Panel; 1 LOCK and 2 LOCK lights come on.

(b) Select flaps 4 degrees; flaps extend to 4 degrees.

(c) Green slat segment lights remain off.

(d) Unlatch Slat Lock switch; 1 LOCK and 2 LOCK lights go off. Slats extend to 30 degrees, and green slat segment lights (14) come on when slats reach 30 degrees.

(8) Move flap handle successively through each detent position (allow flaps to stop at each selected position) and verify that both tapes of the flap position indicator move to the selected position.

(9) Return flap handle to UP position through each successive detent position (allow flaps to stop at each selected position). Verify both tapes of the flap position indicator move to the selected position.

NOTE: If the flap position indicator tape positions are out of tolerance, check adjustment of flap position transmitters (Ref. MM 27-52-01).

(10) When flaps and slats are fully retracted, verify following:

(a) Both tapes of the flap position indicator return to 0-position.

(b) Both slat monitor lights on flap position indicator are off.

(c) The 14 slat position indicating lights are off.

(d) Slat position indicator pointers return to 0-position.

(11) Turn off hydraulic power (Ref. MM 29-11-00).

(12) Turn off electrical power (Ref. MM 24-41-00).

(13) Make appropriate entry in airplane log book.

(14) Install inoperative component placard in Flight Station.

TRAILING EDGE FLAP POSITION INDICATING SYSTEM DESCRIPTION AND OPERATION

1. General

The trailing edge flap position indicating system (Ref. Fig. 1) consists of two flap position transmitters and a flap position indicator. One position transmitter is mounted on, and driven by the asymmetry brake in each wing. The transmitters translate the angular travel of the flap torque shaft drive into a voltage to operate the position indicator. The position indicator is mounted in the pilots center instrument panel; the left tape indicates the position of the left wing flaps and the right tape indicates the position of the right wing flaps. The flap position indicator also incorporates two lights which indicate the status of the leading edge slats: an amber L.E. TRANS light and a green L.E. EXT light (Ref. 27-82-00).

R On aircraft with SB27-262,
R an alternate flap position indication is provided by placards on
R the outboard edge of No. 1 flap panel, No. 1 vane and adjacent
R flap torque box.

2. Flap Position Indicator

A. Description

The vertical scale flap position indicator contains two pairs of 400 Hz receiver synchros, one pair to each tape drive assembly. The receiver synchros receive voltages from transmitter synchros which are remotely located on their respective trailing edge flaps.

The transmitter rotor is mechanically connected to the respective flap drive system and turns in relation to the flap movement. As the transmitter rotor changes position, the stator output voltage also changes. The output is applied to the stators of the corresponding receiver synchro pair in the indicator, causing the receiver rotors to move the same angle as the transmitter rotor. The indicator tape of each module is connected between gears attached to the rotors of the respective synchro pair. Movement of the synchro receiver rotors causes movement of the indicator tape across the scale dial graduations.

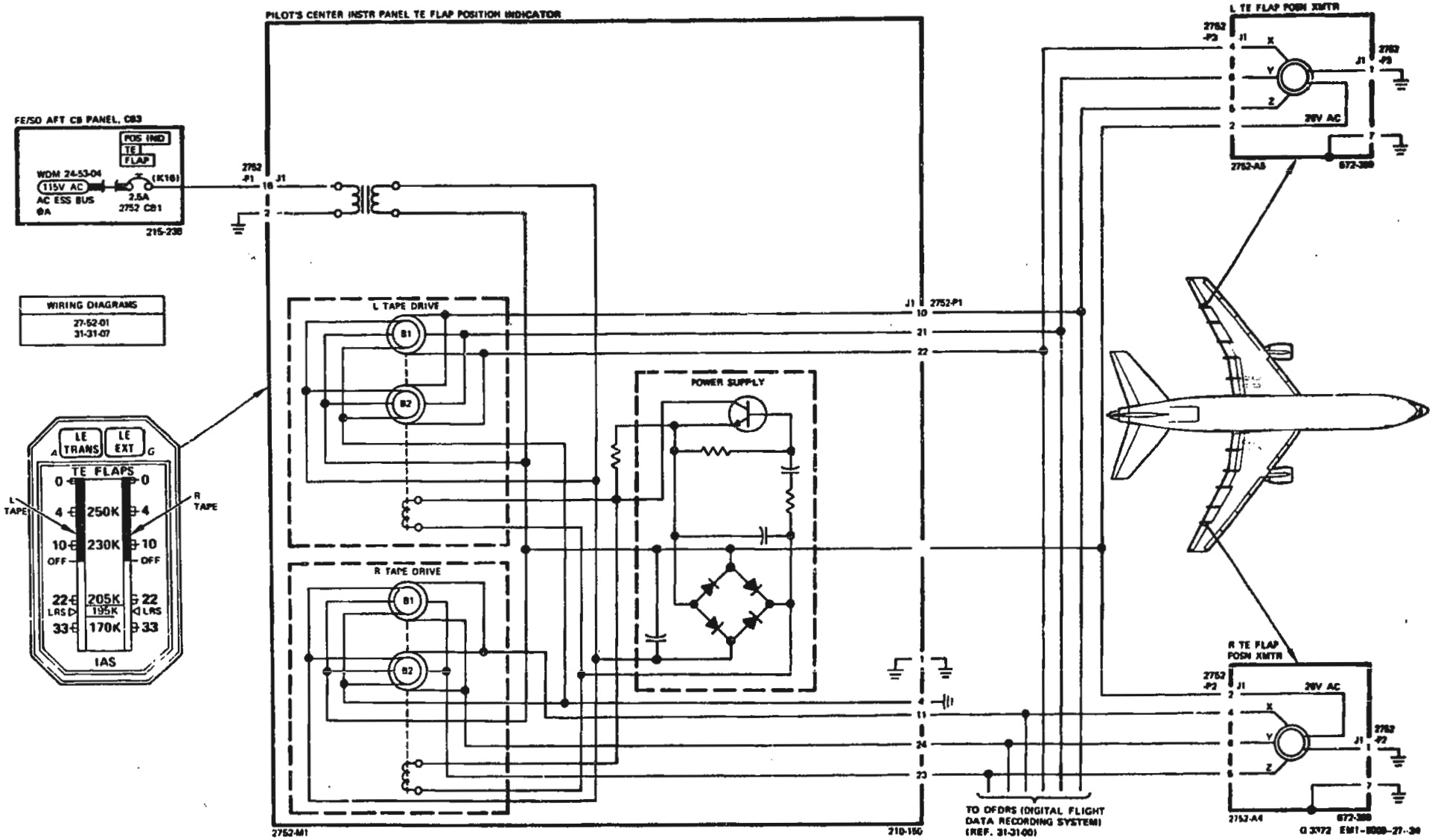
A centering solenoid is provided to synchronize the indicator by resetting each pair of receiver synchros to the OFF position when power is removed. Thus, synchronization and OFF indication are accomplished simultaneously when the

indicator is deenergized. A dc power supply within the position indicator is provided to power the solenoids.

3. Flap Position Transmitter

A. Description

The flap position transmitters are synchro transmitters and are mounted on, and driven by the flap asymmetry brake in each wing. A rotary transformer supplies excitation to the rotor of the synchro.



Trailing Edge Flap Position Indicating System Electrical Schematic
Figure 1

R
R
001B EFFECTIVITY: ALL

R # TRAILING EDGE FLAP POSITION INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

R If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in this section.

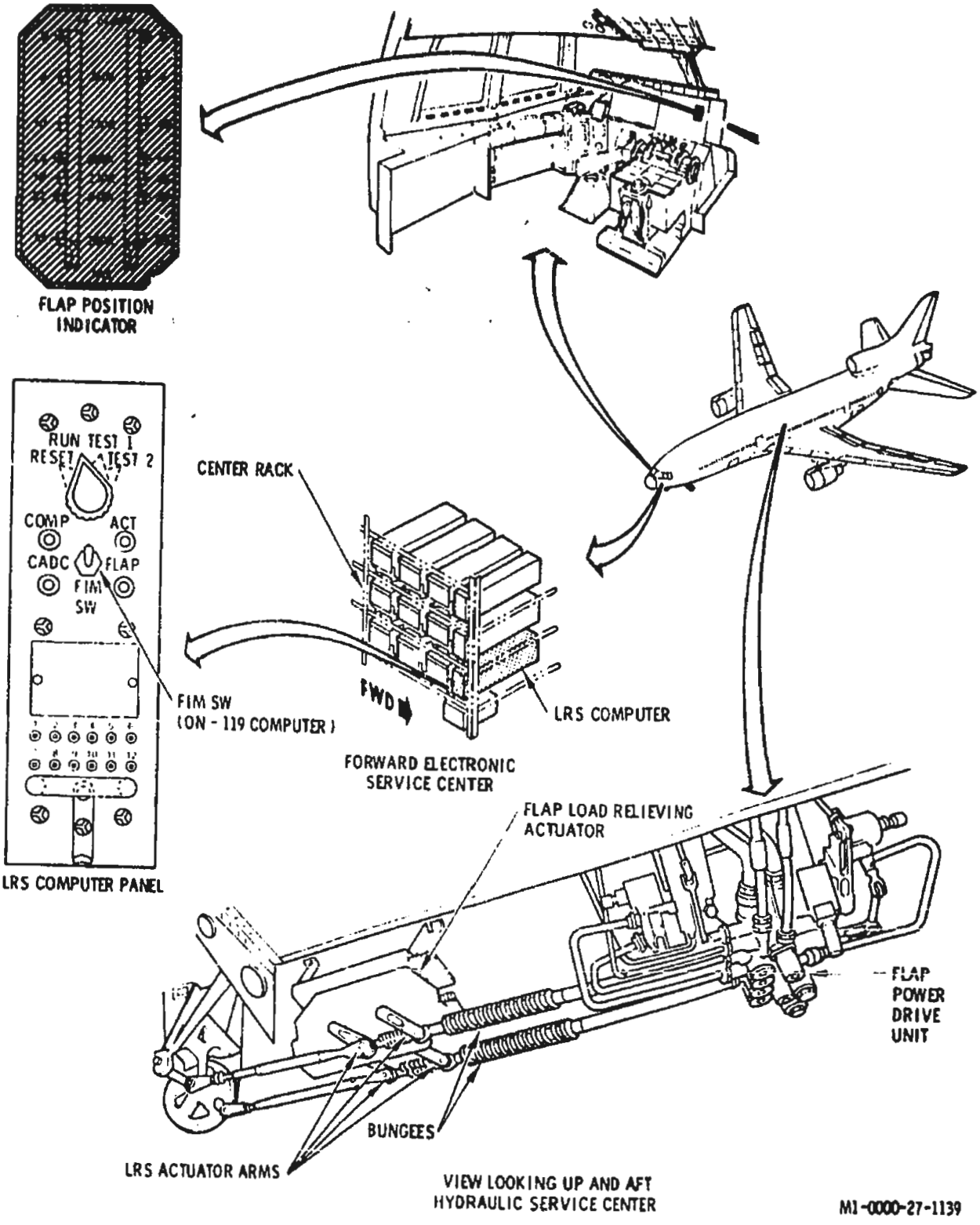
R Table 101

FIGURE	TITLE
101	Flap Position Indicating System Location Index
102	Flap Position Indicating System Locator Diagram
103	Flap Position Indicating System Malfunction
SCHEM 1	Trailing Edge Flap Position Indicating System Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACTUATOR – FLAP LRS	1	HSC; 147AB	27-51-07
COMPUTER – FLAP LRS	1	FESC; 112AB	27-51-06
INDICATOR – FLAP POSITION	1	FLT STA; 842, 843	27-52-02
TRANSMITTER – FLAP POSITION	2	ON ASYM. BREAK; 571AB, 671AB	27-52-01

M1-0000-27-1140

R R Flap Position Indicating System Location Index
Figure 101



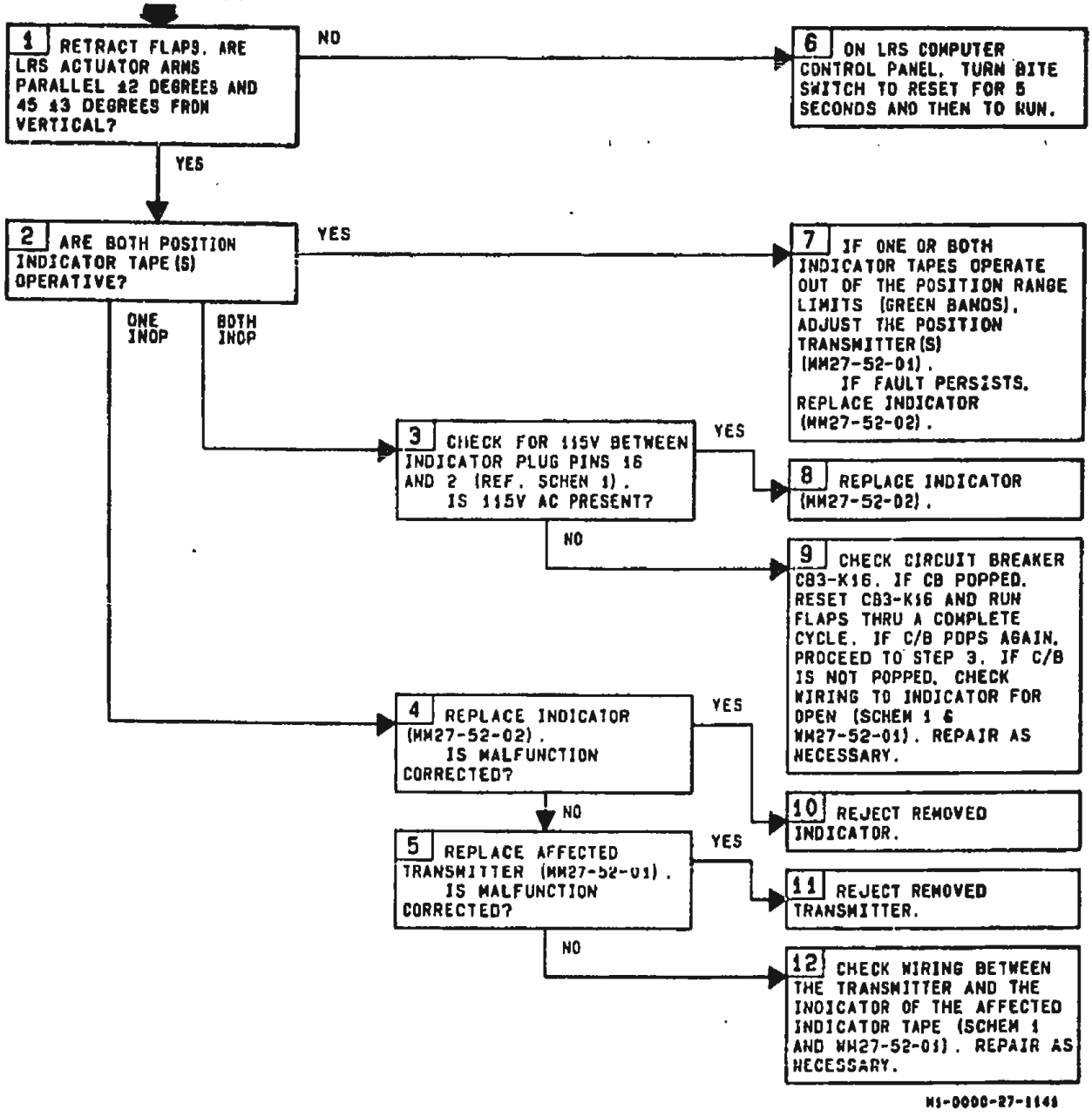
R Flap Position Indicating System Locator Diagram
R Figure 102

PREREQUISITES
HYDRULIC POWER, SYSTEM A AND C (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
L8'S: CB3-K16

WARNING

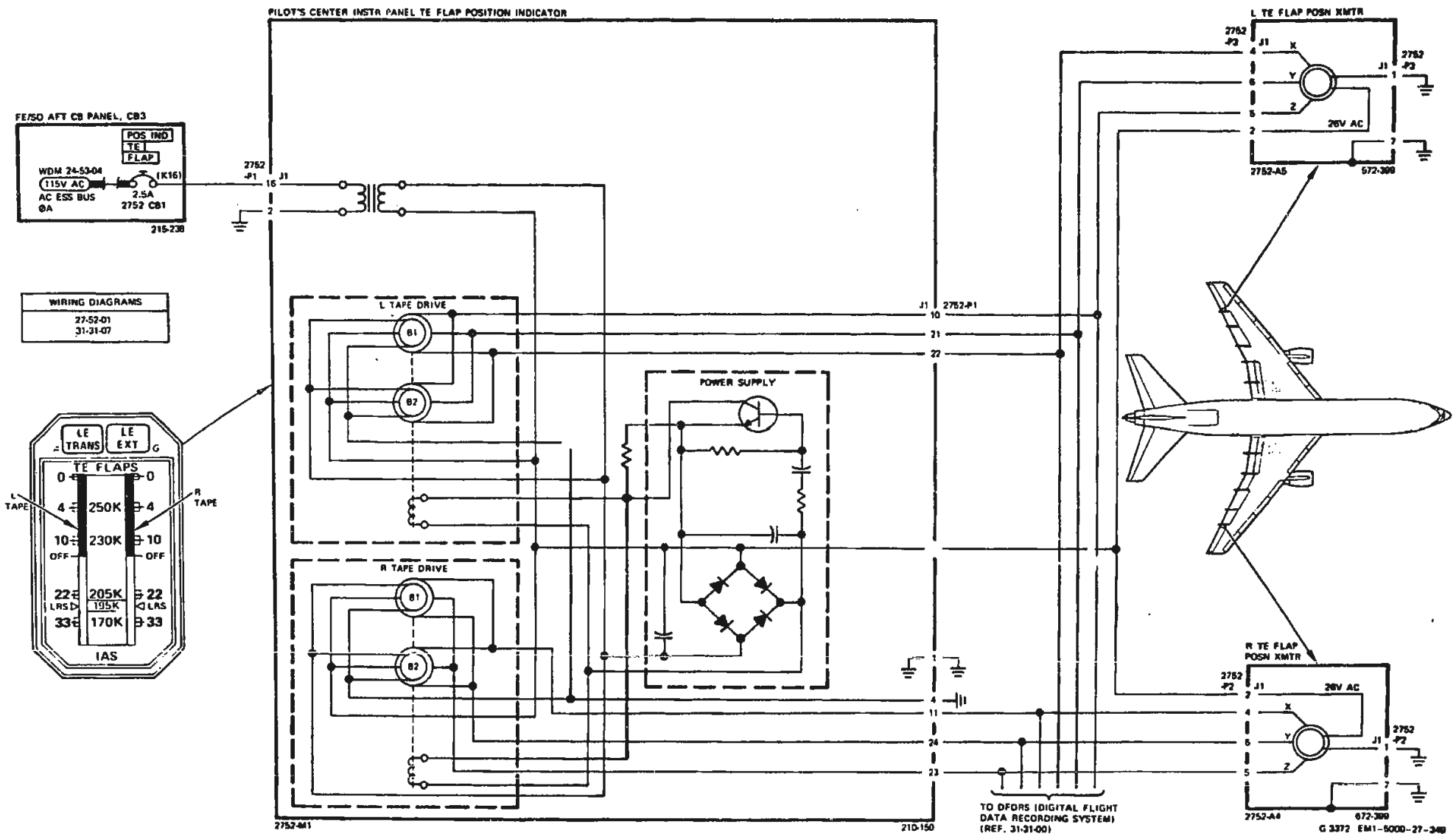
VERIFY THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS

FLAP POSITION INDICATING SYSTEM MALFUNCTION


1 RETRACT FLAPS. ARE LRS ACTUATOR ARMS PARALLEL ±2 DEGREES AND 45 ±3 DEGREES FROM VERTICAL?
NO
6 ON LRS COMPUTER CONTROL PANEL, TURN BITE SWITCH TO RESET FOR 5 SECONDS AND THEN TO RUN.
YES
2 ARE BOTH POSITION INDICATOR TAPE(S) OPERATIVE?
YES
7 IF ONE OR BOTH INDICATOR TAPES OPERATE OUT OF THE POSITION RANGE LIMITS (GREEN BANDS), ADJUST THE POSITION TRANSMITTER(S) (MM27-52-01). IF FAULT PERSISTS, REPLACE INDICATOR (MM27-52-02).
ONE INOP
BOTH INOP
3 CHECK FOR 115V BETWEEN INDICATOR PLUG PINS 16 AND 2 (REF. SCHEM 1). IS 115V AC PRESENT?
YES
8 REPLACE INDICATOR (MM27-52-02).
NO
9 CHECK CIRCUIT BREAKER CB3-K16. IF CB POPPED, RESET CB3-K16 AND RUN FLAPS THRU A COMPLETE CYCLE. IF C/B POPS AGAIN, PROCEED TO STEP 3. IF C/B IS NOT POPPED, CHECK WIRING TO INDICATOR FOR OPEN (SCHEM 1 & MM27-52-01). REPAIR AS NECESSARY.
4 REPLACE INDICATOR (MM27-52-02). IS MALFUNCTION CORRECTED?
YES
10 REJECT REMOVED INDICATOR.
NO
5 REPLACE AFFECTED TRANSMITTER (MM27-52-01). IS MALFUNCTION CORRECTED?
YES
11 REJECT REMOVED TRANSMITTER.
NO
12 CHECK WIRING BETWEEN THE TRANSMITTER AND THE INDICATOR OF THE AFFECTED INDICATOR TAPE (SCHEM 1 AND MM27-52-01). REPAIR AS NECESSARY.

M1-0000-27-1141

R Flap Position Indicating System Malfunction
R Figure 103



R Trailing Edge Flap Position Indicating System Electrical Schematic
R SCHEM 1

R EFFECTIVITY: ALL
R
R
U018

TRAILING EDGE FLAP POSITION INDICATING SYSTEM MAINTENANCE PRACTICES

1. General

This procedure is used to perform an operational test of the flap asymmetry system and the slat indicating system.

NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MMEL.

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-00-00	External Power - Maintenance Practices
29-11-00	Hydraulic Power Systems - Maintenance Practices

3. Deactivation

A. Test flap asymmetry system and slat indicating system as follows:

(1) Verify the following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel, CB1, zone 210:

NO. 2 ASYM BK - TE FLAP (J11) and LE SLAT (J10)

LOCK LIGHT - TE FLAP (J3) and LE SLAT (J12)

(b) On FE/SO overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE - TE FLAP (H21) and LE SLAT (H22)

(2) Turn on electrical power (Ref. MM 24-00-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEMS:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (3) Turn on hydraulic systems A and C (Ref. MM 29-11-00).

R NOTE: Operating flaps and slats with electric pumps
R can cause "jerky" operation, trip the overspeed
R governor in either or both brakes and give
R invalid results. To perform a valid test
R pressurize the B and C hydraulic system using
R ATM pumps and the A hydraulic system using the
R PTU. Alternately, two ground sources each
R capable of 25 GPM at 3000 psi may be used to
R pressurize the A and C hydraulic systems.

R (4) Position the flap handle to the 4-degree detent; the
R flaps will extend to 4 degrees and the slats will fully
R extend. Verify both pointers on slat position
R indicator follow slat movement and all slat segment
R lights come on when slats are fully extended.

R (5) Remove wing access panels 571AB and 671AB to gain
R access to flap asymmetry brakes (Ref. MM 6-40-00).

R (6) Disconnect the electrical connector from either the
R left wing or right wing rotary transducer. (Rotary
R transducer is the shorter of two units mounted on
R inboard side of asymmetry brake; do not disconnect both
R rotary transducers).

R (7) Open circuit breaker CB1-J11. The ASYM DET FAULT light
R or FLAP ASYM DET FAULT light on FE/SO annunciator panel
R must come on.

R (8) Move flap control handle to the 10-degree detent
R position and verify the following:

R (a) The flap asymmetry system actuates to lock both
R asymmetry brakes before the flaps have extended

R two inches (the brake reset knobs on both
R asymmetry brakes trip to the extended position).

R NOTE: Flap lock-up may be immdeiate with no
R noticeable movement of flap.

R (b) The brake indicator rod on the flap PDU brake is
R flush with the hex head, indicating that the flap
R PDU was electrically shut off.

R (c) The TE FLAP LOCK annunciator light comes on and
R the ASYM DET FAULT light goes off or the FLAP/SLAT
R LOCK annunciator light comes on and the FLAP ASYM
R DET FAULT light goes off on the FE/SO annunciator
R panel.

R (9) Reset both asymmetry brakes (push in reset knobs). (It
R requires 25 to 30 pound force to reset asymmetry
R brake).

R (10) Open circuit breaker CB2-H21 and CB1-J13; the TE FLAP
R LOCK light or the FLAP/SLAT LOCK light must go off.
R Flaps will move towards selected position.

R (11) Reset asymmetry comparator by clsing circuit breakers
R CB1-J11 and CB1-J13. Verify ASYM DET FAULT light or
R FLAP ASYM DET FAULT light comes on.

R (12) Position flap handle to 22 degrees; verify following:

R (a) Flaps start to extend and then lock up.

R (b) TE FLAP LOCK light comes on and the ASYM DET FAULT
R light or the FLAP/SLAT LOCK light comes on and the
R FLAP ASYM DET FAULT light goes off.

R (c) Both right and left asymmetry brakes have tripped.

R (d) Flap PDU brake has actuated (brake indicator rod
R is flush with hex head).

R (13) Reset both asymmetry brakes (push in reset knobs).

R (14) Open circuit breakers CB1-J11 and CB1-J13. The TE FLAP
R LOCK light or the FLAP/SLAT LOCK light must go off;
R flaps move toward 22-degree position.

R (15) Reset asymmetry comparator by closing circuit breakers
R CB1-J11 and CB1-J13. Verify ASYM DET FAULT light or
R FLAP ASYM DET FAULT light comes on.

R (16) Position flap handle to 10 degrees; verify following:

R (a) Flaps start to retract and then lock up.

R (b) TE FLAP LOCK light comes on and the ASYM DET FAULT
R light goes off or the FLAP/SLAT LOCK light comes
R on and the FLAP ASYM DET FAULT light goes off.

R (c) Both right and left asymmetry brakes have tripped.

R (d) Flap PDU brake has actuated (the brake indicator
R rod is flush with hex head).

R (17) Reset both asymmetry brakes (push in reset knobs).

R (18) Open circuit breakers CB1-J11 and CB1-J13; the TE FLAP
R LOCK light of FLAP/SLAT LOCK light must go off. The
R flaps move towards selected position.

R (19) Reset asymmetry comparator by closing circuit breakers
R CB2-H21 and CB1-J13. Verify ASYM DET FAULT light or
R FLAP ASYM DET FAULT light comes on.

R (20) Position flap handle to 4 degrees; verify following:

R (a) Flaps start to retract and then lock up.

R (b) TE FLAP LOCK light comes on and the ASYM DET FAULT
R light goes off or the FLAP/SLAT LOCK light comes
R on and the FLAP ASYM DET FAULT light goes off.

R (c) Both right and left asymmetry brakes have tripped.

R (d) Flap PDU brake has actuated (the brake indicator
R rod is flush with hex head).

R (21) Reset both asymmetry brakes (push in reset knobs).

R (22) Reconnect and lock wire the transducer electrical
R connector disconnected in Step 3A(6).

R (23) Open circuit breakers CB2-H21 and CB1-J13; TE FLAP LOCK
R light or FLAP/SLAT LOCK light must go off. Flaps move
R towards 4-degree position.

R (24) Reset asymmetry comparator by closing circuit breakers
R CB2-H21, CB1-J11 and CB1-J13; verify that the TE FLAP
R LOCK and ASYM DET FAULT lights or FLAP/SLAT LOCK and
R FLAP ASYM DET FAULT lights remain off.

R (25) Position flap handle to zero (full up). The flaps and
R slats fully retract. Verify both pointers on slat
R position indicator follow slat movement and all slat
R segment lights are off.

R (26) Turn off hydraulic power if no longer required (Ref. MM
R 29-11-00).

R (27) Turn off electrical power if no longer required (Ref.
R MM 24-00-00).

R (28) Close access panels.

R (29) Install inoperative component placard in Flight
R Station.

FLAP POSITION TRANSMITTER - REMOVAL AND INSTALLATION

1. Equipment and Materials

O-ring, Curtiss-Wright PN 177717-029, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

R Cleaner, Trichloroethane 1,1,1, or equivalent

Silicone Sealing Compound, RTV-108, RTV-140, or equivalent

Grease, MIL-G-23827,or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	24-41-00	External Power/Ground Service System - Maintenance Practices
C	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND LANDING GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND LANDING GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic system C (Ref. 29-11-00) and retract flaps fully.

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give

invalid results. To perform a valid test of the flap actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(2) Shut off hydraulic system C (Ref. 29-11-00).

(3) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(4) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker POSN IND - TE FLAP (K16).

(5) Open the following applicable access door (Ref. 6-40-00):

For left flap position transmitter: 571AB

For right flap position transmitter: 671AB

(6) Disconnect electrical connector from flap position transmitter (Ref. Fig. 401).

(7) Remove screws and washers securing transmitter, and remove transmitter.

B. Installation

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Verify that circuit breaker opened in Step 3A(4) is open and tagged and that flaps are full up.

(2) Lubricate and install O-ring on transmitter housing (Ref. Fig. 401).

NOTE: Verify that the joint between the transmitter mounting flange and the housing is sealed with RTV-108 or RTV-140 silicone sealing compound.

(3) Rotate transmitter gear until mechanical detent position is felt (electrical zero).

(a) Apply grease, MIL-G-23827, to transmitter gear teeth.

(4) With screw holes in asymmetry brake centered on slotted mounting holes of transmitter, and ensuring that transmitter gear does not rotate when meshed with brake gear, position transmitter on asymmetry brake.

(5) Loosely install mounting screws and washers so that transmitter housing can be rotated if fine electrical adjustment is required.

NOTE: If tri-wing screws are used, replace with NAS1351-3H-6P socket-head cap screws, or equivalent.

(6) Connect electrical connector to transmitter.

(7) Turn on electrical power (Ref. 24-41-00).

(8) Remove tag and close circuit breaker opened in Step 3A(4).

C (9) Adjust transmitter.

(a) Observe flap position indicator on pilots center instrument panel.

(b) Rotate transmitter housing until tape moves up and out of view.

(c) Slowly rotate transmitter housing until tape comes into view, and adjust unitl tape is midway between top of 0 range mark and 0 index mark.

(d) Do not overshoot setting and reverse rotation of transmitter housing to set 0 position. If setting is overshot, repeat Steps 3B(9)(b) and 3B(9)(c).

(10) Tighten and lock-wire transmitter mounting screws.

R (11) Using clean rags and Trichloroethane 1,1,1 Cleaner, R clean the area around the perimeter of the mated R transmitter mounting flange. Allow cleaned area to R dry.

R (12) Apply a bead of RTV-108 silicone sealing compound around perimeter of transmitter mounting flange to seal mating surfaces (Ref. Fig. 401).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND LANDING GEAR DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND LANDING GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (13) Remove tags from hydraulic control panels.

R (14) Turn on hydraulic system C (Ref. 29-11-00).

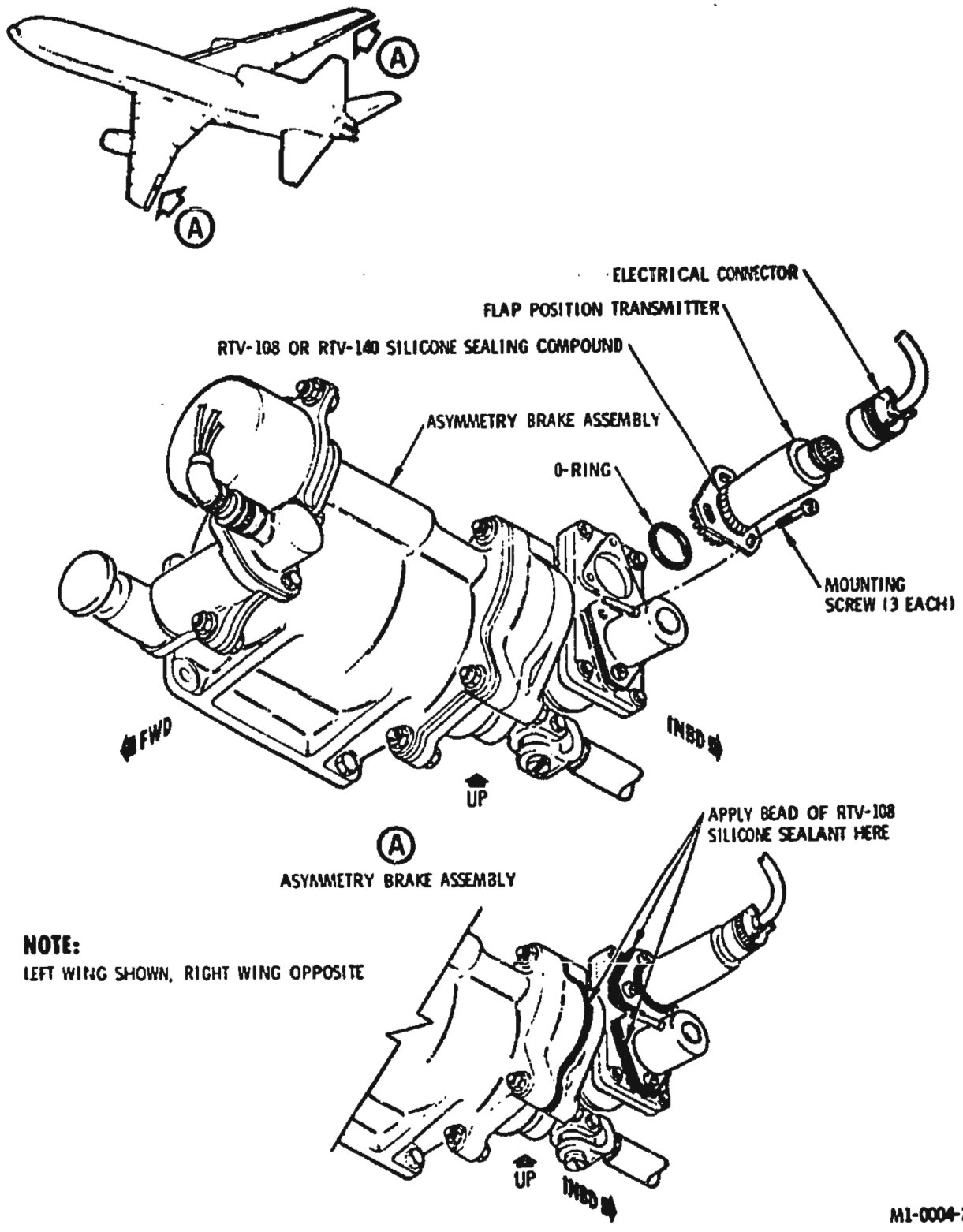
R (15) Position flap handle in each detent from 0 to full flaps. Verify that flap position indicator tapes position to each selection within position limits (green band) on indicator. Return flap handle to full up.

NOTE: If one indicator tape reads zero and other indicator tape reads approximately 22 degrees, resynchronize faulty indicator tape by opening circuit breaker POSN IND - TE FLAP (K16) for one second and then closing.

R (16) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

R (17) Turn off electrical power if no longer required (Ref.
R 24-41-00).

R (18) Close access doors 571AB and 671AB (Ref. 6-40-00).



NOTE:
LEFT WING SHOWN, RIGHT WING OPPOSITE

R Flap Position Transmitter - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

FLAP POSITION INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
27-52-01	Flap Position Transmitter - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) Open and tag the following circuit breakers:

R (a) On pilots overhead circuit breaker panel CB1, zone
R 210:
R CTR - R (L23).

R (b) On Flight Engineer/Second Officers aft circuit
R breaker panel CB3, zone 215:
R POS IND - TE FLAP (K16)

R LE SLAT EXTEND LT (K-18).

(2) On the pilots center instrument panel, locate the flap position indicator at the upper right hand corner. Release pilots center instrument panel quick disconnect fasteners. Depress secondary latch button and pull center instrument panel from support frame until the slide stops engage.

(3) On the face of the instrument panel, loosen both position indicator clamp screws. (Clamp screws are the round head screws located at the upper right and lower left corner of indicator.)

(4) Withdraw position indicator from panel clamp, remove electrical connector and remove position indicator.

B. Installation

R (1) Verify that circuit breakers are open [Ref. Step A(1)].

NOTE: Check PN of position indicator clamp. If clamp PN is MBG67039-1, replace with latest PN

LS15460-1 clamp (Ref. SB 31-027). If clamp must be replaced to install latest PN, check indicator case for evidence of distortion or damage due to clamp strain. Replace indicator if case is damaged.

If latest PN clamp is not available and position indicator cannot be installed in clamp with comparative ease, replace panel clamp with same PN clamp which, due to manufacturing tolerances, may provide a better fit.

(2) Connect electrical connector to flap position indicator.

(3) Slide position indicator into panel cutout until bezel
R is positioned against panel. Secure indicator by
R torquing both clamp screws 5 to 8 lb in. (round head
R screws on face of panel).

R (4) Close circuit breakers opened in Step 2A(1).

(5) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on hydraulic systems A and C (Ref. 29-11-00).

(7) Position flap handle from full up to full down through each detent position (allow flaps to reach each selected position); return to full up. Verify following:

(a) When slats start to extend, the LE TRANS light must come on and stay on until slats fully extend, then LE TRANS light must go off and LE EXT light must come on. (Light sequence will reverse for slat retraction.)(Light sequence will reverse for slat retraction.)

(b) Flap position indicator tapes must position to each selection within position limits on indicator.

(8) Turn off hydraulic power.

(9) Turn off electrical power.

SPOILER AND SPEEDBRAKE CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

Spoilers are installed to improve roll control, to provide aerodynamic braking during flight and on the ground, and to provide direct lift control during approach and landing.

There are six spoiler panels on the upper surface of each wing; they are numbered 1 through 6, with No. 1 being the most inboard panel on each wing. Spoilers 1 through 4 are used for direct lift control (DLC) and ground speedbrakes. Spoilers 2 through 6 are used to assist the ailerons in roll control during flaps extended flight, and for speedbrakes during flaps retracted flight.

Each spoiler is positioned hydraulically by a separate servo actuator. The twelve spoiler acutators are supplied by all four hydraulic systems.

The spoilers are controlled by a speedbrake control lever on the center console, a cable system, and a DLC servo in the hydraulic service center. The output of the DLC servo is applied directly to the No. 1 spoiler in each wing, and to the two mixers in the main wheel wells (Ref. Fig. 1).

The DLC servo is the main controlling element in the spoiler and speedbrake control system and provides:

R (1) Speedbrake control during the entire flight regime.

R (2) Direct lift control during approach and landing.

(3) Automatic deployment of the spoilers after touchdown.

(4) Automatic deployment of the spoilers in case of a rejected takeoff.

(5) Automatic retraction of the spoilers in case of an aborted landing.

R R (6) Automatic retraction of spoilers in case of a stall warning.

The spoiler servos are controlled through a mixer in each main wheel well and a selector in the outboard trailing edge of each wing (Ref. Fig. 2 and 3). The mixers and selectors receive aileron position inputs through interconnecting pushrods, and flap position inputs through an electrical actuator on each mixer and selector.

The mixers provide a means to sum the inputs from the DLC servo and the ailerons, and to dwell (uncouple) the aileron inputs when flaps are retracted. The range of spoiler control by the DLC servo is 0 to 60 degrees. The mixer roll cam is designed so that it takes approximately 5 degrees of aileron input before the spoilers start to extend for roll augmentation. The range
R of spoiler control by the ailerons is 0 to 40 degrees minimum.

The right mixer, located in the right main wheel well, receives aileron position inputs from the right inboard aileron surface, speedbrake command position inputs from the DLC servo, and a flap extend input from an electrical jackscrew acutator mounted on the mixer. The right mixer controls positioning of spoilers 2 and 3 on each wing.

The left mixer, located in the left main wheel well, receives aileron position inputs from the left inboard aileron surface, speedbrake command position inputs from the DLC servo in the hydraulic service center, and flap position inputs from the electrical jackscrew actuator mounted on the mixer. The left mixer controls positioning of the number 4 spoiler on each wing and the outboard spoilers drive selector (which controls spoilers 5 and 6) on each wing.

The selectors are installed to prevent speedbrake deployment of spoilers 5 and 6 during low speed (flaps extended) flight. The selectors respond to either of two inputs: from the left mixer when flaps are retracted, or from the associated inboard aileron when flaps are extended.

2. Operation

The spoiler and speedbrake control system can be divided into two operational modes: roll assist and speedbrake operation. Speedbrake operation is divided into manual (pilot controlled) and electric (computer controlled).

A. Roll Assist

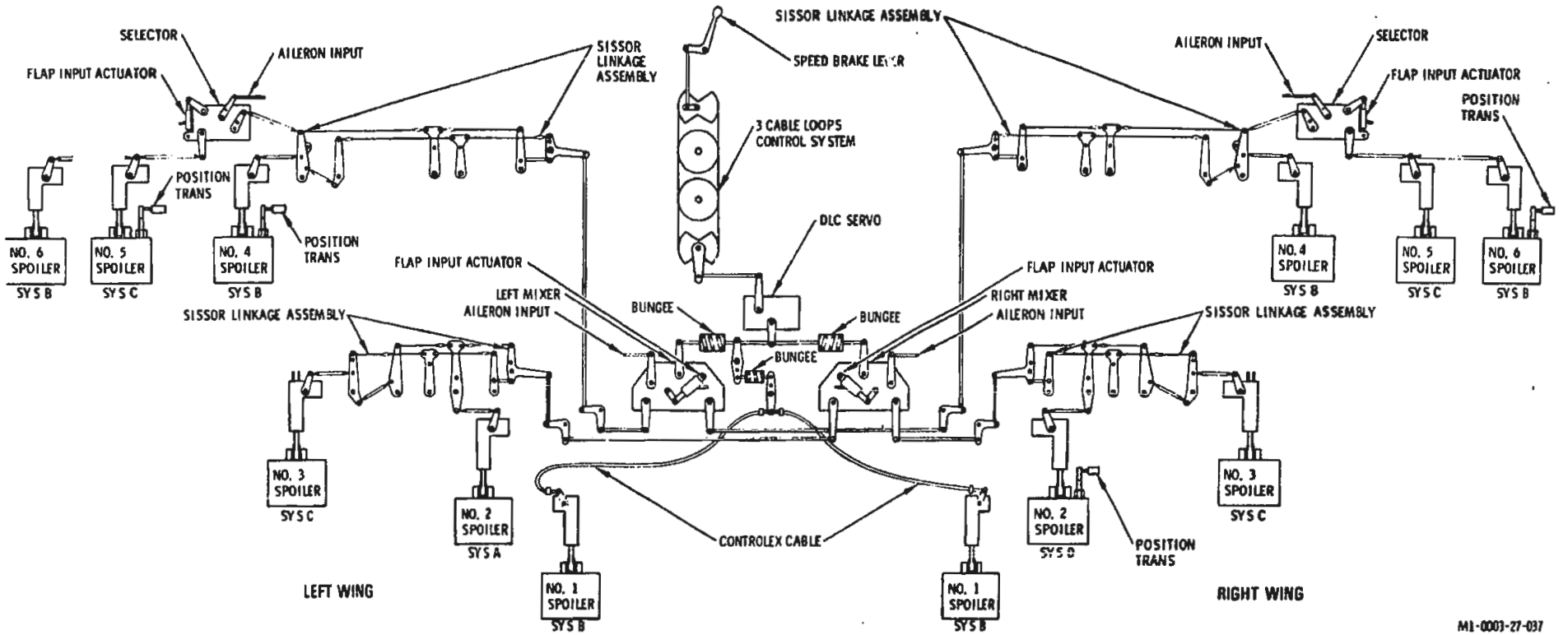
Roll assist is provided when the flaps are extended more than 2.5 degrees. A switch in the flap Power Drive Unit (PDU) switchbox actuates the electrical actuators on the two mixers and two selectors to couple the mixers and selectors to their respective inboard ailerons.

With a left roll initiated, the following results: The left mixer receives left inboard aileron "up" deflections and produces an "up" spoiler signal to the No. 4 spoiler servo in the left wing. The left inboard aileron provides an "up" spoiler signal to spoilers 5 and 6 through the left

AILERON - SPOILER SCHEDULING CHART

SPEEDBRAKE - SPOILER MODES	SPOILER NUMBER 1	2	3	4	5	6	AILERONS INBD	OBD	SPOILER TRAVEL LIMITS
FLAPS UP (0^0)									
AIR SPEED BRAKE	0	X	X	X	X	X	0	0	0^0 TO 60^0
ROLL AUGMENTATION	0	0	0	0	0	0	X	X	DWELLED
FLAPS DOWN (4^0 - 42^0)									
ROLL AUGMENTATION	0	X	X	X	X	X	X	X	0^0 TO 40^0 MIN
DIRECT LIFT CONTROL	X	X	X	X	0	0	0	0	$7^0 \pm 7^0$
AUTOMATIC GROUND SPOILERS	X	X	X	X	0	0	0	0	60^0

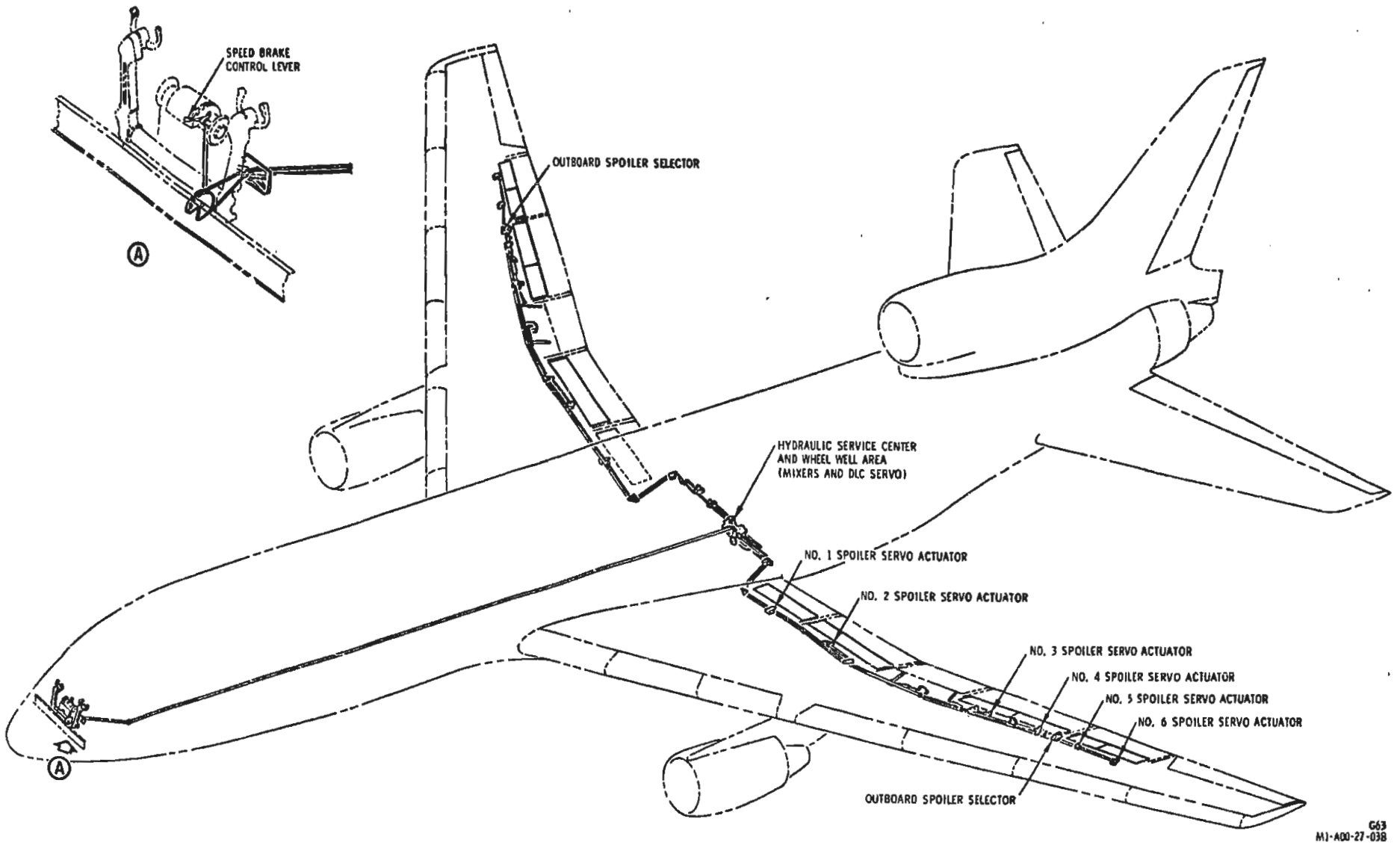
NOTE
X = SPOILER OR AILERON OPERATIVE
0 = SPOILER OR AILERON INOPERATIVE
DLC-FLAPS MORE THAN 30 DEGREES AND 2 OUT OF 3 THROTTLE LEVERS BELOW MAX POWER SETTING
AGS-L AND R MLG STRUTS COMPRESSED OR, L AND R BOGIES (TRUCKS) TILTED



R Spoiler and Speedbrake Control System Schematic
R Figure 1

EFFECTIVITY: ALL

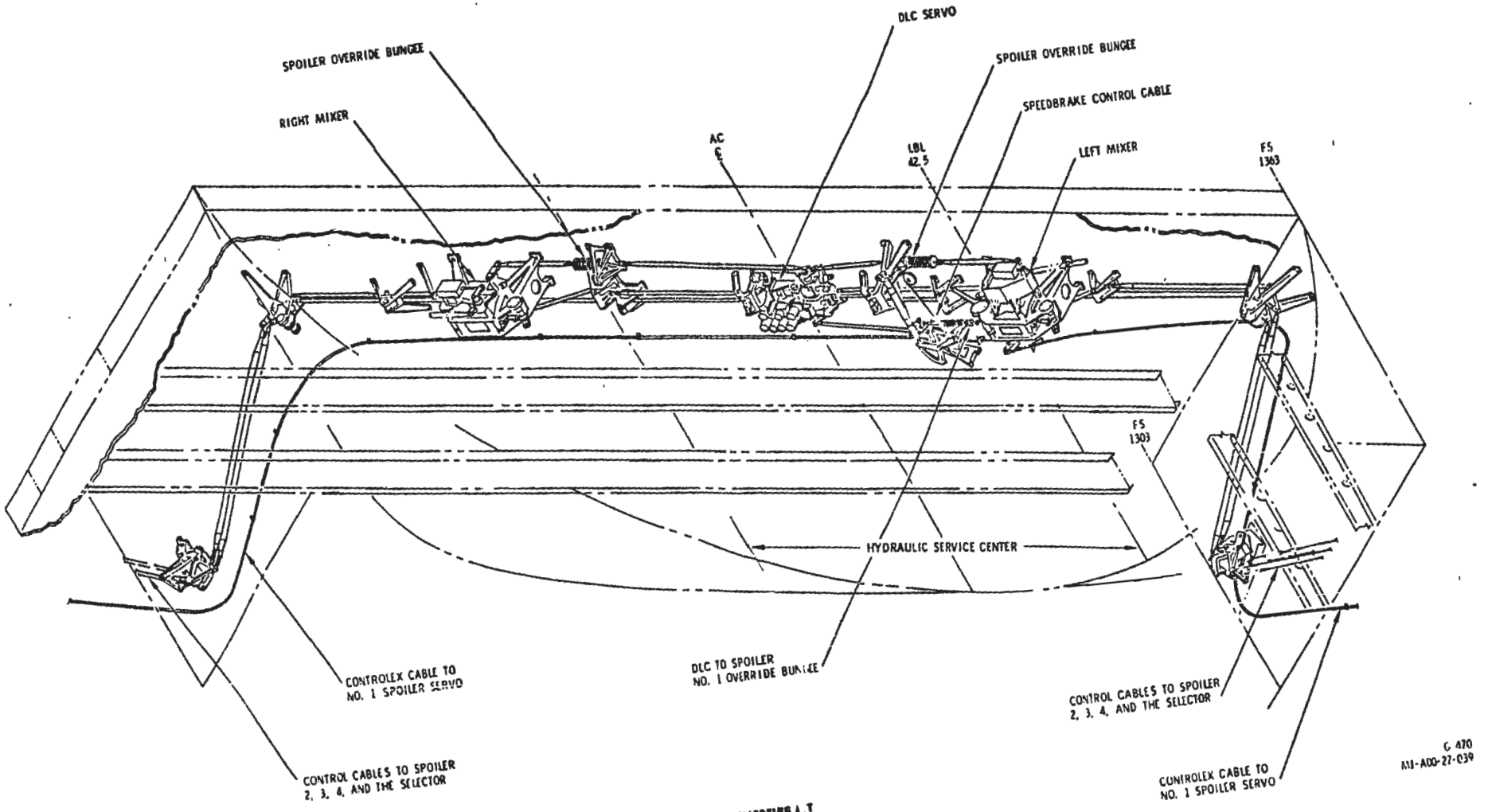
001B



R R Spoiler and Speedbrake System Components Location
Figure 2

EFFECTIVITY: ALL

0018



Spoiler and Speedbrake Components - Hydraulic Service Center and Main Wheel Wells
Figure 3

R
R

EFFECTIVITY: ALL

selector. The left mixer produces no "down" spoiler signal to the right wing components.

The right mixer receives right inboard aileron "down" deflections and produces an "up" spoiler signal to the No. 2 and 3 spoiler servos in the left wing. The right mixer produces no "down" signal to the right wing spoilers. Consequently, spoilers 2 through 6 on the left wing are extended in proportion to aileron deflection. The right wing spoilers do not move.

A right roll under the same circumstances would cause spoilers 2 through 6 on the right wing only to deflect in proportion to aileron deflection. Only the spoilers on the "up" aileron wing are deflected.

B. Speedbrake Operation (Manual)

Speedbrake manual operation consists of high speed speedbrakes (flaps extended less than 2.5 degrees), and low speed speedbrakes (flaps extended more than 2.5 degrees).

(1) Flaps fully retracted:

A switch on the flap Power Drive Unit (PDU) switchbox actuates the electrical actuators on the mixers and selectors to uncouple the mixers from their respective inboard aileron and couple the selectors to the left mixer. In addition, the PDU switch energizes the solenoid shutoff valve on the No. 1 spoiler servo actuators to shut them off.

In this configuration, the spoilers will not respond to roll inputs as the mixers and selectors are uncoupled from their respective inboard ailerons.

R Speedbrake lever inputs to the DLC servo will produce a DLC servo position output to the two mixers. The left mixer controls spoiler 4 on each wing and provides a position input to the selectors which controls spoilers 5 and 6 in each wing. The right mixer will control spoilers 2 and 3 on each wing. Consequently, positioning of the speedbrake lever will deploy spoilers 2 through 6 on each wing in proportion to lever movement.

(2) Flaps extended more than 2.5 degrees:

A flap PDU switch energizes the electrical actuators on the mixers and selectors to couple the mixers and selectors to their respective inboard ailerons. In addition, the solenoid shutoff valve on the No. 1

spoiler servo actuators is deenergized, thus activating these spoilers. In this low speed speedbrake condition, the spoilers can respond to speedbrake and roll input commands.

DLC servo output commands (whether speedbrake lever controlled or autopilot controlled) will deploy spoilers 1 through 4 on each wing in proportion to DLC servo output.

Deflection of the ailerons will provide roll input commands into both mixers and selectors. A left roll input, while spoilers 1 through 4 are deflected for speedbrakes, will cause the following: The left mixer receives left inboard aileron "up" deflections and produces an "up" spoiler signal to No. 4 spoiler servo and to the selector on the left wing. The right mixer receives right inboard aileron "down" deflections and produces an "up" spoiler signal to spoilers 2 and 3 in the left wing. Consequently, spoilers 2 through 4 in the left wing extend above their speedbrake position in proportion to aileron deflection; spoilers 5 and 6 (which are coupled to their respective inboard aileron with flaps extended more than 2.5 degrees) extend in proportion to inboard aileron deflection. Spoilers on the right wing remain at their speedbrake position.

Roll inputs normally do not cause the spoilers on the "down" aileron wing to drop below their speedbrake command position. (If full roll input is applied when speedbrake lever if fully extended, some aircraft may exhibit slight down-spoiler movement on the "down" aileron wing. This is due to tolerance buildup in the mixers and considered normal.)Speedbrake deployment of
R the spoilers is limited to 60 degrees and roll control
R is 40 degrees minimum, however, the sum of speedbrake and roll inputs never exceeds 60 degrees.

Normal operating force of the speedbrake lever is 3 to 5 pounds. If hydraulic power to both DLC servo channels is lost, the pilot can apply positioning commands to spoiler servos through the DLC servo with a force of 35 to 46 pounds on the speedbrake lever; however, the speedbrake lever must be held in the selected position.

If the speedbrake lever is positioned full aft when the DLC servo is shut down, the speedbrake lever may require a slight forward push to fully stow in a full forward position. The above is due to cable friction. As long as the spoilers are full down and the unsafe takeoff aural warning does not sound, it is normal for the speedbrake

lever to be as much as 3/4-inch from the full forward position.

R A condition can occur where full extension or retraction of the spoilers may not be obtained when the speedbrake handle is moved slowly. This is caused by friction in the system working against the system bungee springs. If the spoilers operate normally with normal handle speed, the aircraft R should be considered normal.

C. Speedbrake Operation (Electric)

For the speedbrake electric mode, the DLC servo receives positioning commands from the Flight Control Electronic System (FCES) computer (Ref. 22-17-00). The computer positioning commands to the DLC servo are reflected in the speedbrake lever (the speedbrake lever follows DLC servo movement).

R There are two variations to electric mode, depending on whether the approach and landing are made by the pilot or autopilot. In both variations the DLC servo operates as a proportional servo, controlled by signals from the FCES computer, and drives the servos of spoilers 1, 2, 3, and 4. R These signals originate from Autotrim Transducer in the autopilot servo (Ref. 22-17-00, Fig. 13) and represent R stabilizer out-of-trim position signals. The electric mode is armed when flaps are extended more than 30 degrees and two of the three throttles are positioned below the minimum takeoff/go-around setting.

When the DLC is armed, the DLC servo is biased to deploy the spoilers to 7 degrees (DLC neutral). The spoilers are then automatically modulated between zero and 14 degrees in response to the pitch axis command to the stabilizer. When all interlock requirements are fulfilled, the intercept of R the glideslope triggers engagement of the autoland DLC mode.

In the autoland mode, glideslope error signals are processed R by Pitch Autopilot Computer (Ref. 22-11-00) and fed to the stabilizer autopilot servo which positions the stabilizer. The Autotrim Transducer in the stabilizer autopilot servo senses stabilizer out-of-trim position. These signals are fed to the DLC servo which deploys spoilers 1 through 4 in proportion to these error signals, thus producing altitude changes with reduced pitch attitude excursions.

In the case of a go-around, the spoilers, which are extended, will immediately retract when at least two throttles are advanced to takeoff power. In the go-around mode, the spoilers are retracted and the speedbrake lever is R positioned forward by action of DLC servo which is driven to

spoiler retract position. Under these conditions the speedbrake lever may not be positioned full forward due to cable friction and the speedbrake lever may require a slight forward push to fully stow.

An important function of the electric mode is ground speedbrake application. Ground speedbrakes shorten the stopping distance either during landing roll or during a rejected takeoff by destroying most of the lift and hastening transfer of aircraft weight to the landing gear.

The automatic ground speedbrakes are activated after touchdown when all necessary interlocks are complete. These interlocks include landing gear truck pitch-down and shock strut compressed signals. When proper truck and shock strut interlocks are complete, indicating the aircraft has touched
R down, the FCES computer sends a 16-degree deflection command signal to the DLC servo which drives spoilers 1 through 4. Then, when both shock struts indicate the aircraft is fully on the runway, a 60-degree command signal is directed by the FCES computer to the DLC servo. This two-step ground speedbrake deployment insures a smooth air to ground transition.

In case of a rejected takeoff, spoilers 1 through 4 are also automatically extended. The controlling signal is generated by positioning at least two throttles to reverse thrust setting.

During landing roll-out, the spoilers will be automatically retracted if trailing edge flap handle is positioned to less than 30 degrees and the throttles are not selected for reverse thrust. Automatic retraction of the spoilers is also generated by the Stall Warning System (Ref. 22-17-00).

Manual override of the automatic function of the DLC is accomplished by overriding centering force of an engage hook which normally positions the manual control valve to neutral during the automatic mode. The force necessary at the speedbrake lever to override the automatic system is approximately 12 pounds. The larger flow capacity of the manual valve washes out the effect the electro-hydraulic servovalve has on the actuator, thus, limiting the authority of the automatic system.

3. Spoiler and Speedbrake Control System Panels and Indicators

A. Description and Operation

The spoiler and speedbrake control system is monitored for condition and performance by a FCES and PFCS panel on the

pilots overhead panel. Spoiler position is displayed on the surface position indicator on the pilots main instrument panel (Ref. 27-32-00). In addition, ground maintenance controls and annunciators are located on the face of the flight control auxiliary unit (Ref. 22-10-12) located on the center rack of the forward electronic service center (Ref. Fig. 4).

The PFCS control panel contains six switchlights. Five of the switchlights contain PUSH and OFF legends. The sixth switchlight only contains an OFF legend. The PUSH legends are illuminated by activation of the jam warning switch on the pilots aileron control torque limiter (Ref. 27-11-00, Fig. 11). The jam warning switch signals the logic unit in
R the Flight Control Electronic System (FCES) Computer (Ref. 22-17-00), and the logic unit determines which switchlights to illuminate.

If, for instance, a jam in the Captains aileron control path is experienced, rotation of the control wheels will acutate the jam warning switch on the Captains torque limiter. Switchlights L5 & 6 and L & R4 will illuminate as these are the spoilers controlled by the left spoiler mixer which receives roll inputs from the Captains control path. Depressing the illuminated switchlights will deactivate the associated spoiler servo actuators and turn on the OFF legends.

The switchlight with only the OFF legend controls spoilers L and R1. These spoilers do not affect roll control, but if a malfunction is suspected, they can be turned off by depressing the L and R1 switchlight, which will turn on the OFF legend.

The FCES panel contains two DLC/AUTO SPLR switchlights (one for each DLC servo channel). The DLC/AGSB section of the
R FCES computer monitors operation of the DLC servo. If the DLC servo is not responding properly to FCES positioning commands, the associated channel switchlight FAIL light will come on. Releasing (out) the switchlight will disable that channel of the DLC servo and turn on the OFF legend. If both DLC servo channels are disabled, or the auto ground spoiler section of FCES computer is inoperative, the AUTO GND SPLRS INOP light on the pilots annunciator panel will come on.

The flight control auxiliary unit control panel contains test controls and annunciator lights which permit testing of the following:

(1) The mixer and selector dwell actuators.

(2) The No. 1 spoiler shutoff valves.

(3) The monitor circuits to determine that the mixers, selectors, and No. 1 spoilers are in the proper mode.

The panel contains two momentary switches and three annunciator lights. Depressing the MANUAL switch and positioning the toggle switch to FLAPS UP or DOWN will cause the mixer and selector dwell actuators and the No. 1 spoiler shutoff valves to actuate to the selected position. Moving the FLAPS switch to a position opposite the actual flap position will introduce a fault condition and cause the three annunciator lights to come on.

4. Speedbrake Lever

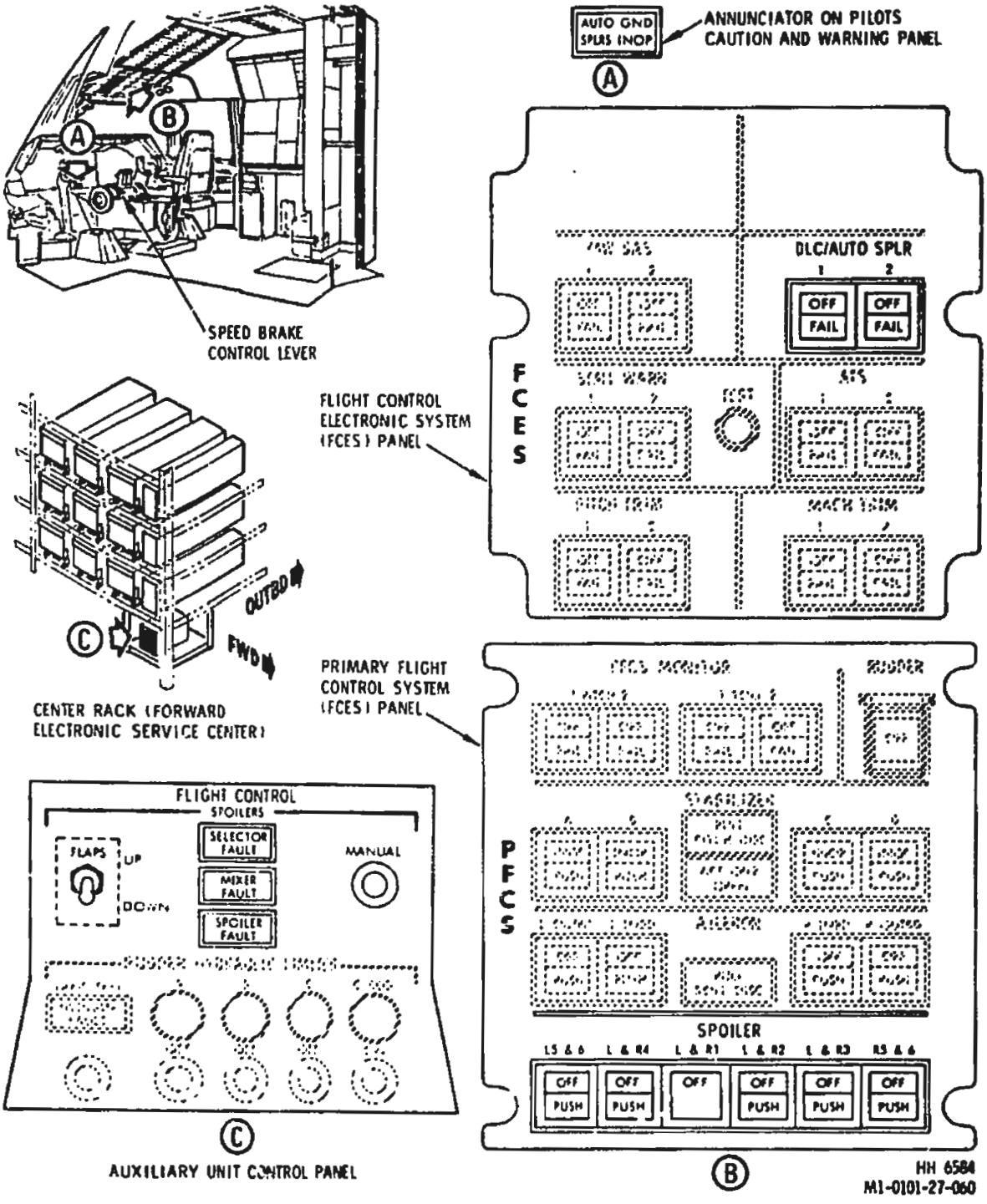
A. Description and Operation

The speedbrake lever is mounted on the left side of the center console. The lever does not contain any detents or locking mechanism. The lever can be positioned anywhere
R from full forward (spoilers retracted) to full aft (spoilers
R extended) and will stay in the selected position.

The speedbrake lever is connected by an adjustable pushrod to a cable quadrant below the flight station floor. A cable system consisting of three Lockclad cable loops transmits speedbrake lever motion to the DLC servo in the hydraulic service center.

An automatic disable pushbutton switch and dual lights are incorporated on top of speedbrake lever. The switch allows the pilot to shut off hydraulic power to the DLC servo in event of DLC servo hardover deployment of the spoilers. The dual lights will illuminate when the switch is positioned in the off (DLC servo disabled) position. When shut down, the DLC servo will automatically retract the spoilers and position the speedbrake lever full forward.

If the speedbrake lever is positioned full aft when the DLC servo is shut down, the speedbrake lever may require a slight forward push to fully stow in the full forward position. The above is due to cable friction. As long as the spoilers are full down and the unsafe takeoff aural warning does not sound, it is normal for the speedbrake lever to be as much as 3/4-inch from the full forward position.



Flight Station Spoiler and Speedbrake Control Panels
Figure 4

5. Lockclad Cables

A. Description

The spoiler controls use Lockclad cables to transmit speedbrake lever positions to the DLC servo in the fuselage and mixer position commands to the spoiler servos in the wings. The fuselage cables are 3/32-inch diameter; the wing cables are 1/8-inch diameter.

Lockclad cable consists of 7 by 19 tinned carbon steel wire that is put in tension when an aluminum tube is swaged along its entire length. Lockclad cable reduces elastic stretch during operation and tension changes due to temperature variations. The Lockclad cables are straight runs that are supported by fairlead rollers.

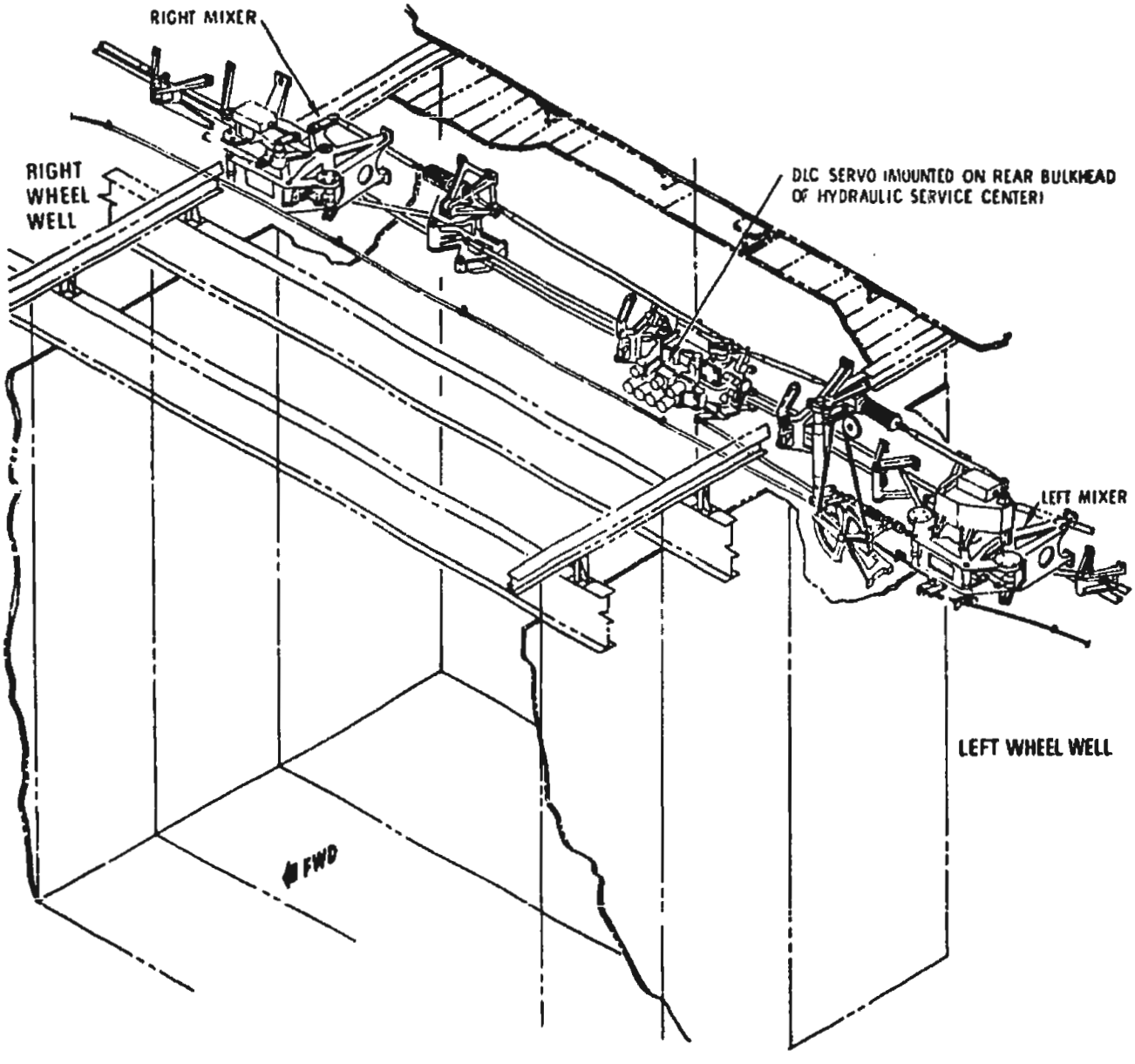
6. Direct Lift Control Servo Module

A. Description

The DLC servo is a dual servo actuation system with primary and secondary channels. Two parallel actuators drive a single (structurally redundant) output lever. The output lever drives two pushrods: one connected to the left mixer in the left wheel well, and one connected to the right mixer in the right wheel well. The DLC servo is mounted on the rear bulkhead of the hydraulic service center (Ref. Fig. 5).

The DLC servo has two modes of operation: manual and electric. The manual mode is divided into the hydraulic mode and the mechanical mode. The manual hydraulic mode is the normal mode for pilot operation. The pilot positions the speedbrake lever which, through the servo internal summing lever linkage, positions the dual tandem control valve (Ref. Fig. 6). The control valve modulates hydraulic system pressure to the two integral piston actuators which respond to the hydraulic differential pressure and positions the output lever in proportion to input command. When the output lever reaches the command position, the summing lever linkage will reposition the control valve to neutral, thus stopping actuator movement and locking the actuators in the command position. The speedbrake lever can be placed in any position from zero to MAX (60 degrees) and the DLC servo will respond accordingly.

The manual mechanical mode is used in case of loss of hydraulic power to both DLC servo channels. Moving the
R speed brake lever will drive input arm of the DLC servo and,
R through the internal summing lever linkage, drive output arm of the DLC servo. With loss of hydraulic power, the DLC



DLC Servo Installation
Figure 5

actuators will automatically be in the bypass position,
R which connects associated actuator lines to each other and to return. Consequently the actuators will not impede movement of the DLC servo output lever.

The electric mode is the automatic mode of operation of the DLC servo. Two electro-hydraulic servovalves (one for each channel) are plate mounted to the DLC servo. These two servovalves receive signals from the Flight Control Electronic Systems (FCES) computer (Ref. 22-17-00). The two
R servovalves convert electrical input command signals to proportional hydrualic pressure differentials and ports these hydraulic signals to their respective actuators.

In each servo channel, the electro-hydraulic servovalve and the pilot controlled spool valve feed the same actuator.
R Since flow capability of the spool valve is twice that of the servovalve, the pilot can nullify the effect of the
R computer controlled servovalve, thus giving pilot override capabilities over a malfunctioning automatic system.

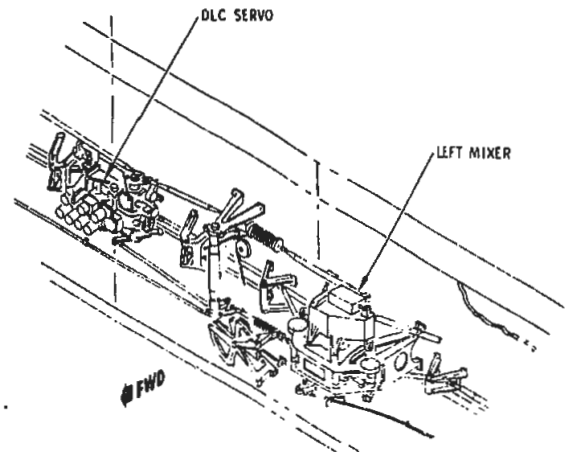
A description of the major components of the DLC servo (Ref. Fig. 6) is as follows:

(1) Manual Control Valve

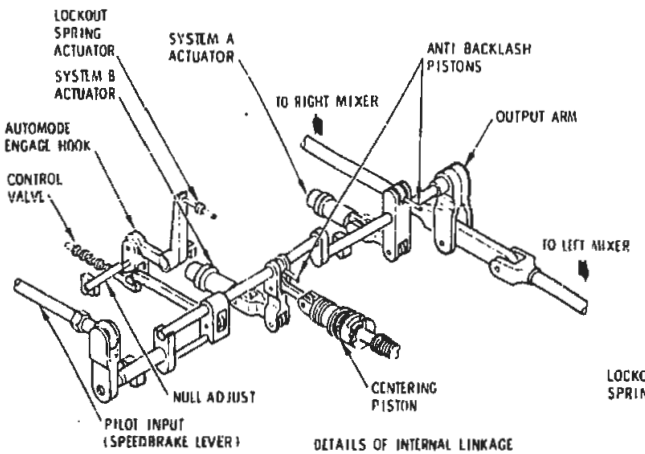
The manual control valve is a dual tandem spool valve. The spool is spring loaded so that a failure in the input linkage will position the DLC actuators to command the spoilers to the retracted position. The control valve housing is divided between the two hydraulic systems so that a crack in the housing will not propagate into both housings and cause loss of both hydraulic systems. In each system, a solenoid valve can be deenergized to shut off supply pressure to its respective half of the spool valve.

(2) Bypass Valve

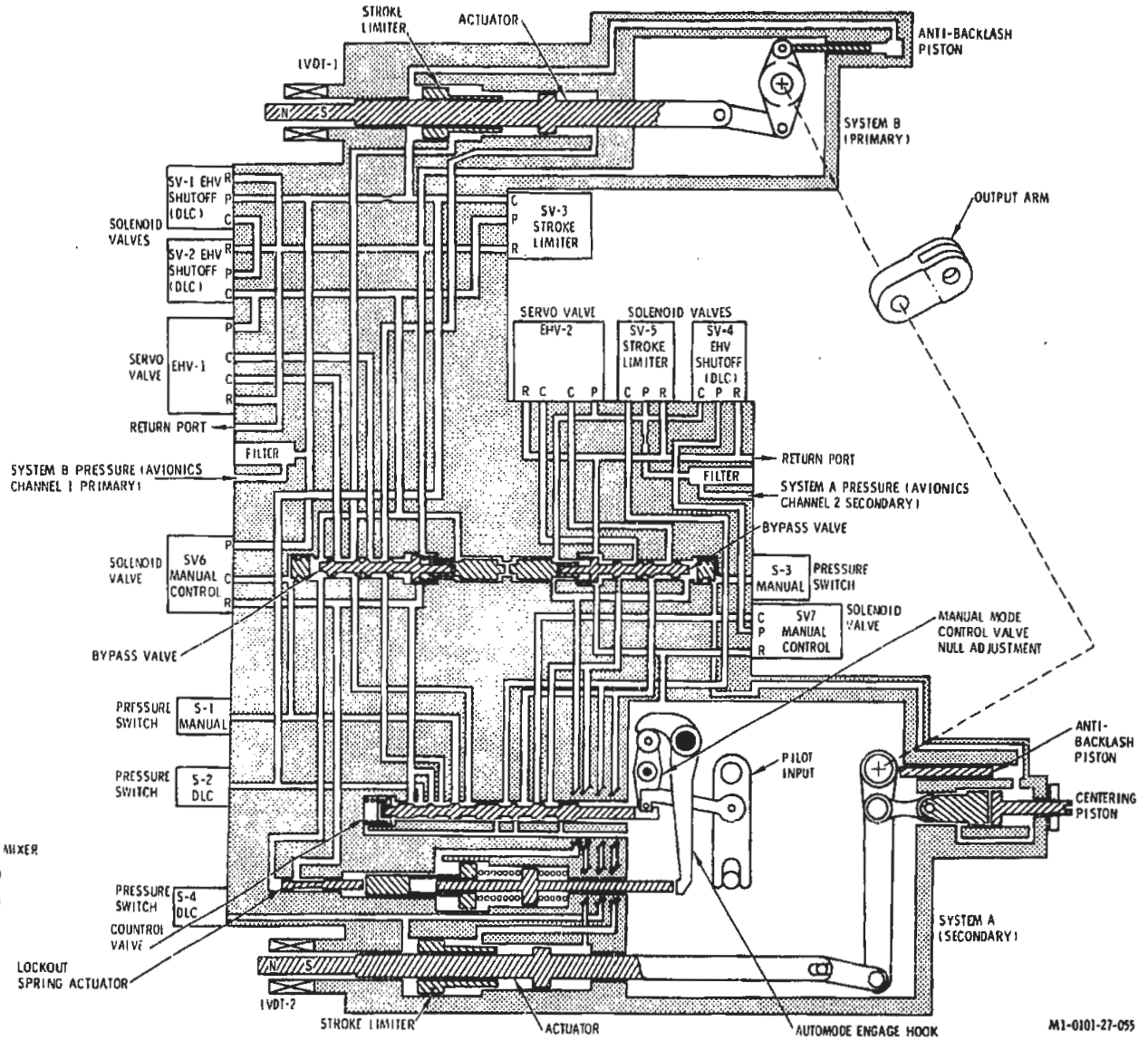
Two bypass valves are installed in a common bore and arranged so that the loss of pressure to one channel will permit the opposite system pressure to drive the valve in the failed system to the bypass position. The bypass position interconnects the actuator lines of the failed channel, which eliminates the drag of the failed system actuator on the active channel. The bypass valve is also used as a blocking valve in the hydromechanical (lever operated) mode. In this mode, pressure is supplied to the opposite ends of each bypass valve to block the passages from the electro-hydraulic servovalve to the actuators. The servovalve and the manual control valve pressurize the



HYDRAULIC SERVICE CENTER



DETAILS OF INTERNAL LINKAGE



R DLC Servo Schematic
R Figure 6

EFFECTIVITY: ALL

001E

actuator through common hydraulic passages. Positioning the bypass valve to the blocking position eliminates the hydraulic leakage loss through the inactive servovalve.

(3) Centering Piston

The centering piston is located in the secondary channel and receives pressure directly from the secondary system for operation in both electric and hydromechanical modes. The centering piston acts as a hydraulic bungee between the primary and secondary actuators, and permits up to a 20 degree error between the two actuators without degrading DLC servo performance.

(4) Lockout Spring Actuator

The lockout spring actuator consists of a spring operated piston and a dual hydraulic actuator mounted in tandem. Pressure is supplied from both hydraulic systems to the dual actuator. Pressure from either of the two actuators compresses a spring that engages the hook. The hook locks the manual control valve spool at null, and is actuated when the electric (automatic) mode is engaged by the FCES computer. Thus, pilot speed brake lever inputs are prevented. However, if the pilot wants to override the electrical mode due, for instance, to a malfunction in the electrical mode, then he can apply an input into the manual control valve and cam the hook out of the way by compressing the lockout actuator spring. This is accomplished by applying about 12 pounds force to the speed brake control lever. This action allows the pilot to take immediate command of the DLC servo.

(5) Stroke Limiter

A stroke limiting piston in each actuator is pressurized by a solenoid valve when the electric (automatic) mode is engaged by the FCES computer. The limiting position limits the actuator stroke so that maximum spoiler deflection is limited to 16 degrees.

R NOTE: Although the DLC is designed to extend the
R spoilers as indicated above, play in the linkage
R between the DLC servo and spoiler servos will
R reduce DLC spoiler deflection by two degrees.

B. Operation

Operation of the DLC servo (Ref. Fig. 6) is controlled by seven solenoid operated shutoff valves and four pressure
R switches that are plate mounted to servo. Control of manual
R (hydraulic) mode, and electric (mechanical) mode is as
R follows:

(1) *Manual Mode - Hydraulic*

R The DLC servo is a hydraulically powered position follow-up servo controlled manually from the speedbrake lever. Solenoid valves 6 and 7 are energized to provide system pressure to the manual control dual
R spool valve. Pressure to bypass valves from solenoid valves 6 and 7 block the electro-hydraulic servovalve
R ports from actuator. Solenoid valves 6 and 7 are energized any time normal electrical power is supplied to the DLC servo system.

(2) Manual Mode - Mechanical

R Solenoid valves 1, 2, 4, 6, and 7 are deenergized.
R This puts actuators in a bypass condition allowing the
R input lever to drive output lever through internal feedback linkage. This mode is activated by depressing the pushbutton switch on the speedbrake lever, which deenergized solenoid valve 6 and 7. Loss of system pressure in the DLC servo by deactivation of solenoid valves 6 and 7 will deenergize solenoid valves 1, 2, and 4.

(3) Electric Mode

R The DLC servo receives positioning commands from the FCES computer. The signal to position the spoilers is generated by the Autotrim Transducer on the autopilot stabilizer servo (Ref. 22-17-00, Fig. 13). The Autotrim Transducer is connected to the autopilot servo
R output lever which, in turn, is connected to pilot-to-stabilizer servo control linkage. Consequently, as the pilot or autopilot positions the stabilizer servo input linkage, the Autotrim Transducer senses this motion. This motion represents stabilizer out-of-trim position signals. These signals are sent
R to the FCES computor which generates DLC position
R command signals which are directed to two electro-hydraulic servovalves on the DLC servo.

R All solenoid valves are energized when DLC operates in
R the electric mode. Electric mode is automatically
R activated when flaps are extended more then 30 degrees
R and throttle settings are below takeoff/go-around
R position. In the primary channel, solenoid valves 1

R and 2 are in series and supply pressure to the primary
R channel servovalve (EHV 1), bypass valve, lockout
R spring actuator, and solenoid valve 3. In secondary channel, solenoid valve 4 supplies pressure to the secondary channel servovalve (EHV 2), bypass valve, lockout spring actuator, and solenoid valve 5. Pressure from solenoid valves 3 and 5 actuate the stroke limiter in their respective actuators to limit spoiler deflection to 16 degrees.

Pressure from solenoid valves 1, 2, and 4 cause the
R lockout spring actuator to engage the hook which positions manual control valve spool to null. Signals to the servovalves of both DLC channels modulates the flow to the actuators, which through the internal linkage, operate the DLC output lever. Dual Lineal Variable Differential Transformers (LVDT)connected to each actuator provide electrical feedback to the FCES computer to complete the servo loop.

When energized, solenoid valves 6 and 7 port each
R system pressure to dual tandem manual control valves,
R which are held in null by the engaged hook. If the
R pilot has to override electric mode, the manual control valves are ready to provide instantaneous position commands in response to speedbrake lever movement.

Pressure switch 1 and 3 sense if solenoid valves 6 and 7 respectively are operating, by sensing the loss of pressure downstream of these solenoid valves. Solenoid valves 6 and 7 supply hydraulic pressure to their respective halves of the dual manual control valve
R spool. Loss of pressure to the manual spool eliminates capability of the pilot overriding a malfunctioning servovalve. Consequently, loss of solenoid valve 6 or 7 will cause the respective channel to be shut down.

Pressure switch 1 senses loss of pressure downstream of solenoid valve 6 and provides a signal to the logic
R unit of FCES Computer. This signal will deactiviate channel one by deenergizing solenoid valves 1 and 2.
If pressure switch 3 senses loss of pressure downstream
R of solenoid valve 7 then channel 2 will be deactivated by deenergizing solenoid valve 4. Pressure switch 2 and 4 sense if the appropriate solenoid valves in each channel are operating properly in the electric mode.

Pressure switch 2 senses if solenoid valves 1, 2, and 3 are operating by sensing pressure downstream of solenoid valve 3. A loss-of-pressure signal from pressure switch 2 will signal the logic unit of the
R FCES Computer to deactivate the electric mode function

of channel 1. Pressure switch 4 serves the same function for channel two by sensing pressure downstream of solenoid valve 5. A loss-of-pressure signal from pressure switch 4 will cause the deactivation of the channel 2 electric mode function.

The centering piston in the secondary channel is a hydraulic bungee that is compressed when the two actuators are out of phase or when the actuator in the secondary channel has a tracking error. When the inline monitoring system in the FCES Computer (which compares input commands with output position) detects a sufficient error in the output position of either actuator LVDT, it shuts off (deenergizes) solenoid valves 1 and 2 or 4. This causes the appropriate bypass valve to connect actuator ports to return and allow the remaining system to function normally.

7. Electro-Hydraulic Servovalve

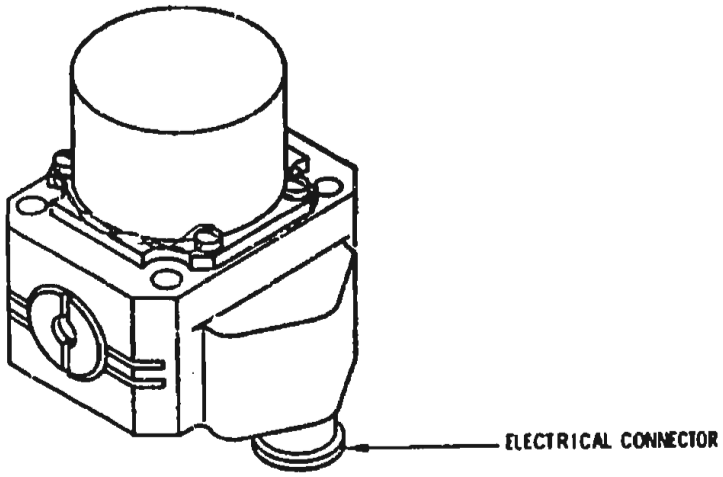
A. Description

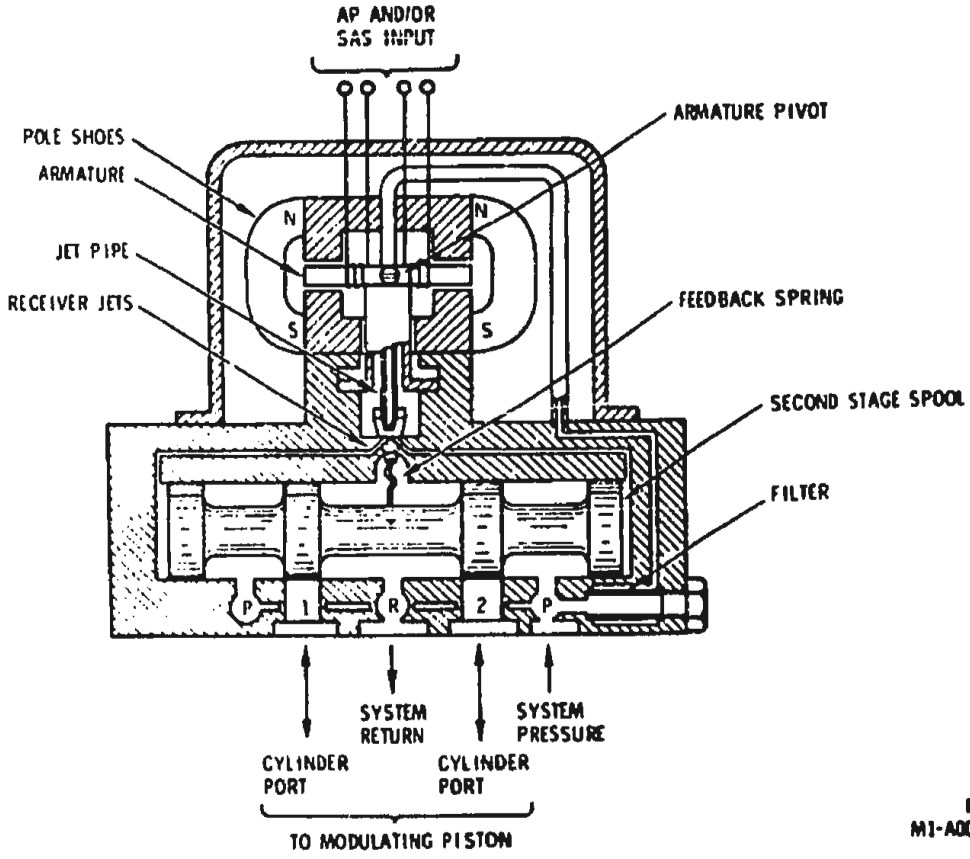
The electro-hydraulic servovalve is a four-way proportional valve that controls flow of hydraulic fluid to and from the Direct Lift Control (DLC) servo actuator. Hydraulic flow developed by the valve is proportional in magnitude and direction to differential current applied to the torque motor.

The servovalve is essentially a signal converter and a two-stage hydraulic amplifer. The servovalve receives small electrical signals and converts them to large hydraulic output signals which are used to drive the DLC actuator. The valve consists of a torque motor, a jet-pipe first stage nozzle with mechanical feedback, and a second stage four-way spool valve coupled to first stage nozzle through feedback spring (Ref. Fig. 7). A 100 micron filter, installed in the valve pressure manifold, insures contaminant free fluid supply to the valve. The servovalve is attached to the DLC servo assembly by four screws; and is hydraulically sealed by plate type gasket face seals. Two of these valves are installed on the DLC servo, one for each channel.

The torque motor is an electromagnetic device which consists of two pole shoes, two coils connected through the ships wiring to the (FCES) Computer, and an armature which is coupled to the first stage nozzle. The nozzle is held in the neutral (hydraulic null) position by a spring.

B. Operation





HH 5087
M1-A00-27-035

Electro-Hydraulic Servovalve
Figure 7

Hydraulic system pressure is supplied to the servovalve where the oil is filtered and ported to both pressure ports of the second stage spool valve and to the first stage nozzle. With a balanced electrical signal applied to the two coils of the torque motor, the nozzle is held in the neutral position. In this condition, the nozzle oil-jet impinges equally on both second stage spool receiver jets thus producing equal hydraulic pressures across the seond stage spool which maintain the second stage spool valve in th null position.

A FCES electrical input command signal would produce an unbalanced magnetic force in the torque motor and cause the armature and nozzle to rotate slightly. In this condition, the nozzle oil-jet impinges unequally on the second stage spool receiver jets and produces a differential pressure across the second stage spool which would displace the spool. Displacement of the second stage spool would control hydraulic flow and pressure to the DLC servo actuator. The actuator drives a position transducer (LVDT) which senses actuator displacement and provides the feedback signal to the FCES computer, which completes the servo position loop.

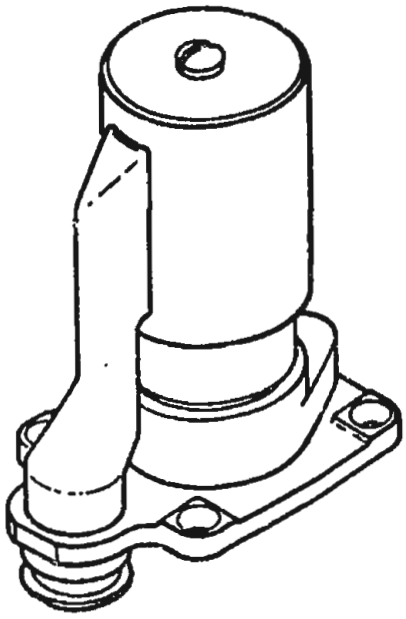
R Displacement of second stage spool would also apply a mechanical force through the feedback spring, which tends to
R return the nozzle towards null position. The internal mechanical feedback mechanism stabilizes servovalve operation and provides for more accurate servovalve positioning.

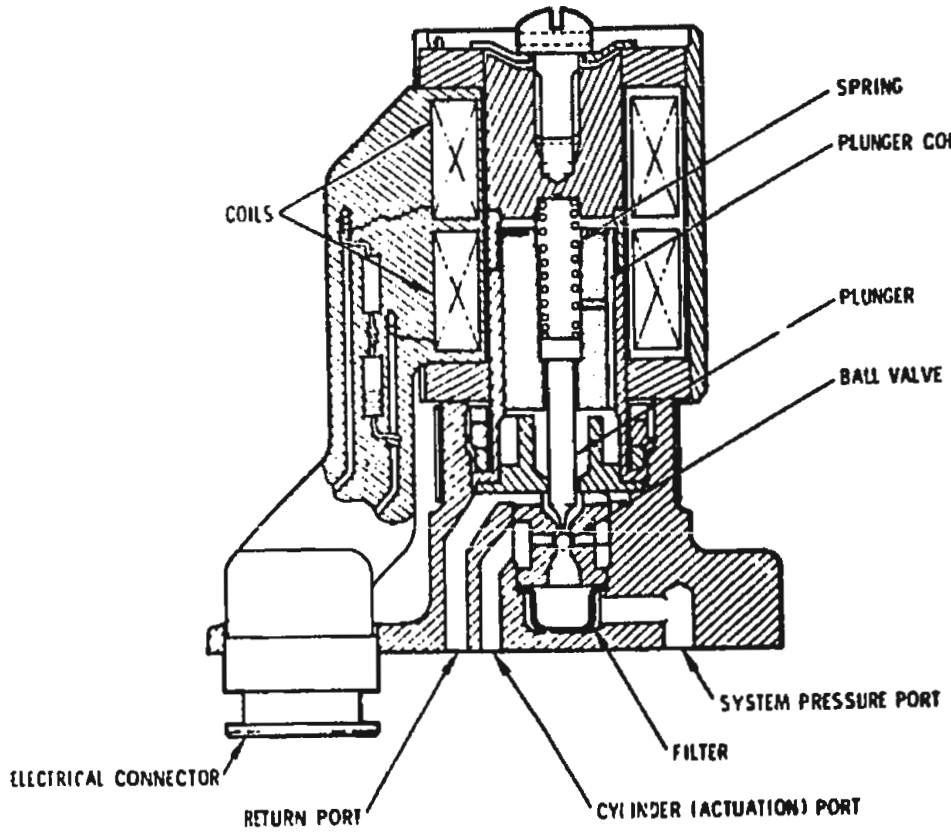
8. Solenoid Shutoff Valve

A. Description and Operation

The solenoid shutoff valve is a plate mounted, electrically controlled, two-position, three-way hydraulic valve (Ref. Fig. 8). The valve contains three ports: a pressure supply port, a cylinder port, and a system return port; and functions to open the cylinder port to either pressure or to return. Seven shutoff valves are installed on the dual
R channel (DLC) servo. The valve is mounted to the DLC servo with four screws, and is sealed by a gasket plate face seal. The valve consists of a double coil assembly, filter, sleeve assembly, and a ball check valve assembly. The filter, installed in the pressure supply manifold of the valve insures contaminant free fluid supply to the valve.

Operation consists of energizing and deenergizing the solenoid. With the solenoid deenergized, a spring loaded plunger holds the ball on the pressure inlet seat, against system pressure. This opens the cylinder port to system





HH 6468
MI-A00-27-062

Solenoid Shutoff Valve
Figure 8

return so that no hydraulic pressure can build up in the shutoff valve cylinder port.

When the solenoid is energized by 28V dc, the double coil magnetic force on the plunger core and system pressure on the ball overcome plunger spring force to raise the plunger. System pressure then holds the ball against the return seat and opens pressure port to the shutoff valve cylinder port. Loss of solenoid electrical power will allow the spring loaded plunger to force the ball on pressure inlet seat, thus shutting off hydraulic flow to the shutoff valve cylinder port.

9. Spoiler Override Bungee

A. Description and Operation

An override spring bungee is installed in the push rod system between the (DLC) servo and spoiler mixers (Ref. Fig. 9). One bungee is located in the upper rear left corner of the hydraulic service center, zone 147, and is installed between the DLC servo output arm and the speedbrake input arm on the left mixer. A second bungee is located in the upper rear right corner of the hydraulic service center and is installed between DLC servo output arm and speedbrake input arm on the right mixer.

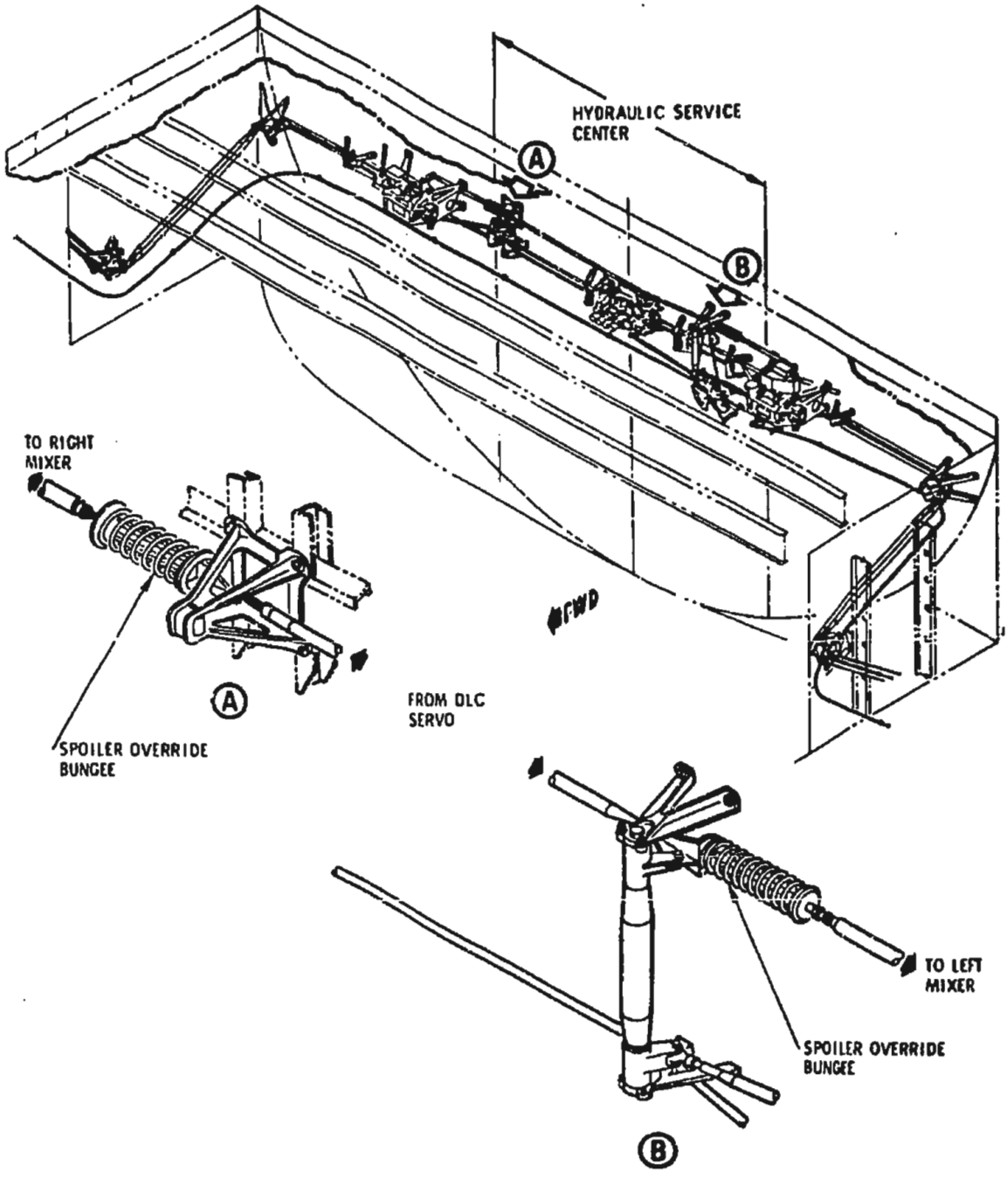
The override spring bungees are installed to insure that a jam in one mixer will not prevent the normal operation of the other mixer. Normally, bungees operate as a solid part of the push rod system. However, if a mixer jams, then the DLC servo would overcome the 114 pound spring bungee in the jammed system and continue to position the operable mixer in response to DLC servo input commands.

The bungee is a double acting caged spring, and is designed so that either a compression or tension load will cause the spring to compress. The bungee end fitting allows adjustment between the bungee and interconnecting push rods, to provide for rigging adjustment of spoiler input linkage.

10. Spoiler Mixer Assembly

A. Description and Operation

Two spoiler mixer assemblies, in conjunction with two outboard selector assemblies, are used to control positioning of the spoilers. Six symmetrical sets of spoilers are provided, numbered 1 to 6, with number 1 spoiler being the most inboard panel on each wing. The



Spoiler Override Bungee
Figure 9

R mixers and selectors control ten of the spoilers, as the No. 1 spoilers are controlled directly by the (DLC) servo (Ref. Fig. 1).

R The mixers provide a means to sum roll and speedbrake input when flaps are extended more than 2.5 degrees. When flaps are retracted, mixers uncouple or dwell the roll input. The mixer outputs are applied through cables and linkages to the spoiler servo actuators which hydraulically position the spoilers.

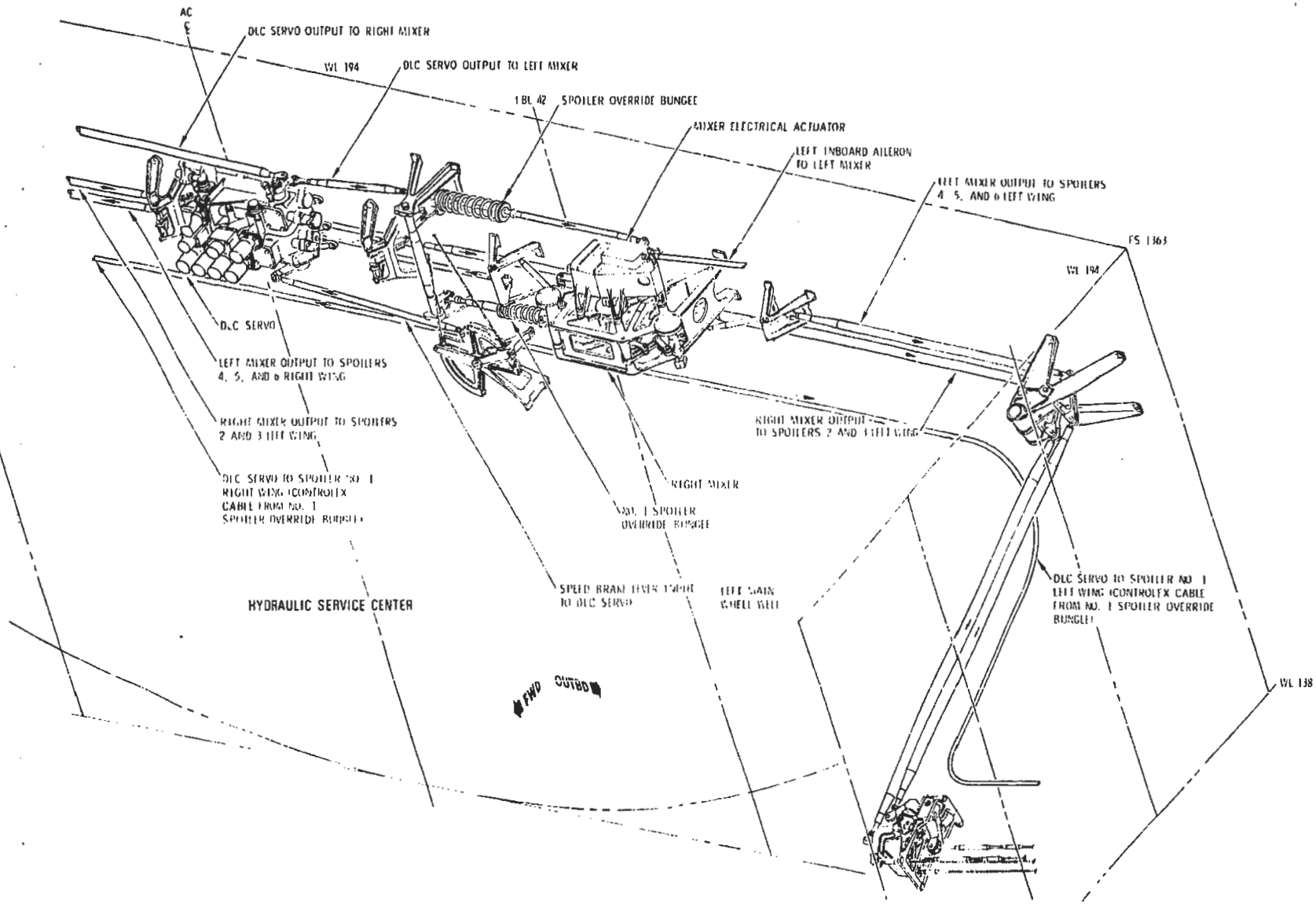
The left mixer is located in the left main wheel well, zone 149, and is mounted to the rear bulkhead (Ref. Fig. 10). This mixer receives aileron positioning inputs from the left inboard aileron surface, and speedbrake positioning commands from the DLC servo. In addition, an electrical actuator is mounted on top of the mixer. The electrical actuator responds to switch signals from the flap drive mechanism. When the flaps extend past 2.5 degrees a circuit is completed to drive the actuator to undwell (couple) the aileron inputs into the mixer (Ref. Fig. 11).

R The output of the left mixer is cable and pushrod connected to the No. 4 spoiler servo in each wing, and to the outboard spoiler selector in each wing. Consequently, the left mixer controls positioning of spoiler 4, 5, and 6 in each wing.

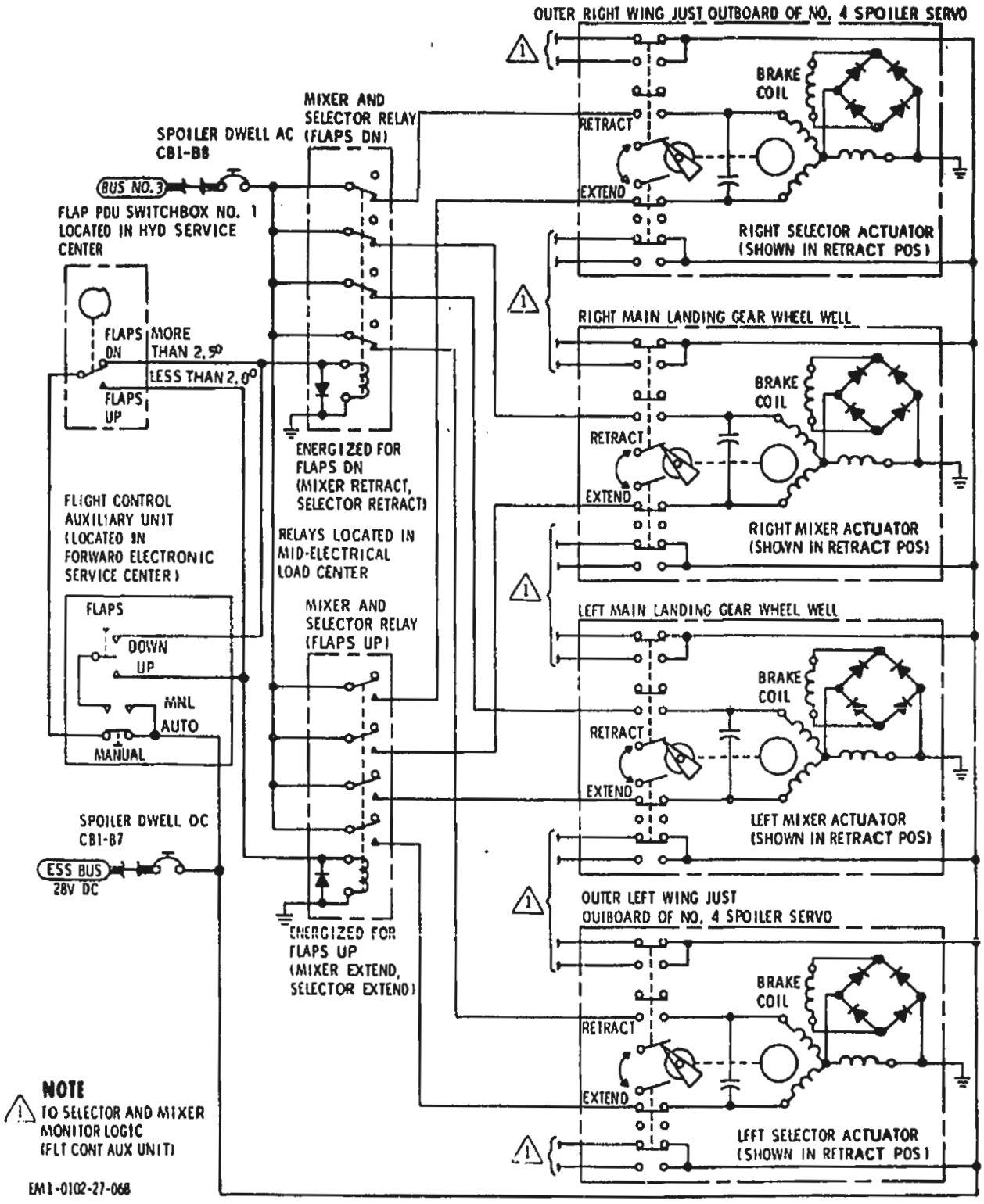
The right mixer is located in the right main wheel well, zone 148, and is mounted to the rear bulkhead (Ref. Fig. 12). This mixer receives aileron positioning inputs from the right inboard aileron surface, and speedbrake positioning commands from the DLC servo. An electrical actuator is also mounted on this mixer and receives the same flap position switch signals as the left mixer: when flaps extend more than 2.5 degrees the actuator undwells (couples) the aileron inputs to the mixer.

R The output of the right mixer is connected to the No. 2 and 3 spoiler servos in each wing by a pushrod and cable system.

The spoiler mixers are functionally identical and consist of two frame members which provide support pivots for the roll cam, electrical actuator, and various bellcranks and links. The roll cam is contoured so that the radius on one side of
R the neutral position increases and radius on the opposite side stays constant as the cam rotates (Ref. Fig. 13). Two
R roller output arms are spring loaded to follow cam contour. With the flaps extended more than the 2.5 degrees, the aileron linkage is undwelled (coupled), which configures the aileron input linkage to rotate the cam.


AC
DLC SERVO OUTPUT TO RIGHT MIXER
WL 194
DLC SERVO OUTPUT TO LEFT MIXER
LBL 42
SPOILER OVERRIDE BUNGEE
MIXER ELECTRICAL ACTUATOR
LEFT INBOARD AILERON TO LEFT MIXER
LEFT MIXER OUTPUT TO SPOILERS 4, 5, AND 6 LEFT WING
FS 1363
WL 194
DLC SERVO
LEFT MIXER OUTPUT TO SPOILERS 4, 5, AND 6 RIGHT WING
RIGHT MIXER OUTPUT TO SPOILERS 2 AND 3 LEFT WING
RIGHT MIXER OUTPUT TO SPOILERS 2 AND 3 LEFT WING
DLC SERVO TO SPOILER NO. 1 RIGHT WING (CONTROLEX CABLE FROM NO. 1 SPOILER OVERRIDE BUNGEE)
RIGHT MIXER
NO. 1 SPOILER OVERRIDE BUNGEE
SPEED BRAKE LEVER CABLE TO DLC SERVO
LEFT MAIN WHEEL WELL
HYDRAULIC SERVICE CENTER
DLC SERVO TO SPOILER NO. 1 LEFT WING (CONTROLEX CABLE FROM NO. 1 SPOILER OVERRIDE BUNGEE)
WL 138
FWD
OUTBD
G 475
M1-A00-27-057

Spoiler Mixer Installation - Left Wheel Well
Figure 10


OUTER RIGHT WING JUST OUTBOARD OF NO. 4 SPOILER SERVO
BRAKE COIL
RETRACT
EXTEND
RIGHT SELECTOR ACTUATOR (SHOWN IN RETRACT POS)
RIGHT MAIN LANDING GEAR WHEEL WELL
RIGHT MIXER ACTUATOR (SHOWN IN RETRACT POS)
LEFT MAIN LANDING GEAR WHEEL WELL
LEFT MIXER ACTUATOR (SHOWN IN RETRACT POS)
OUTER LEFT WING JUST OUTBOARD OF NO. 4 SPOILER SERVO
LEFT SELECTOR ACTUATOR (SHOWN IN RETRACT POS)
MIXER AND SELECTOR RELAY (FLAPS DN)
SPOILER DWELL AC CB1-B8
BUS NO. 3
FLAP PDU SWITCHBOX NO. 1 LOCATED IN HYD SERVICE CENTER
FLAPS DN
FLAPS UP
MORE THAN 2.5°
LESS THAN 2.0°
ENERGIZED FOR FLAPS DN (MIXER RETRACT, SELECTOR RETRACT)
RELAYS LOCATED IN MID-ELECTRICAL LOAD CENTER
FLIGHT CONTROL AUXILIARY UNIT (LOCATED IN FORWARD ELECTRONIC SERVICE CENTER)
FLAPS
DOWN
UP
MNL
AUTO
MANUAL
MIXER AND SELECTOR RELAY (FLAPS UP)
SPOILER DWELL DC CB1-B7
ESS BUS 28V DC
ENERGIZED FOR FLAPS UP (MIXER EXTEND, SELECTOR EXTEND)
NOTE
TO SELECTOR AND MIXER MONITOR LOGIC (FLT CONT AUX UNIT)
EM1-0102-27-068

Mixer and Selector Actuator Electrical Schematic
Figure 11

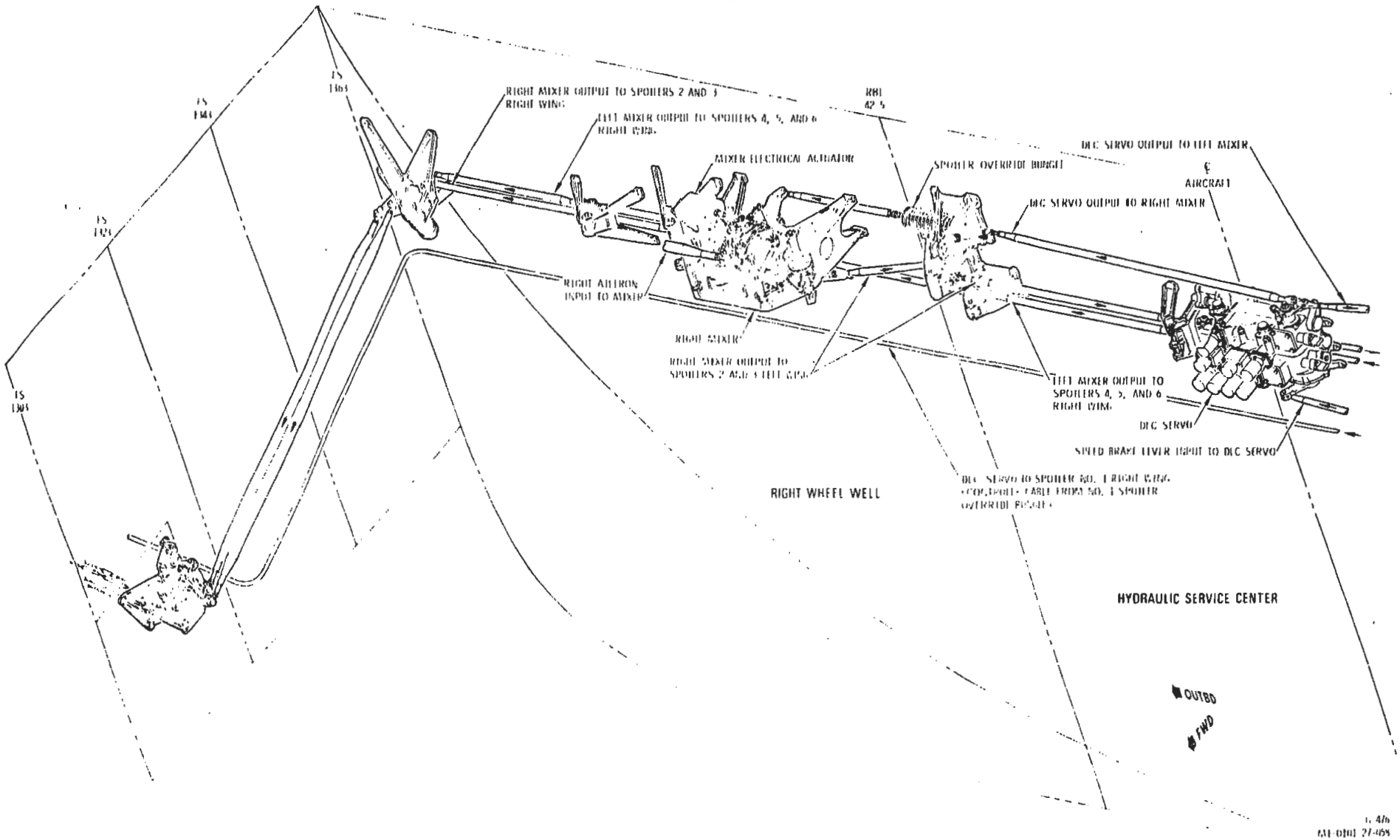
Aileron inputs go into the mixer, which rotates the roll cam (the roll cam is designed so that it requires approximately 5 degrees of aileron before spoiler deployment is initiated). The increasing radius of the cam drives the roller arm of the up-aileron wing and deploying the spoilers in proportion to aileron deflection. The opposite side of the cam rotates with the constant radius section against the roller arm. Consequently, no spoiler action occurs on the down-aileron wing. The aileron-spoiler deflection ratio (gain characteristics) is not lineal (proportional); as aileron rotation increases, the proportion of spoiler deflection increases. In effect, the more aileron applied, the higher the spoiler gain. Full aileron deflection of 20 degrees will produce spoiler deflection of 40 degrees on the up-aileron wing.

When the flaps are extended to less than 2.5 degrees, a switch on the flap drive mechanism will actuate mixer actuators to dwell (uncouple) the aileron input. Aileron inputs to the mixer will not rotate the roll cam under these conditions.

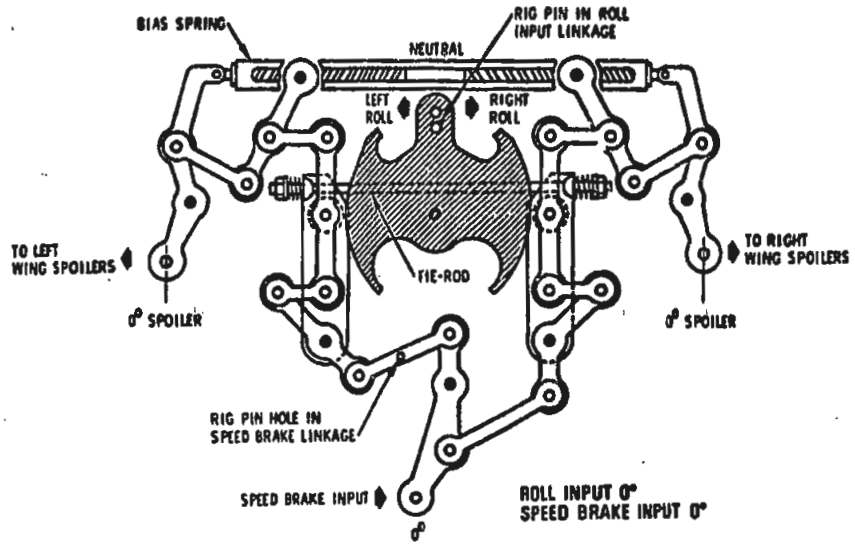
Speedbrake command outputs from the DLC servo (Ref. Fig. 1, Para. 3) are applied to the speedbrake input arm of both left and right mixers. The speedbrake input arm is link connected to the bottom of both roller arms. Rotation of the speedbrake input arm causes the roller arms to rotate equally, using the cam follower rollers as a fulcrum point. Thus, speedbrake inputs apply symmetrical (equal) spoiler position commands to both left and right wing spoilers. The range of speedbrake control of the spoilers is 60 degrees. Spoiler deflection is proportional to speedbrake lever movement.

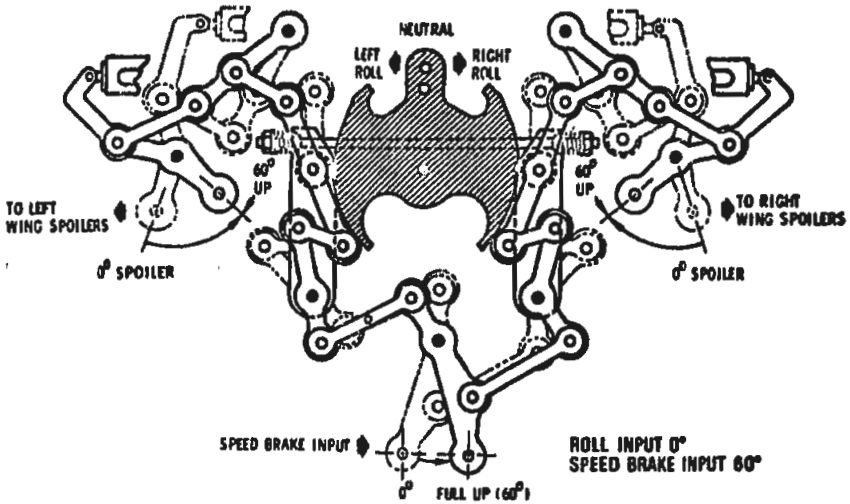
Various combinations of roll inputs and speedbrake inputs can be applied to the mixer. With speedbrake applied, roll inputs will cause spoilers on the up-aileron wing to deflect upwards in proportion to roll inputs; spoilers on the down-aileron wing will remain at the speed brake setting. (If full roll input is applied when the speedbrake lever is fully extended, some aircraft may exhibit slight down-spoiler movement on the down-aileron wing. This is due to tolerance buildup in mixers and is normal.)

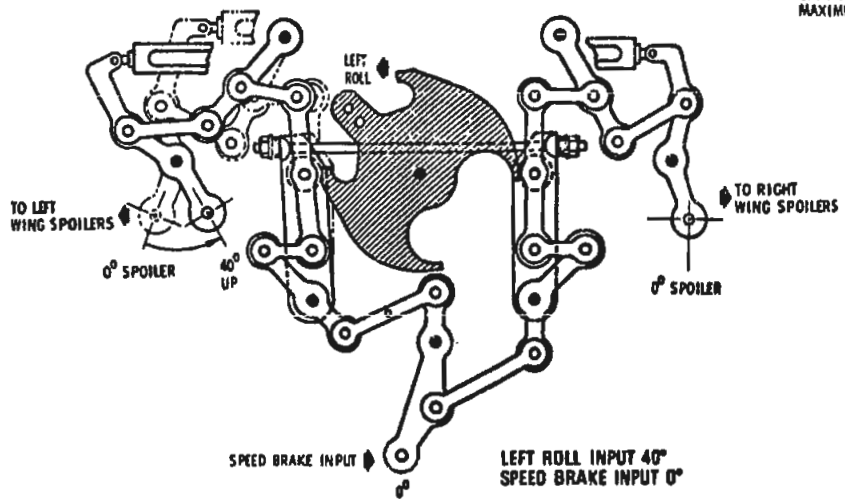
R The range of speedbrake control is 60 degrees, and the range of roll control is 40 degrees. The output linkage of the mixer is configured so that the sum of speedbrake and roll inputs never exceed 60 degrees at the output.

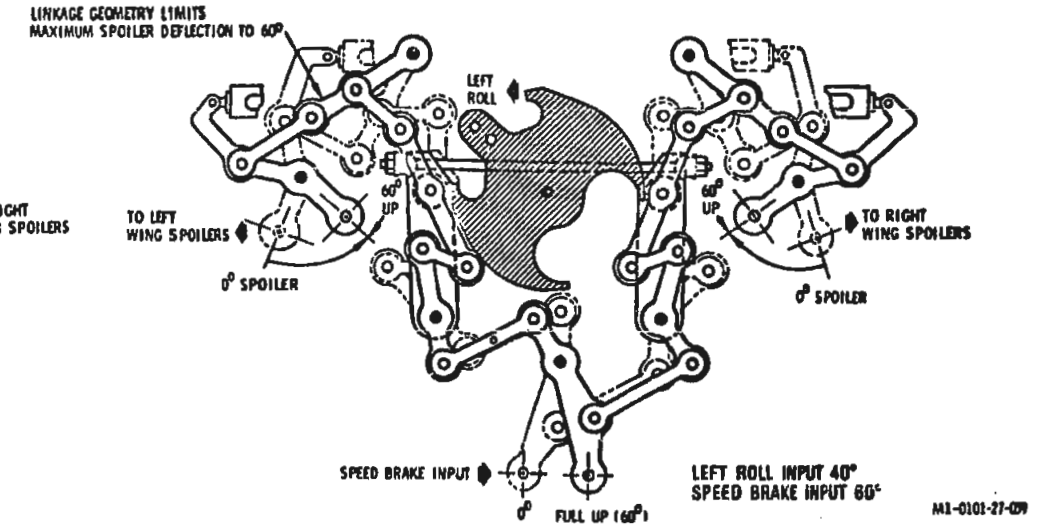

FS 1041
FS 1164
FS 1321
FS 1481
RIGHT MIXER OUTPUT TO SPOILERS 2 AND 3 RIGHT WING
LEFT MIXER OUTPUT TO SPOILERS 4, 5, AND 6 RIGHT WING
MIXER ELECTRICAL ACTUATOR
RBI 42.5
DEC SERVO OUTPUT TO LEFT MIXER
SPOILER OVERRIDE BUNGEE
℄ AIRCRAFT
DEC SERVO OUTPUT TO RIGHT MIXER
RIGHT AILERON INPUT TO MIXER
RIGHT MIXER
RIGHT MIXER OUTPUT TO SPOILERS 2 AND 3 LEFT WING
LEFT MIXER OUTPUT TO SPOILERS 4, 5, AND 6 RIGHT WING
DEC SERVO
SPEED BRAKE LEVER INPUT TO DEC SERVO
DEC SERVO TO SPOILER NO. 1 RIGHT WING CONTROL CABLE FROM NO. 1 SPOILER OVERRIDE BUNGEE
RIGHT WHEEL WELL
HYDRAULIC SERVICE CENTER
OUTBD
FWD
1, 4th
AU-0101 27-65

R Spoiler Mixer Installation - Right Wheel Well
R Figure 12









R Spoiler Mixer Operational Schematics
R Figure 13

EFFECTIVITY: ALL

0018

11. Direct Lift Control (DLC) To No. 1 Spoiler Control System

A. Description and Operation

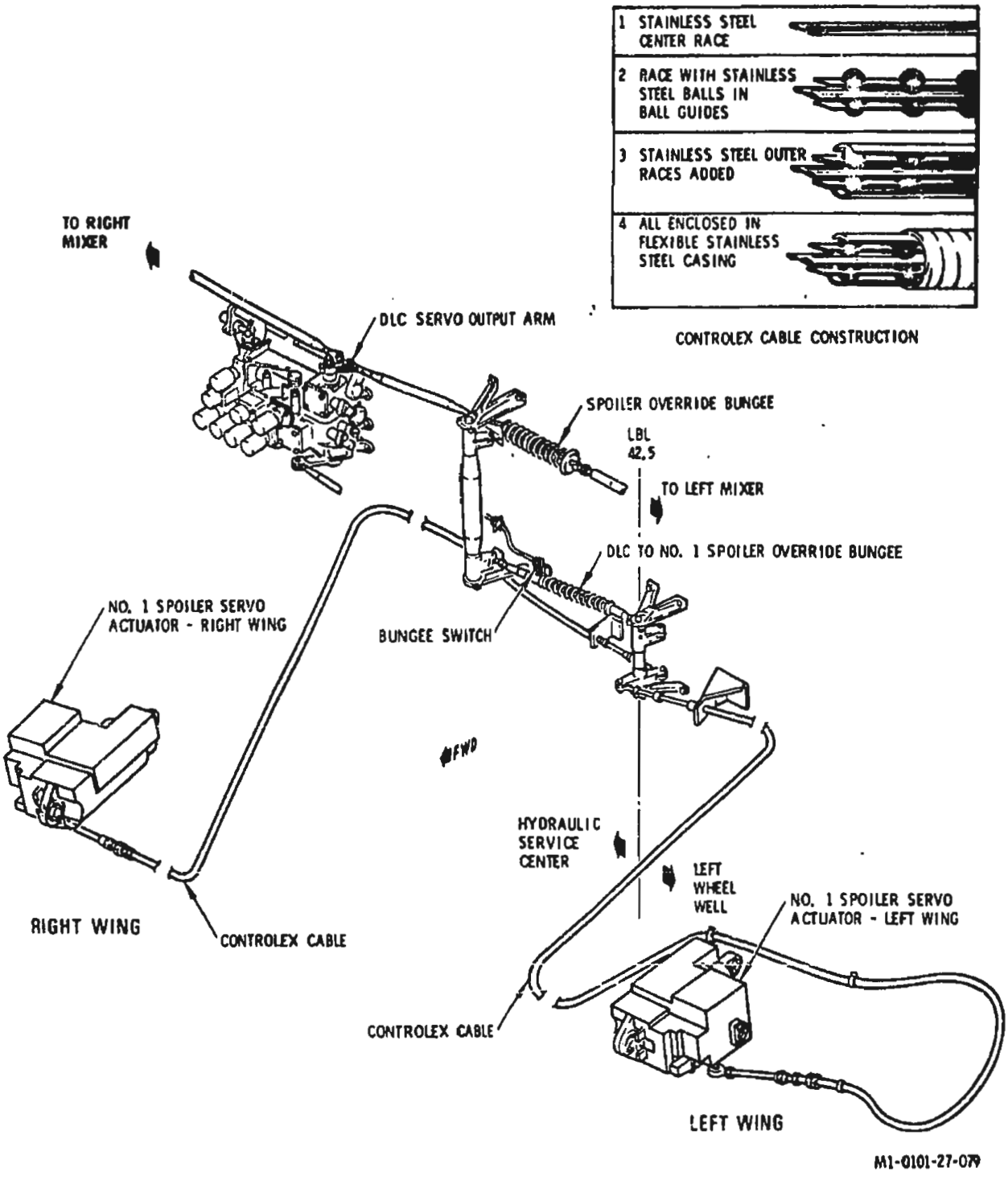
The No. 1 spoilers are used for low speed (flaps extended) speedbrake application only. For high speed (flaps retracted) speedbrakes, No. 1 spoiler servos are disabled by actuation of the spoiler solenoid shutoff valves by the flap Power Drive Unit (PDU) limit switchbox (Ref. 27-51-00, Fig. 9).

The DLC servo controls the No. 1 spoilers through an override spring bungee and two CONTROLEX cables (Ref. Fig. 14). The No. 1 spoiler override bungee is installed to insure continuous operation of the DLC servo if a No. 1 spoiler or its control path is jammed. The CONTROLEX cable consists of a flat stainless steel ribbon supported by ball bearing races. The assembly is enclosed in a housing which produces a flexible push-pull control system.

The output of the DLC servo is connected to left and right spoiler mixers in the wheel wells by a separate push rod and spoiler override bungee. The DLC servo left output push rod is connected to a torque tube assembly in the hydraulic service center zone 147. The torque tube assembly upper drive arm is connected to the spoiler override bungee that drives the left mixer. The torque tube assembly lower drive arm is connected to the No. 1 spoiler override bungee that extends through the left wall of the hydraulic service center and drives the upper arm of a torque tube assembly in the left wheel well. The lower arms of the second torque tube drives both CONTROLEX cables. Both torque tube lower supports have rig pin provisions to provide for rigging No. 1 spoiler control system.

The CONTROLEX cables extend from the left wheel well to No. 1 spoilers located in the trailing edge of the inboard wings and are supported by loop clamps. The CONTROLEX cable ends are threaded to receive rod end bearings. The rod ends are adjustable to allow rigging of the cables.

The No. 1 spoiler override bungee consists of a caged, double-acting compression spring. The bungee is designed so that either a compression or tension load will compress the bungee spring. Normally the bungee acts as a solid pushrod to control No. 1 spoilers. However, if a malfunction in either No. 1 spoiler servo or its CONTROLEX cable causes a 114 pound force to develop across the bungee, then the bungee will compress and prevent jamming of the DLC servo output. The bungee is approximately 18 inches long and contains an adjustable rod eye on each end to provide rigging adjustment.


1 STAINLESS STEEL CENTER RACE
2 RACE WITH STAINLESS STEEL BALLS IN BALL GUIDES
3 STAINLESS STEEL OUTER RACES ADDED
4 ALL ENCLOSED IN FLEXIBLE STAINLESS STEEL CASING
CONTROLEX CABLE CONSTRUCTION
TO RIGHT MIXER
DLC SERVO OUTPUT ARM
SPOILER OVERRIDE BUNGEE
LBL 42.5
TO LEFT MIXER
DLC TO NO. 1 SPOILER OVERRIDE BUNGEE
NO. 1 SPOILER SERVO ACTUATOR - RIGHT WING
BUNGEE SWITCH
FWD
HYDRAULIC SERVICE CENTER
LEFT WHEEL WELL
NO. 1 SPOILER SERVO ACTUATOR - LEFT WING
RIGHT WING
CONTROLEX CABLE
CONTROLEX CABLE
LEFT WING
M1-0101-27-079

No. 1 Spoiler Servo Control System
Figure 14

On aircraft 001-026 with SB 27-101, and 027-999, a switch is installed on the No. 1 spoiler override bungee to shut down the No. 1 spoilers if the CONTROLEX cable or spoiler input jams in either the spoiler extend or retract direction. Bungee compression actuates the switch which energizes the solenoid shutoff valve on the left and right No. 1 spoiler servos (Ref. Fig. 14).

The solenoid shutoff valves on No. 1 spoilers servos are normally energized to shut off No. 1 spoiler servos when flaps are retracted. If the CONTROLEX cable jams and shuts off No. 1 spoiler servos with the flaps extended 2.5 degrees or more, a pressure switch on the spoiler servo will send a "no pressure" signal to the FCAU. With flaps extended, the "no pressure" state of the spoiler servos is a fault and the FCAU will turn on ROLL SPEED BRAKE light on the pilots annunciator panel and SPOILER 1 FAULT light on the FCAU (Ref. Fig. 4).

12. Scissor Linkage Assembly

A. Description and Operation

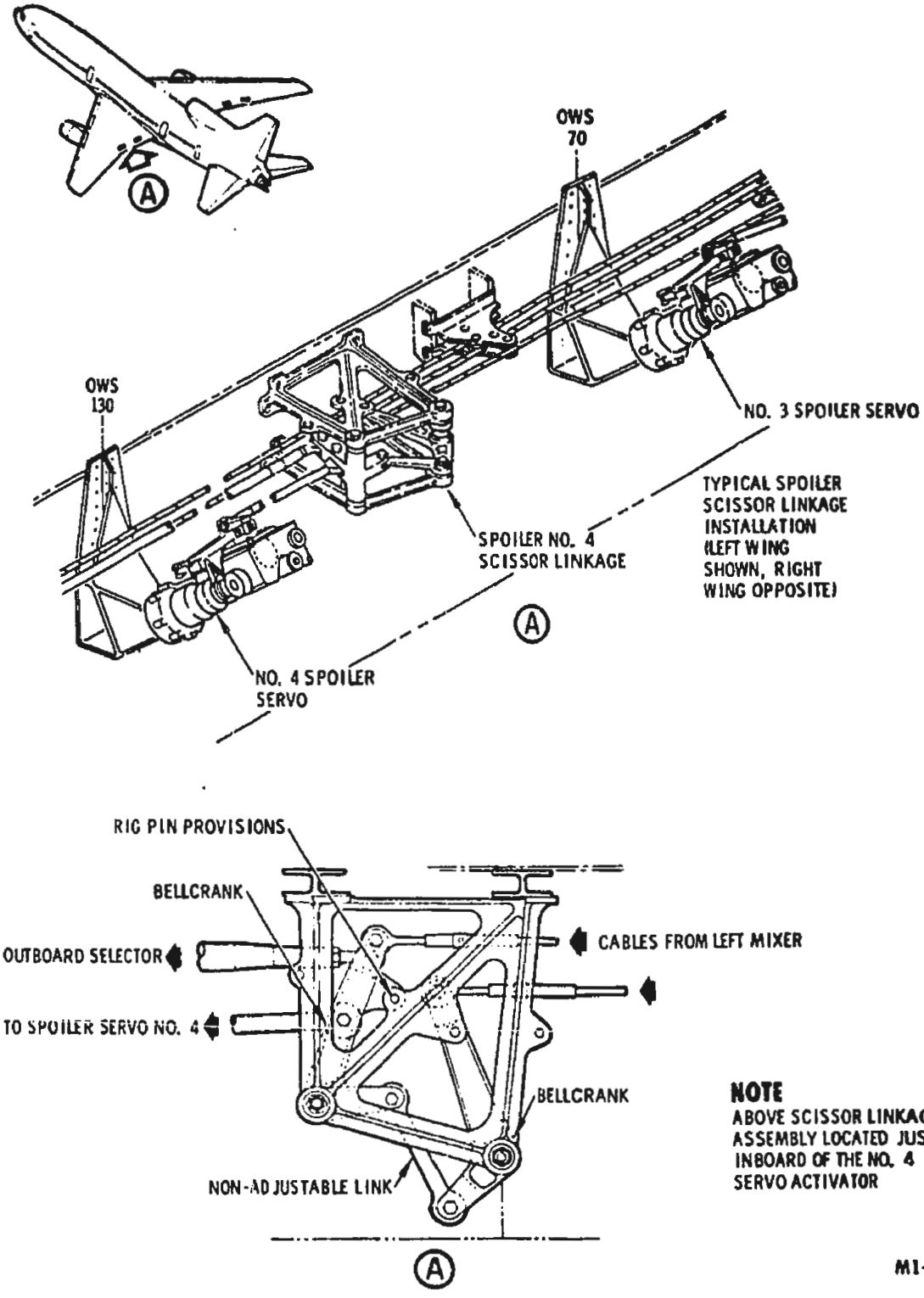
The scissor linkage assembly is a simple arrangement of linkages to provide for converting either push rod motion to cable motion or cable motion to push rod motion. The scissor linkage assembly consists of a bracket that provides pivot bearing support for two bellcranks and a short non-adjustable link that interconnects two bellcranks (Ref. Fig. 15). Where necessary, rig pin provisions are provided to allow for rigging of cables and control push rods.

The spoiler control system contains four scissor linkage assemblies in each wing (Ref. Fig. 1). Two assemblies are mounted on the wheel well outer bulkheads, zone 148 and 149, and are accessible from respective wheel well. One assembly is mounted in the trailing edge of each wing just inboard of the No. 3 spoiler servoactuator, zone 560 and 660. And one assembly is located in the trailing edge of each wing just inboard of the No. 4 spoiler servoactuator, zone 560 and 660.

13. Spoiler Servo Actuator

A. Description

The spoiler servo actuator is a closed-loop position servo which operates in response to mechanical inputs to position spoiler panel to the commanded position. There are twelve servo actuators, one for each panel. All twelve servo



Scissor Linkage Assembly
Figure 15

actuators are functionally identical and differ only in actuator piston size and area. In addition, No. 1 spoiler servo actuator contains a pressure switch the other servo actuators do not have.

The following is a detailed description of the major components of the servo actuator (Ref. Fig. 16).

(1) Control Valve

The control valve is a conventional, two-land, three-way spool. Spool flow rates and spoiler deflection rates are controlled by rectangular holes in the spool sleeve which act as flow controlling orifices. A compression spring loads the spool valve against the summing linkage to eliminate backlash and improve resolution. In addition, the spring will position spool valve to retract the spoiler upon loss of attachment to the servo actuator input link.

(2) Summing Linkage

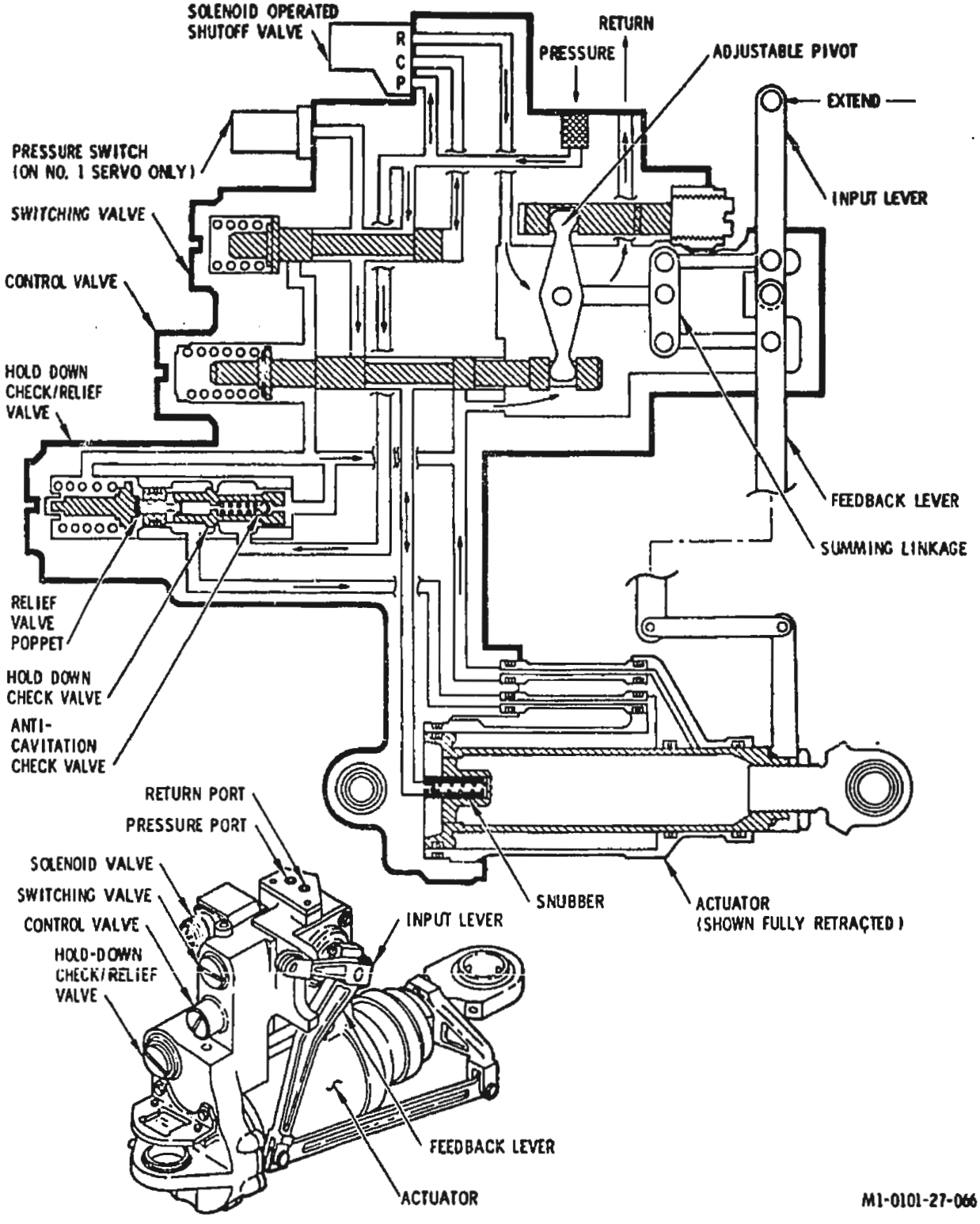
The internal summing linkage receives position commands and actuator feedback displacements, algebraically sums them, and produces an error signal to stroke the spool valve. The input and feedback motions are transmitted through concentric shafts which are internal to the servo actuator assembly and immersed in hydraulic fluid. One pivot pin on the summing linkage is designed to fail in shear in the event of a jammed spool valve; thus permitting free motion of the input crank.

(3) Hold-Down Check and Relief Valve

The hold-down check and relief valve is installed in the retract pressure line between the pressure port and actuator. The hold-down check valve functions to hydraulically lock the retract side of the piston to prevent extension of spoiler if system pressure falls below 1500 psi.

A check valve provides anti-cavitation protection to the actuator. The check valve permits hydraulic fluid to back-flow from return to the retract side of the actuator piston, thus allowing spoiler panel to blow down in the event of a hydraulic failure while the spoiler is extended.

The relief valve function is provided by a poppet acting through a spring guide directly on the hold-down



Spoiler Servo Actuator Schematic
Figure 16

check valve springs. Hydraulic pressure is relieved to return if retract side pressure exceeds 3600 psi.

(4) Pressure Operated Switching Valve

A pressure operated switching valve is installed in the pressure line between the inlet pressure port and servo control valve. Operation of the switching valve is controlled by a two-position three-way solenoid shutoff valve that is operated from the flight station PFCS panel. When the switching valve is actuated, it blocks pressure to servo actuator and vents the extend cylinder port to return. This allows the airloads to retract spoiler to the float position regardless of input lever position.

The switching valve is a spring loaded spool valve. The spring holds the spool valve in the deactuated position which ports system pressure to servo actuator. Pressurizing the opposite end of the spool valve shuttles the valve against the spring to shut off hydraulic flow to servo actuator.

(5) Solenoid Shutoff Valve

The solenoid shutoff valve is an electrically controlled two-position three-way spool valve that is plate mounted to the spoiler servo actuator. The solenoid shutoff valve controls position of the switching valve. When the solenoid valve is deenergized, system pressure is prevented from entering the actuation port of the switching valve. In this condition, system pressure is supplied to the spoiler servo actuator. When the solenoid valve is energized, system pressure is ported to the actuation port of the switching valve and shuttles the spool against spool spring. System pressure to servo actuator is now blocked and pressure trapped in servo actuator is vented to return.

The twelve solenoid valves on twelve spoiler servo actuators are controlled from six switchlights on the PFCS monitor panel located on the pilots overhead panel (Ref. Fig. 4).

(6) Actuator

The actuator utilizes an unbalanced area piston. System pressure is ported to the retract side at all times and control pressure from the spool control valve is applied to the extend area. A hydraulic snubber is installed on the retract side of the piston to reduce

bottoming loads. Extend snubbing is accomplished by restriction of the retract supply port by the piston as the piston approaches bottoming. Spoiler extension of 60 degrees is controlled by piston bottoming in the cylinder. Hydraulic leakage is controlled by a two-stage static and dynamic seal. The cavity between the seals is ported to return. Thus, the outer static and dynamic seal is exposed to reservoir pressures only.

B. Operation

Mechanical positioning commands are applied to six sets of spoiler servo actuators from three sources: spoiler one on each wing is controlled directly from DLC servo. Spoilers two and three on each wing are controlled by the right mixer. Spoiler four and the outboard spoiler selector on each wing (which controls the selection of aileron or speedbrake inputs to spoilers five and six) are controlled by the left mixer.

With an up spoiler signal applied to a spoiler servo, operation is as follows: Position commands are applied to the spoiler servo through input arm (Ref. Fig. 16). The internal summing lever linkage strokes the spool control valve to a open pressure line to the extend port. The retract port always has system pressure applied, but the retract piston working area is approximately one-half of the extend piston working area. The spoiler actuator extends in response to differential hydraulic forces created across the piston. Piston displacement is fed back to the summing linkage and repositions the spool to null when the actuator reaches command position. At this point piston movement ceases and spoiler is hydraulically locked in the command position. Piston displacement is proportional to input arm displacement.

A down spoiler input would stroke the spool control valve and open the extend port to return. System pressure on the retract side of the piston would retract the spoiler. Piston displacement is fed back to the summing linkage and repositions the spool to null when the actuator reaches the command position.

14. Outboard Spoilers Control Selector

A. Description

The outboard spoilers control selector is installed to prevent speedbrake deployment of spoilers five and six during flaps down operation, as this would produce

undesireable pitch motions. The selector provides a means of selecting either of two inputs: from left mixer, when flaps are retracted; or from inboard aileron, when flaps are extended. Consequently, when flaps are retracted, the left mixer provides only speedbrake inputs to the selector, so spoilers five and six respond to speedbrake commands. When flaps are extended, the selector responds to aileron commands only and spoilers five and six provide roll augmentation.

Two selectors are provided with one installed in each wing. The selectors are installed in the trailing edge of the wing just outboard of the number four spoiler servo, zone 560, 660. The selector shifting mechanism is operated by an electrical jackscrew actuator mounted to the selector (Ref. Fig. 17). The actuators receive electrical signals from the flap power drive unit number one switchbox (Ref. Fig. 11). When flaps are extended less then 2.5 degrees, the selector actuators are operated to couple left mixer output to selectors. When flaps are extended more than 2.5 degrees, the selector actuators are operated to couple associated inboard ailerons to selectors.

The selector mechanism consists of an aluminum alloy frame that supports various bellcranks, arms, and linkages. Major components consist of an aileron input lever, a speedbrake input lever, two guide assemblies, an output cam assembly and an electrical actuator. The two input levers contain cam tracks that engage rollers mounted on the guide assemblies. The two guide assemblies are bolted together and pivot from the output cam arm extension. The guide assemblies are also connected by two links to the electrical actuator. Rollers, mounted on the guide assemblies are engaged in the input lever cam tracks (Ref. Fig. 18).

B. Operation

Operation consists of coupling guide assembly rollers to either aileron input lever or to speedbrake input lever. Figure 18 shows selector in both modes of operation. The upper view shows the actuator fully retracted with guide assembly lower roller engaged in the recess of aileron input lever cam track (flaps extended more then 2.5 degrees). The guide assembly upper roller is concentric with mixer input lever pivot. Consequently, mixer input lever rotation would not transmit any motion to guide assembly. However, aileron input lever rotation would transmit motion through guide assembly engaged lower roller to the guide assembly. The left end of guide assembly is coupled to output cam extension arm, thus guide assembly motion would be transmitted to output cam and cause it to rotate.

The output cam drives a spring loaded roller arm that is link-connected to an output lever. The output lever is push rod-connected to input arms of spoiler actuators 5 and 6. Thus, the inboard aileron being positioned up would deploy spoilers 5 and 6 in proportion to aileron deflection.

The lower view of Figure 18 shows actuator fully extended with the guide assembly upper roller engaged in recess of the mixer input lever cam track (flaps extended less then 2.5 degrees). The guide assembly lower roller is now concentric with the aileron input lever pivot. So now, aileron input lever rotation would not transmit any motion to the guide assembly. However, mixer input lever rotation would now transmit motion through the guide assembly engaged upper roller to the guide assembly and then to the output cam, causing it to rotate and providing spoilers five and six with speedbrake inputs. Consequently, speedbrake outputs from left mixer would deploy spoilers five and six on each wing in proportion to mixer output.

Operation of the electrical actuator from one position to the other takes approximately ten seconds.

15. Selector and Mixer Dwell Actuator

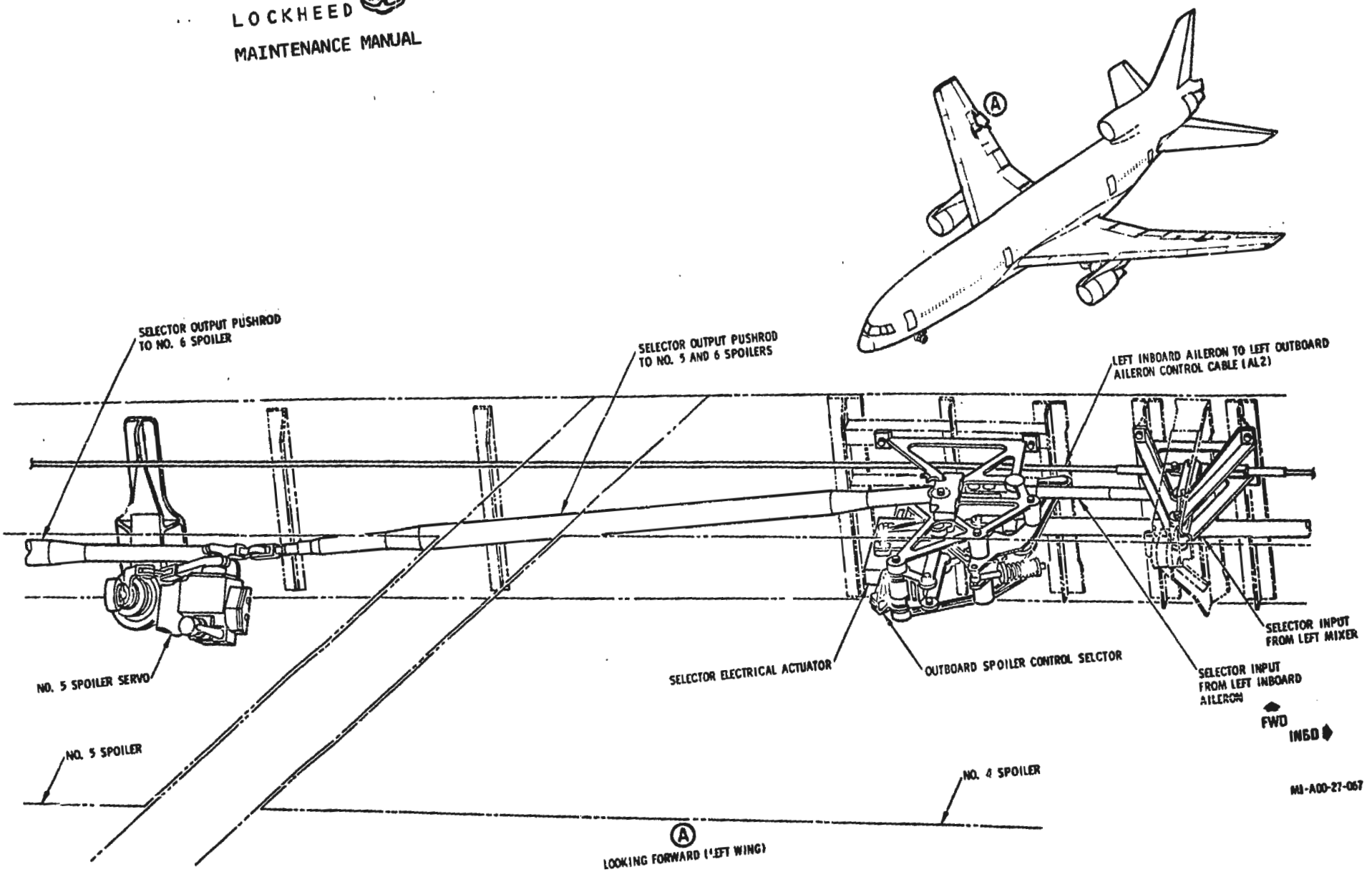
A. Description and Operation

Four identical electrical actuators are used to couple and uncouple aileron inputs to the two mixers, and to select aileron or mixer input into the outboard selectors.

The electrical actuator assembly is composed of a motor, gear train, and jackscrew actuator (Ref. Fig. 19). The motor is a single phase, 115V ac motor that incorporates a magnetic brake. The brake is released when power is applied to motor.

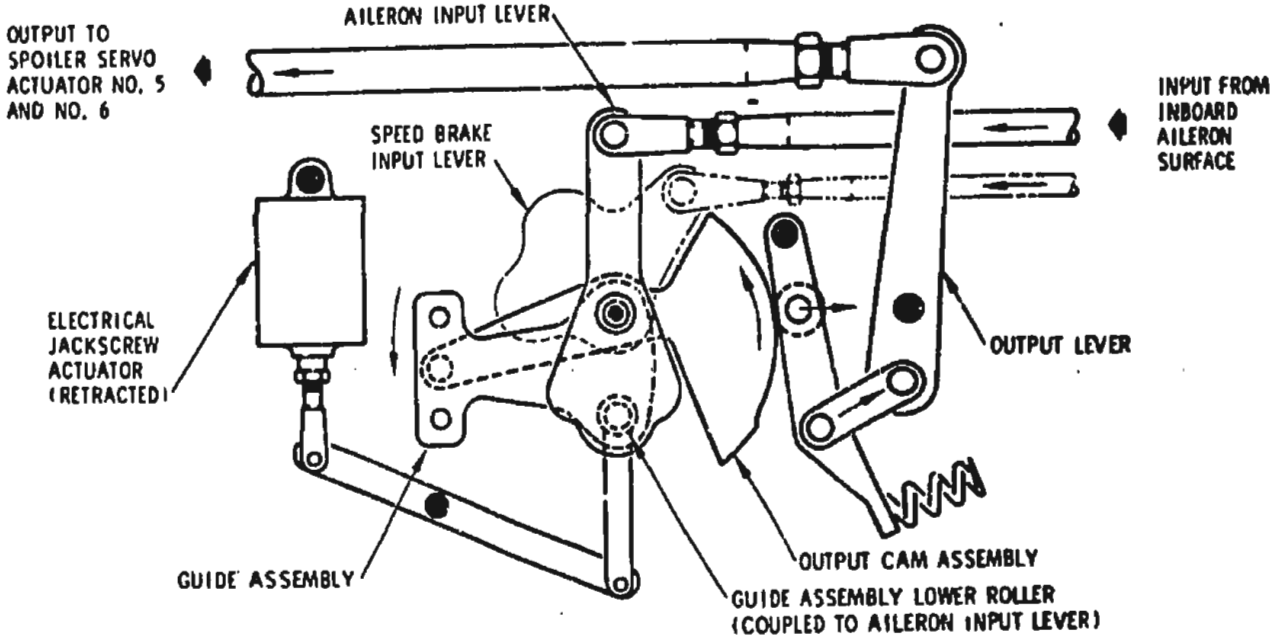
A gear train, with a gear reduction of almost 100 to 1, transmits power to the actuating screw. The actuating screw mates with and drives a nut that travels along the acme threaded screw. The nut incorporates an extension sleeve that is threaded to receive a self-aligning rod end bearing. The extension sleeve provides the actuator output. The actuator stroke is approximately 2.5 inches.

Two double-throw double-pole microswitches are mounted below the actuating screw and are actuated by an extension on the drive nut. One set of contacts on each switch are used as limit switches to control the actuator stroke. The other two sets of contacts on each switch are used to provide the actuator monitor circuits in the Flight Control Auxiliary

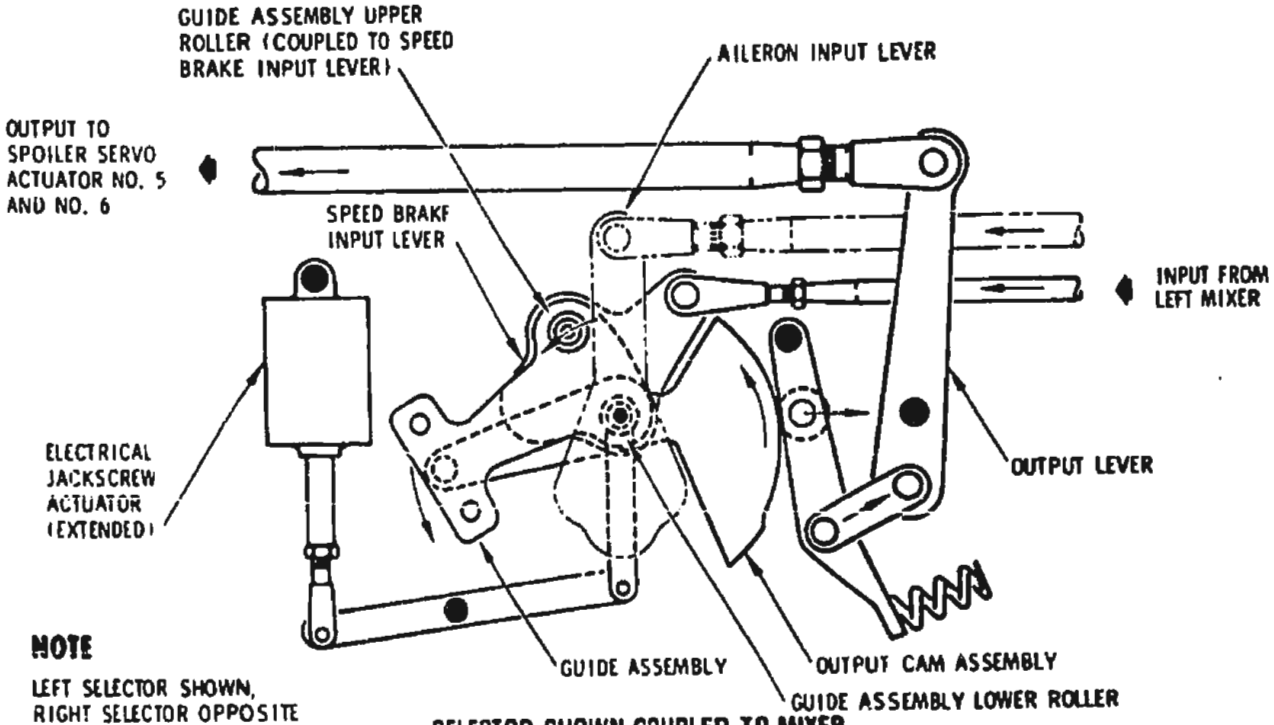

SELECTOR OUTPUT PUSHROD TO NO. 6 SPOILER
SELECTOR OUTPUT PUSHROD TO NO. 5 AND 6 SPOILERS
LEFT INBOARD AILERON TO LEFT OUTBOARD AILERON CONTROL CABLE (AL2)
NO. 5 SPOILER SERVO
SELECTOR ELECTRICAL ACTUATOR
OUTBOARD SPOILER CONTROL SELCTOR
SELECTOR INPUT FROM LEFT MIXER
SELECTOR INPUT FROM LEFT INBOARD AILERON
FWD
INBD
NO. 5 SPOILER
NO. 4 SPOILER
A
LOOKING FORWARD (LEFT WING)
MI-A00-27-067

Outboard Spoilers Control Selector
Figure 17

R EFFECTIVITY: ALL
R


AILERON INPUT LEVER
OUTPUT TO SPOILER SERVO ACTUATOR NO. 5 AND NO. 6
SPEED BRAKE INPUT LEVER
INPUT FROM INBOARD AILERON SURFACE
ELECTRICAL JACKSCREW ACTUATOR (RETRACTED)
OUTPUT LEVER
GUIDE ASSEMBLY
OUTPUT CAM ASSEMBLY
GUIDE ASSEMBLY LOWER ROLLER (COUPLED TO AILERON INPUT LEVER)

SELECTOR SHOWN COUPLED TO INBOARD AILERON
FLAPS EXTENDED MORE THAN 2.5°


GUIDE ASSEMBLY UPPER ROLLER (COUPLED TO SPEED BRAKE INPUT LEVER)
AILERON INPUT LEVER
OUTPUT TO SPOILER SERVO ACTUATOR NO. 5 AND NO. 6
SPEED BRAKE INPUT LEVER
INPUT FROM LEFT MIXER
ELECTRICAL JACKSCREW ACTUATOR (EXTENDED)
OUTPUT LEVER
GUIDE ASSEMBLY
OUTPUT CAM ASSEMBLY
GUIDE ASSEMBLY LOWER ROLLER

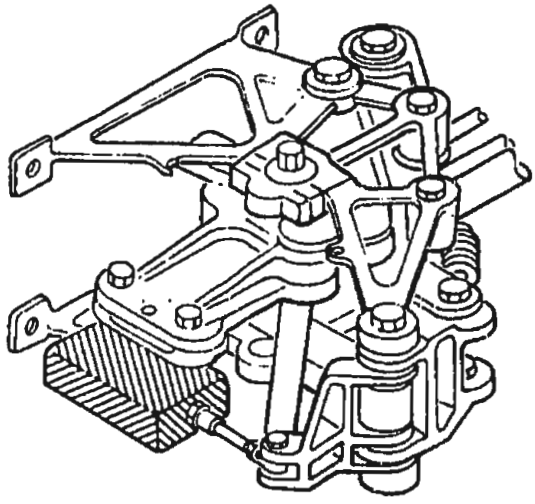
NOTE

LEFT SELECTOR SHOWN, RIGHT SELECTOR OPPOSITE

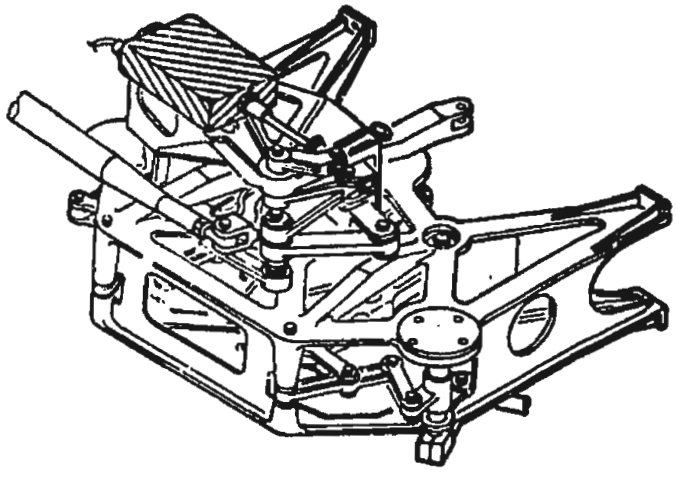
SELECTOR SHOWN COUPLED TO MIXER
FLAPS EXTENDED LESS THAN 2.5°

M1-0102-27-069

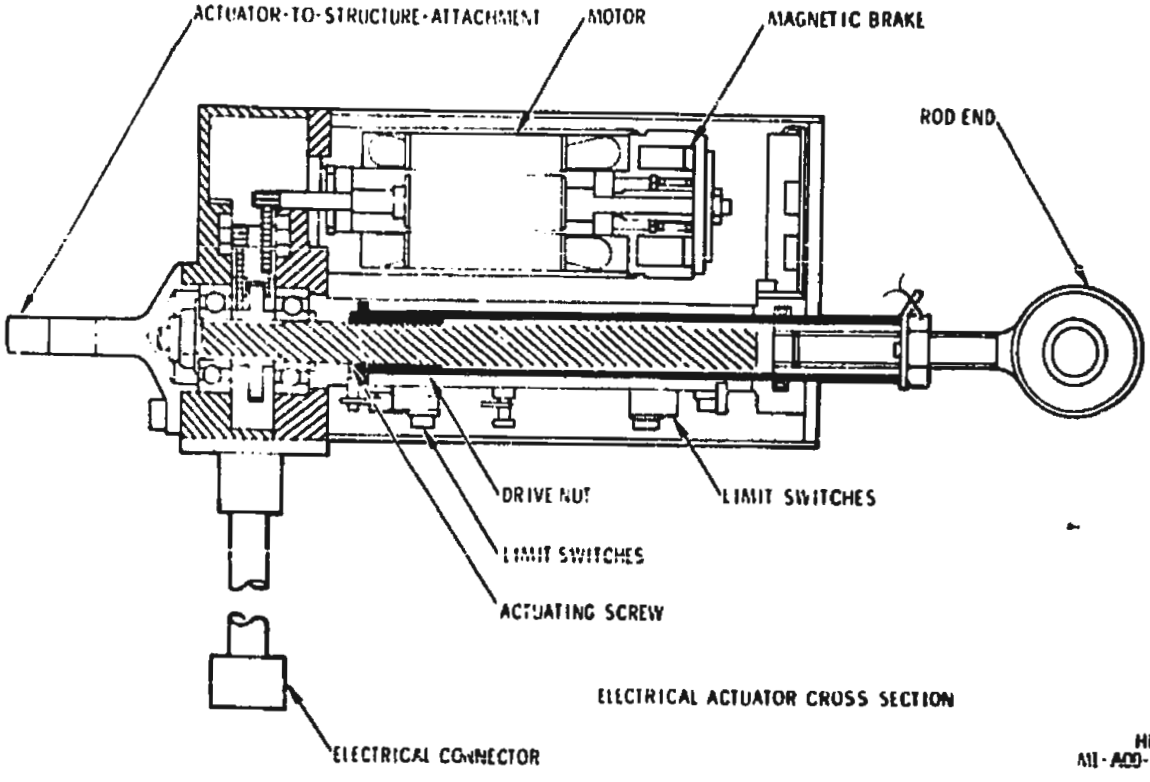
R R Spoiler Selector Functional Diagram
Figure 18



SELECTOR INSTALLATION



MIXER INSTALLATION



ELECTRICAL ACTUATOR CROSS SECTION

HH 4388
AII-A00-27-072

Mixer and Selector Dwell Actuator
Figure 19

Unit (FCAU) Computer (Ref. 22-10-12) with a full extend or retract condition signal. The FCAU logic compares flaps up or down mode signal from flap PDU No. 2 switchbox with condition signal. If the logic detects that a mixer actuator is not in the selected position, the MIXER FAULT light on the FCAU, and the ROLL SPEED BRAKE light on the pilots caution and warning panel will come on. A selector actuator not in the selected position will turn on SELECTOR FAULT light on the FCAU and SPOILER L5 & 6 and R5 & 6 switchlight PUSH legends on the PFCS panel (Ref. Fig. 4).

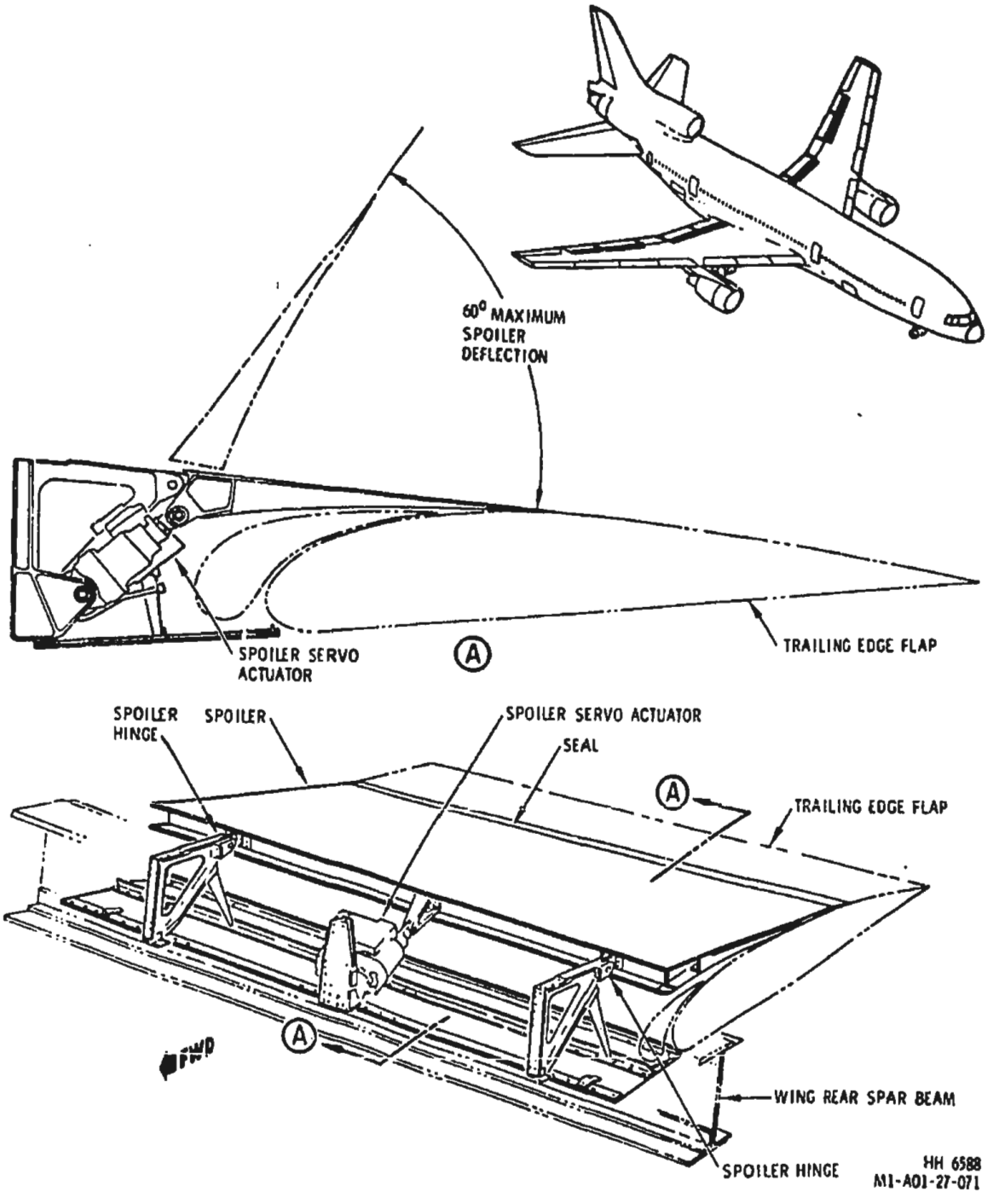
16. Spoilers

A. Description

The spoiler system consists of six spoiler panels on each wing. Spoilers are located on upper surface of the wing, and when fully retracted are flush with wing surface. Spoilers are numbered one to six with number one being the most inboard panel on each wing. None of the spoilers are interchangeable due to different span, chord dimensions, and configuration due to wing sweepback (Ref. Fig. 20).

Spoilers one and two are hinged from an auxiliary spar; spoilers three through six are hinged from the wing box rear spar. All spoilers use two hinge assemblies per panel. Spoilers one and two, because of their large span, use a four tang hinge assembly; spoilers three through six use a single bearing hinge assembly (Ref. Fig. 20).

The spoilers are composed of aluminum alloy front spar and skins bonded to an aluminum alloy honeycomb core structure. Machined hinges and the machined actuator attach fitting are riveted to the front spar structure. A three-inch metal seal is attached to the spoiler trailing edge and contacts the flap upper skin. This seal reduces air leakage around the spoiler panels.



Spoiler Installation
Figure 20

SPOILER AND SPEEDBRAKE CONTROL SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a fault using a fault code number, the code number can be found in Fault Isolation Reference Table in Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW HYDRAULIC SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF SPOILERS MUST BE OPERATED WITH AC PUMPS, DO NOT OPERATE OTHER CONTROL SYSTEMS AND OPERATE SPEEDBRAKE LEVER SLOWLY (MINIMUM 4 SECONDS STOP TO STOP).

NOTE: During engine shutdown, individual aileron and spoiler panels may make unselected movements. This is dependent on the sequence of engine shutdown and the associated hydraulic system depressurization.

CR NOTE: Spoiler Override Bungees have a one inch colored band to
CR help identify the different bungees as follows:

CR Red band - P/N 1556403-101/-107 (22 pounds force)
CR Yellow band - P/N 1630515-101 (14 pounds force)
CR Green band - P/N 1556403-103/-105 (10 pounds force)

2. Fault Isolation/Identification

Table 101 lists the fault isolation procedures and schematics in this section.

Table 101

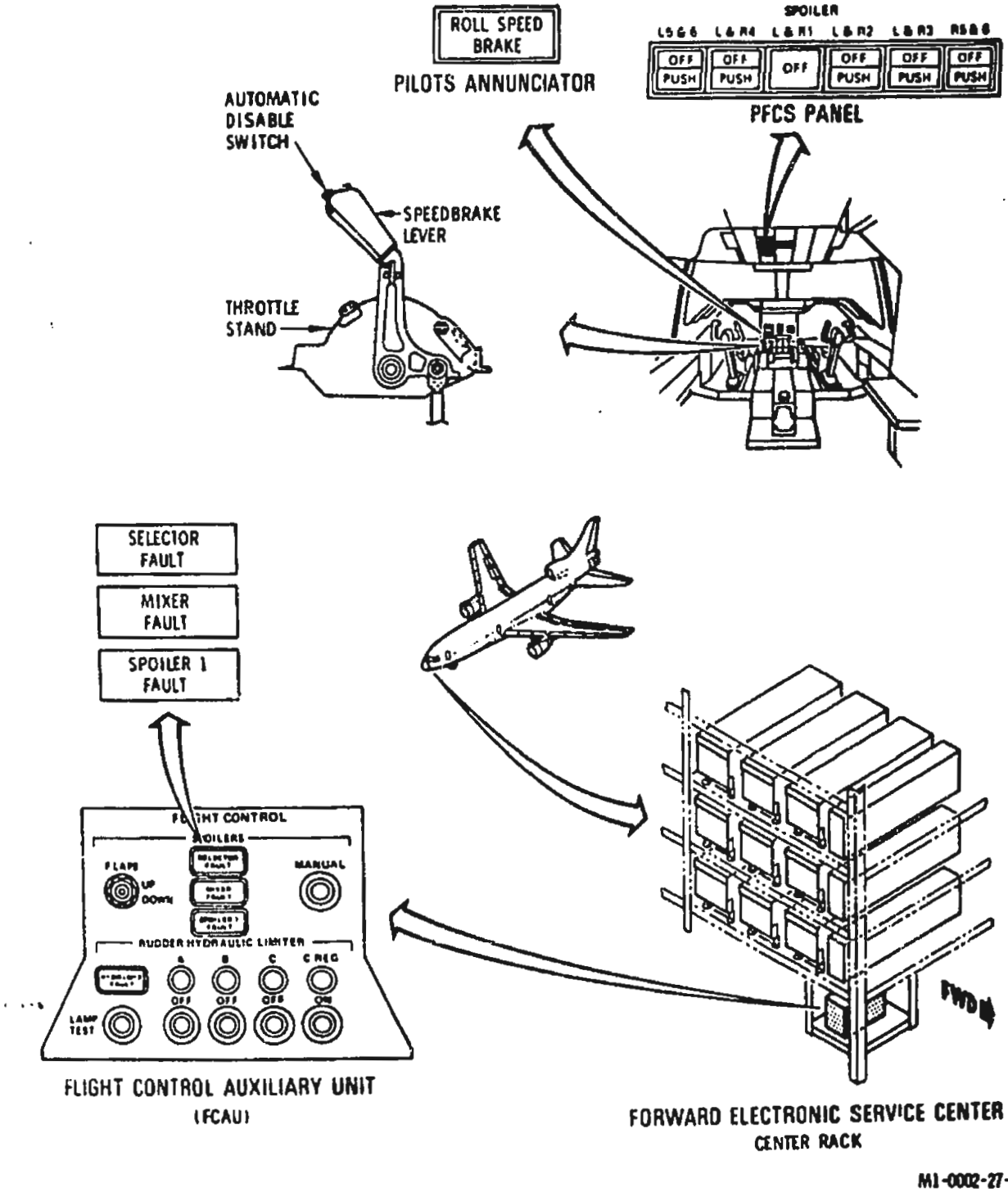
FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	SPOILER 1 FAULT Light on FCAU On
104	MIXER FAULT Light on FACU On
105	ROLL SPEED BRAKE light (Pilots Annunciator Panel) and SPOILER L5&6 and R5&6 PUSH lights (PFCS Panel) On
106	Speedbrake Control Lever Operation Stiff or Notchy
107	One or More Spoilers Do Not Operate
108	DLC Servo Malfunction
109	ROLL SPEED BRAKE Legend on pilots annunciator panel On
110	Spoiler Float in Flight
111	Spoiler Switchlight PUSH Legends On
112	Spoiler Does Not Fully Retract On Ground With Speedbrake Lever Full Forward
113	Spoiler Vibrates in Flight With Flaps At 10°
114	Speedbrake Lever Does Not Fully Stow After a DLC/AGS Landing
115	One or More Spoilers Do Not Fully Deploy
116	Spoiler Fault Monitoring Troubleshooting Guide
SCHEM 1	Spoiler Servo Control Electrical Schematic
SCHEM 2	Spoiler Fault Monitoring Electrical Schematic
SCHEM 3	Spoiler Mixer and Selector Control Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
AUXILIARY UNIT, FLIGHT CONTROL	1	FESC	22-10-12
BUNGEE, NO. 1 SPOILER OVERRIDE	1	HYDRAULIC SERVICE CENTER	27-61-34
MIXER, SPOILER	2	RH AND LH WHEEL WELL	27-61-12
PANEL, PFCS	1	CAPT OVHD PNL	22-17-02
PDU, FLAP	1	HYDRAULIC SERVICE CENTER	27-51-15
SELECTOR, SPOILER	2	OUTBOARD WING, TE	27-61-24
SERVO, DLC	1	HYDRAULIC SERVICE CENTER	27-61-06
SERVO, SPOILER	6	AT EACH SPOILER PNL RH AND LH WING	27-61-17

M1-0000-27-751

Component Locator Index
Figure 101

R EFFECTIVITY: ALL
R
0018

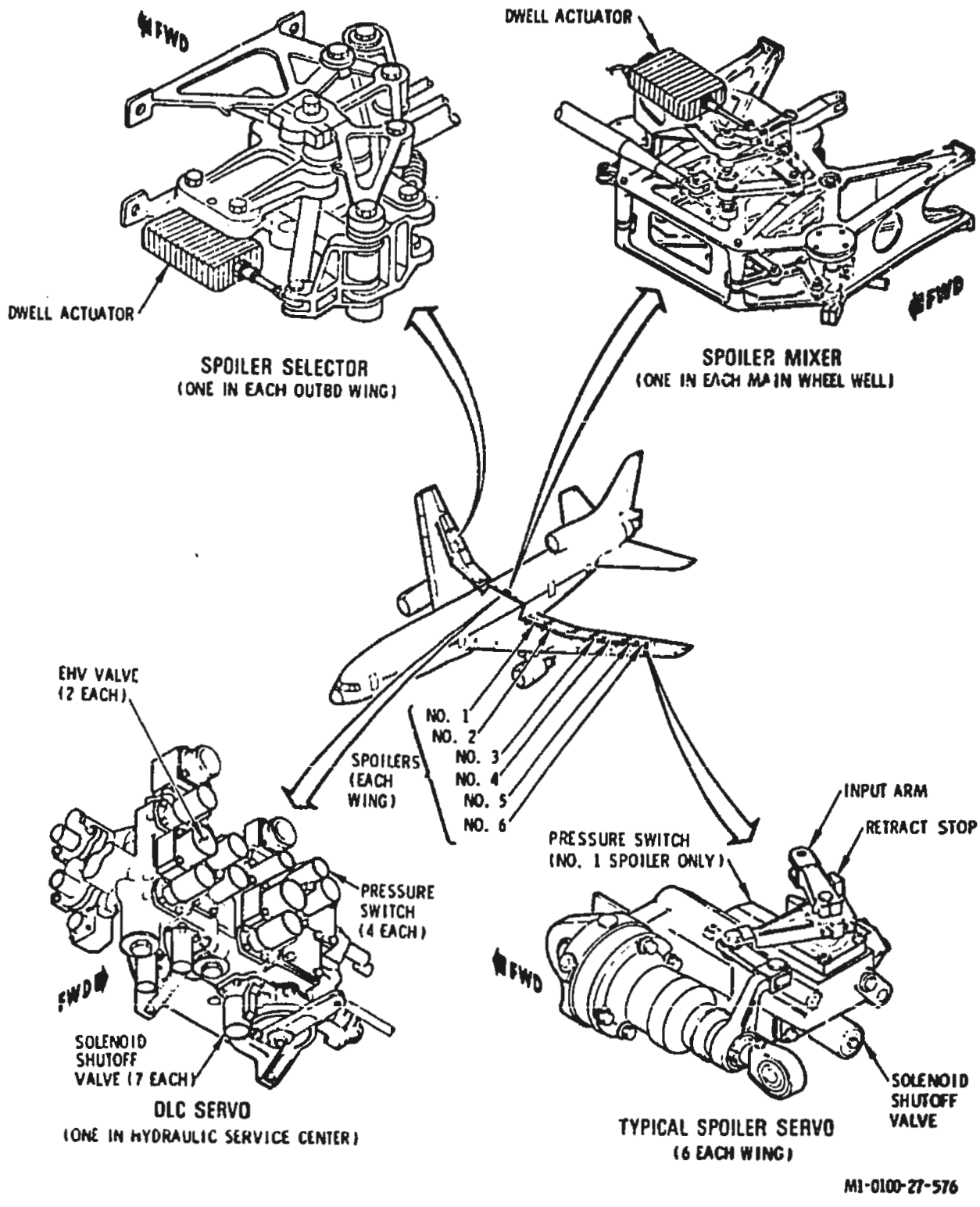


R
R

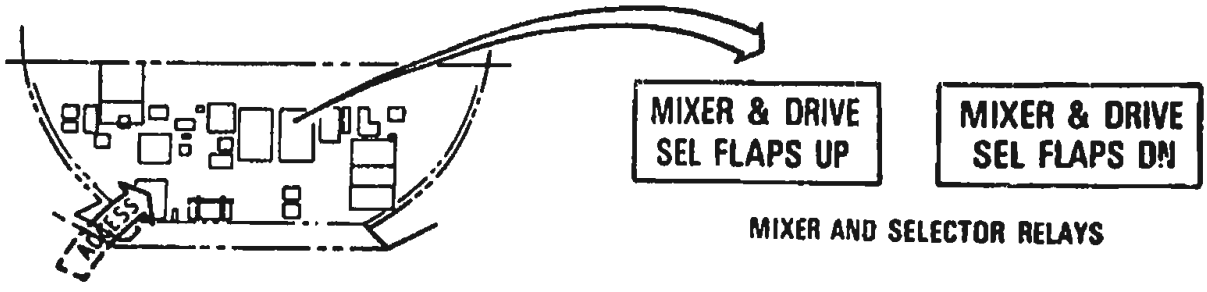
Component Locator Diagram
Figure 102 (Sheet 1)

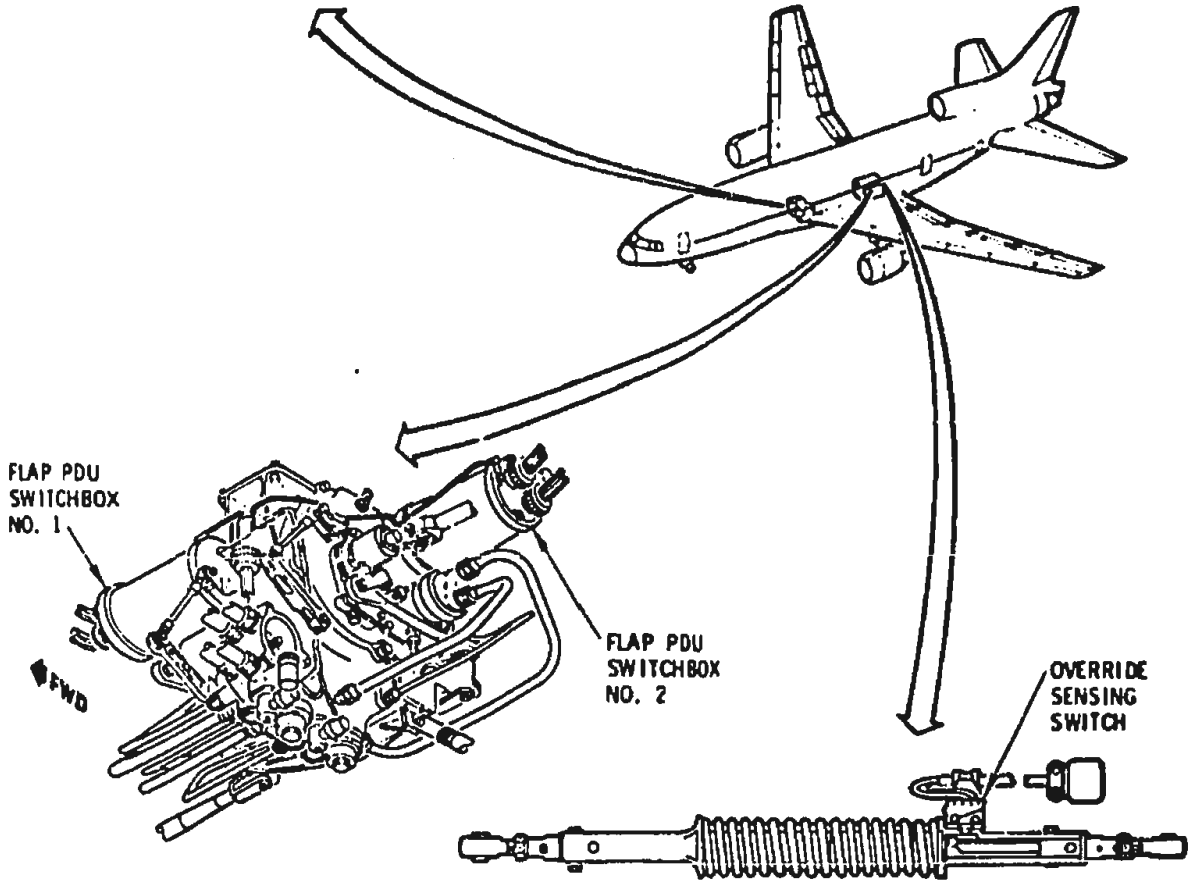
EFFECTIVITY: ALL

001B



Component Locator Diagram
Figure 102 (Sheet 2)

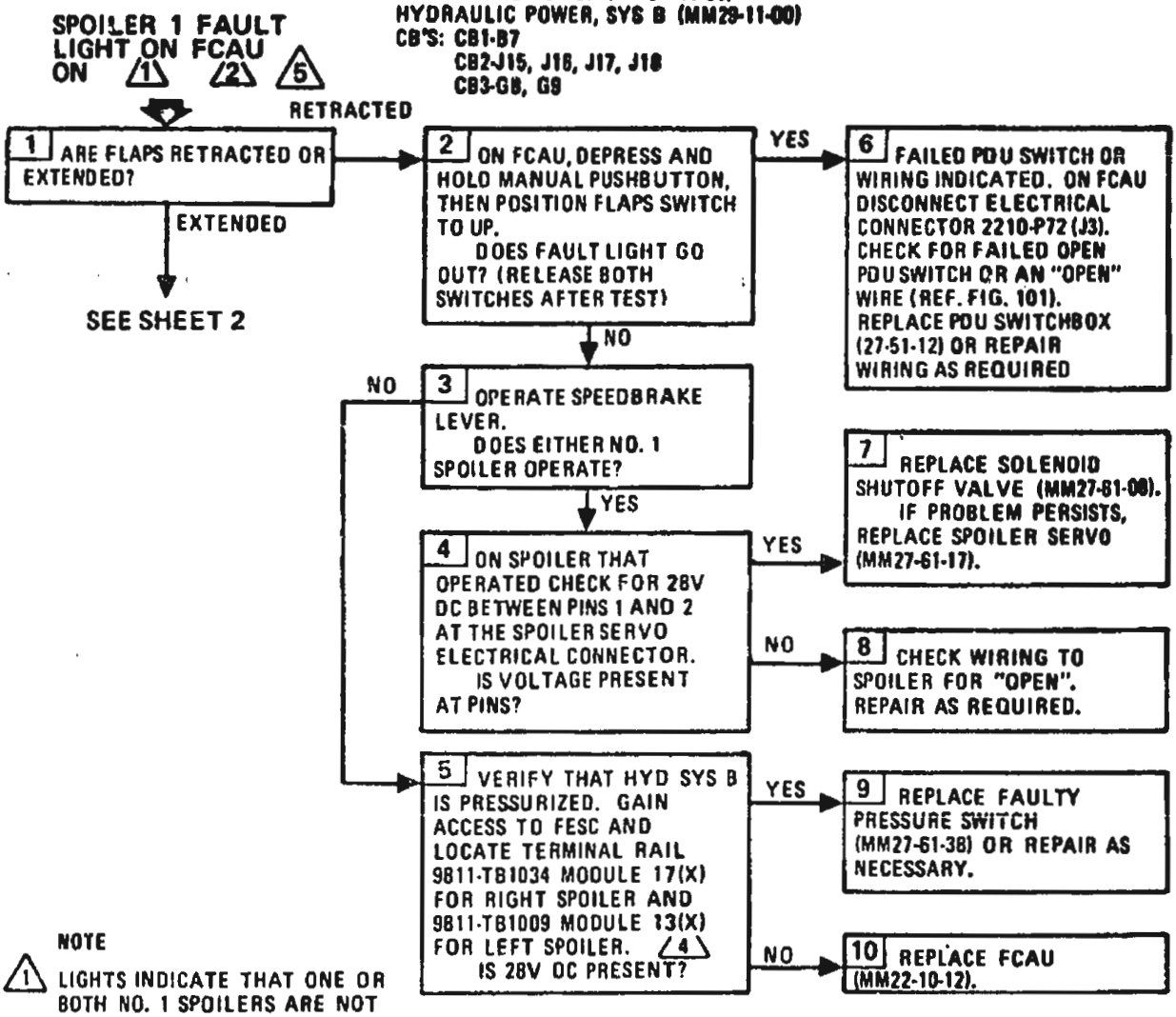




M1-0100-27-577

R Component Locator Diagram
R Figure 102 (Sheet 3)

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER, SYS B (MM29-11-00)
CB'S: CB1-B7
CB2-J15, J16, J17, J18
CB3-G8, G9

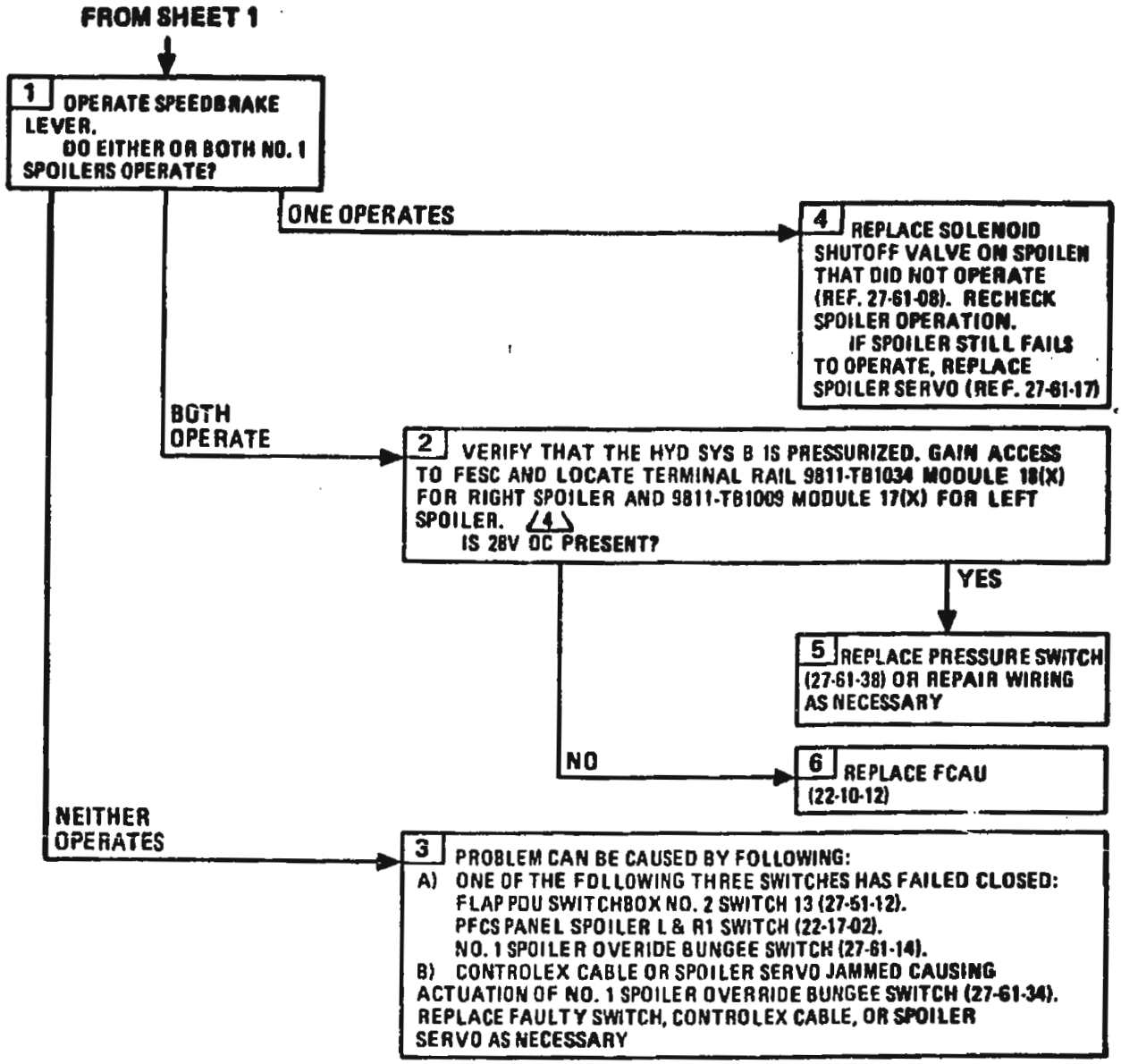

SPOILER 1 FAULT LIGHT ON FCAU ON 1 2 5
RETRACTED
1 ARE FLAPS RETRACTED OR EXTENDED?
EXTENDED
SEE SHEET 2
2 ON FCAU, DEPRESS AND HOLD MANUAL PUSHBUTTON, THEN POSITION FLAPS SWITCH TO UP.
DOES FAULT LIGHT GO OUT? (RELEASE BOTH SWITCHES AFTER TEST)
YES
6 FAILED PDU SWITCH OR WIRING INDICATED. ON FCAU DISCONNECT ELECTRICAL CONNECTOR 2210-P72 (J3). CHECK FOR FAILED OPEN PDU SWITCH OR AN "OPEN" WIRE (REF. FIG. 101). REPLACE PDU SWITCHBOX (27-51-12) OR REPAIR WIRING AS REQUIRED
NO
NO
3 OPERATE SPEEDBRAKE LEVER.
DOES EITHER NO. 1 SPOILER OPERATE?
YES
7 REPLACE SOLENOID SHUTOFF VALVE (MM27-61-08). IF PROBLEM PERSISTS, REPLACE SPOILER SERVO (MM27-61-17).
4 ON SPOILER THAT OPERATED CHECK FOR 28V DC BETWEEN PINS 1 AND 2 AT THE SPOILER SERVO ELECTRICAL CONNECTOR.
IS VOLTAGE PRESENT AT PINS?
YES
NO
8 CHECK WIRING TO SPOILER FOR "OPEN". REPAIR AS REQUIRED.
5 VERIFY THAT HYD SYS B IS PRESSURIZED. GAIN ACCESS TO FESC AND LOCATE TERMINAL RAIL 9811-TB1034 MODULE 17(X) FOR RIGHT SPOILER AND 9811-TB1009 MODULE 13(X) FOR LEFT SPOILER. 4
IS 28V DC PRESENT?
YES
9 REPLACE FAULTY PRESSURE SWITCH (MM27-61-38) OR REPAIR AS NECESSARY.
NO
10 REPLACE FCAU (MM22-10-12).

NOTE

1. LIGHTS INDICATE THAT ONE OR BOTH NO. 1 SPOILERS ARE NOT IN COMMANDED STATE.
2. POSSIBLE FAULTS:
   FLAP PDU SWITCHBOX.
   SPOILER SOLENOID SHUTOFF VALVE.
   SPOILER PRESSURE SWITCH.
   CONTROLEX CABLE.
   NO. 1 SPOILER BUNGEE SWITCH.
   FCAU.
3. TO POSITION SPOILER TO OPPOSITE MODE, RECONNECT ELECTRICAL CONNECTORS 2210-P72, P73 AND P74 BEFORE POSITIONING FLAPS.
4. BOTH TERMINAL RAILS ARE LOCATED ON THE LEFT HAND CENTER RACK OF THE FORWARD WALL OF THE FESC.
5. IF F.C.A.U. TEST BOX IS AVAILABLE USE PROCEDURE FIG. 117.

M1-0001-27-1181

CR SPOILER 1 FAULT Light on FCAU On
CR Figure 103 (Sheet 1)

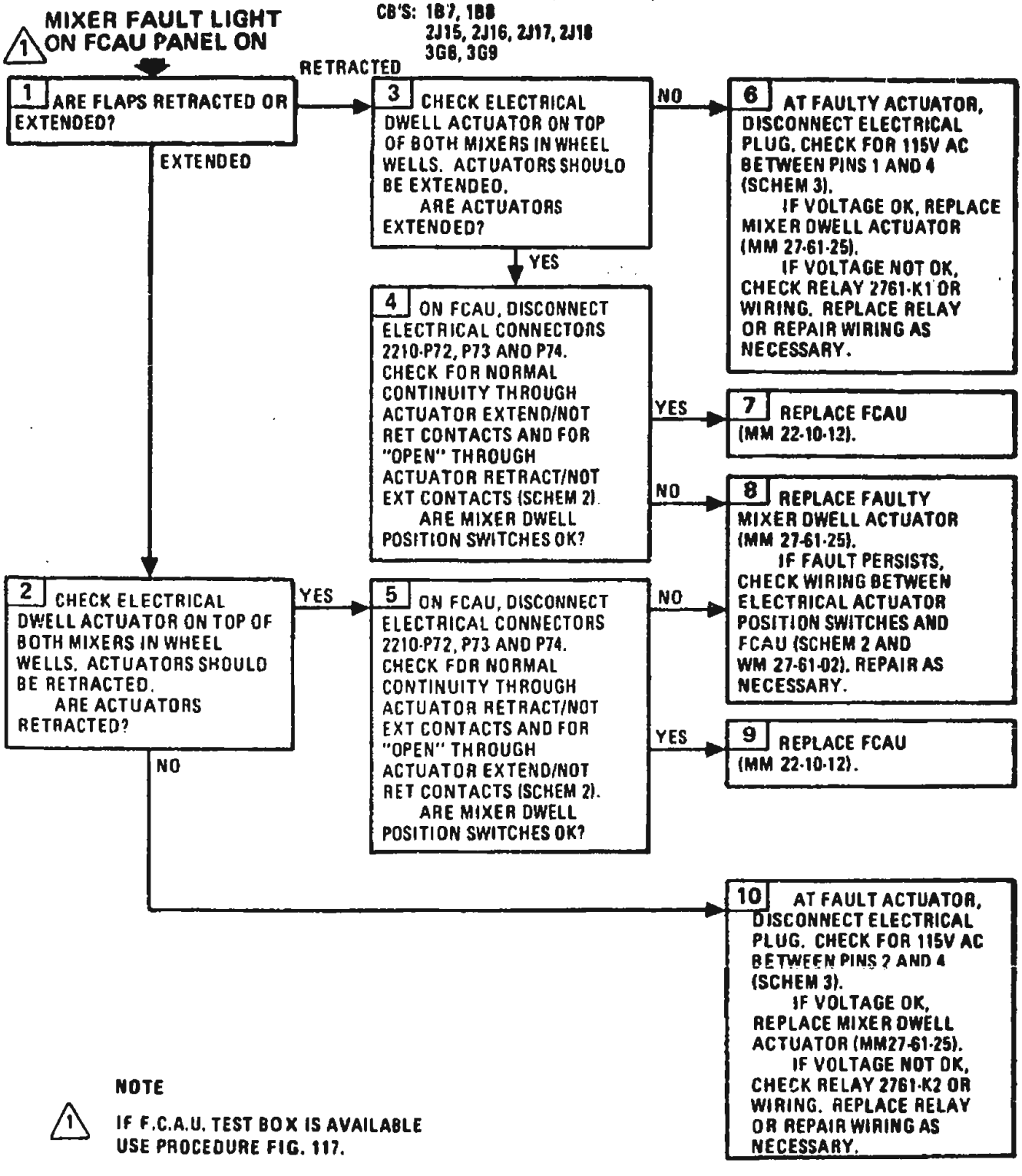

FROM SHEET 1
1 OPERATE SPEEDBRAKE LEVER.
DO EITHER OR BOTH NO. 1 SPOILERS OPERATE?
ONE OPERATES
4 REPLACE SOLENOID SHUTOFF VALVE ON SPOILER THAT DID NOT OPERATE (REF. 27-61-08). RECHECK SPOILER OPERATION.
IF SPOILER STILL FAILS TO OPERATE, REPLACE SPOILER SERVO (REF. 27-61-17)
BOTH OPERATE
2 VERIFY THAT THE HYD SYS B IS PRESSURIZED. GAIN ACCESS TO FESC AND LOCATE TERMINAL RAIL 9811-TB1034 MODULE 18(X) FOR RIGHT SPOILER AND 9811-TB1009 MODULE 17(X) FOR LEFT SPOILER. (4)
IS 28V DC PRESENT?
YES
5 REPLACE PRESSURE SWITCH (27-61-38) OR REPAIR WIRING AS NECESSARY
NO
6 REPLACE FCAU (22-10-12)
NEITHER OPERATES
3 PROBLEM CAN BE CAUSED BY FOLLOWING:
A) ONE OF THE FOLLOWING THREE SWITCHES HAS FAILED CLOSED:
FLAP PDU SWITCHBOX NO. 2 SWITCH 13 (27-51-12).
PFCS PANEL SPOILER L & R1 SWITCH (22-17-02).
NO. 1 SPOILER OVERIDE BUNGEE SWITCH (27-61-14).
B) CONTROLEX CABLE OR SPOILER SERVO JAMMED CAUSING ACTUATION OF NO. 1 SPOILER OVERRIDE BUNGEE SWITCH (27-61-34).
REPLACE FAULTY SWITCH, CONTROLEX CABLE, OR SPOILER SERVO AS NECESSARY

M1-0001-27-842

R SPOILER 1 FAULT Light on FCAU On
R Figure 103 (Sheet 2)

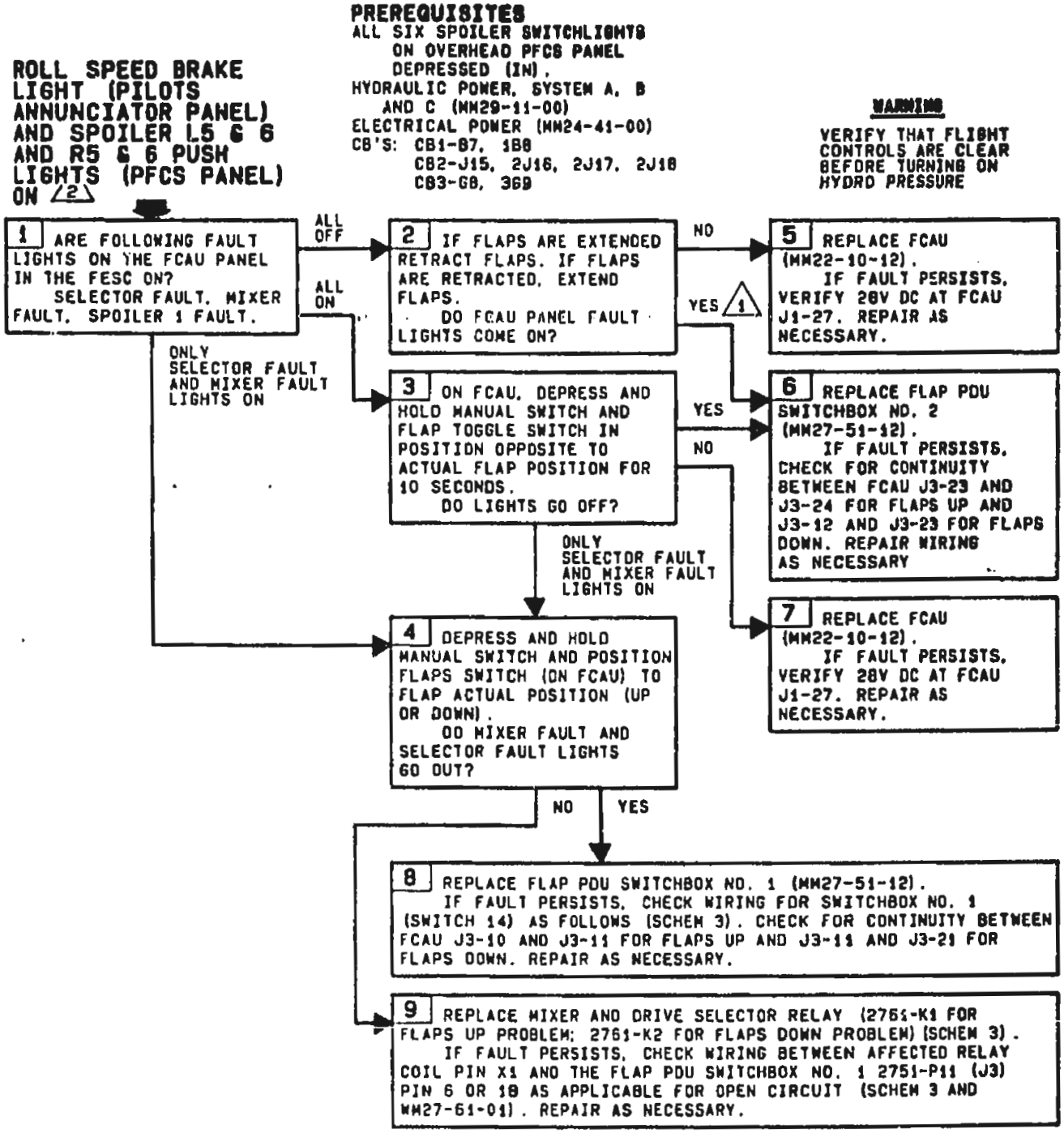
EFFECTIVITY: ALL

001B

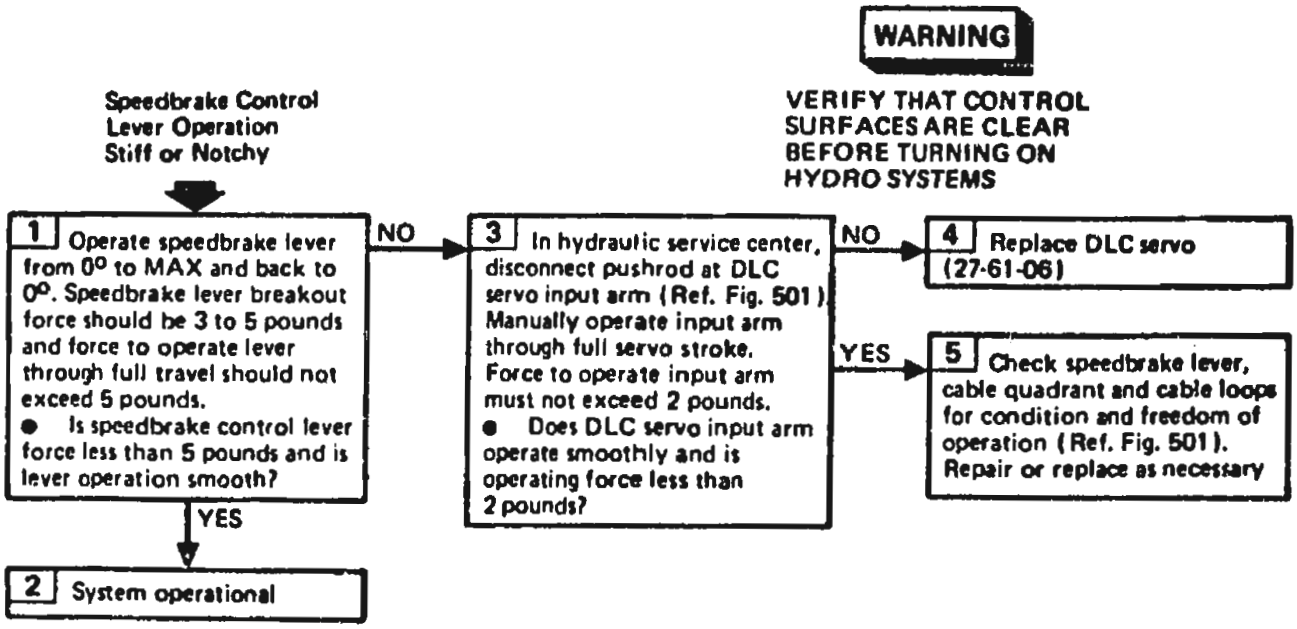

PREREQUISITES
ELECTRICAL POWER (MM 24-41-00)
CB'S: 1B7, 1B8
2J15, 2J16, 2J17, 2J18
3G8, 3G9
1 MIXER FAULT LIGHT ON FCAU PANEL ON
1 ARE FLAPS RETRACTED OR EXTENDED?
RETRACTED
EXTENDED
3 CHECK ELECTRICAL DWELL ACTUATOR ON TOP OF BOTH MIXERS IN WHEEL WELLS. ACTUATORS SHOULD BE EXTENDED. ARE ACTUATORS EXTENDED?
NO
YES
6 AT FAULTY ACTUATOR, DISCONNECT ELECTRICAL PLUG. CHECK FOR 115V AC BETWEEN PINS 1 AND 4 (SCHEM 3). IF VOLTAGE OK, REPLACE MIXER DWELL ACTUATOR (MM 27-61-25). IF VOLTAGE NOT OK, CHECK RELAY 2761-K1 OR WIRING. REPLACE RELAY OR REPAIR WIRING AS NECESSARY.
4 ON FCAU, DISCONNECT ELECTRICAL CONNECTORS 2210-P72, P73 AND P74. CHECK FOR NORMAL CONTINUITY THROUGH ACTUATOR EXTEND/NOT RET CONTACTS AND FOR "OPEN" THROUGH ACTUATOR RETRACT/NOT EXT CONTACTS (SCHEM 2). ARE MIXER DWELL POSITION SWITCHES OK?
YES
7 REPLACE FCAU (MM 22-10-12).
NO
8 REPLACE FAULTY MIXER DWELL ACTUATOR (MM 27-61-25). IF FAULT PERSISTS, CHECK WIRING BETWEEN ELECTRICAL ACTUATOR POSITION SWITCHES AND FCAU (SCHEM 2 AND WM 27-61-02). REPAIR AS NECESSARY.
2 CHECK ELECTRICAL DWELL ACTUATOR ON TOP OF BOTH MIXERS IN WHEEL WELLS. ACTUATORS SHOULD BE RETRACTED. ARE ACTUATORS RETRACTED?
YES
5 ON FCAU, DISCONNECT ELECTRICAL CONNECTORS 2210-P72, P73 AND P74. CHECK FOR NORMAL CONTINUITY THROUGH ACTUATOR RETRACT/NOT EXT CONTACTS AND FOR "OPEN" THROUGH ACTUATOR EXTEND/NOT RET CONTACTS (SCHEM 2). ARE MIXER DWELL POSITION SWITCHES OK?
NO
NO
YES
9 REPLACE FCAU (MM 22-10-12).
10 AT FAULT ACTUATOR, DISCONNECT ELECTRICAL PLUG. CHECK FOR 115V AC BETWEEN PINS 2 AND 4 (SCHEM 3). IF VOLTAGE OK, REPLACE MIXER DWELL ACTUATOR (MM27-61-25). IF VOLTAGE NOT OK, CHECK RELAY 2761-K2 OR WIRING. REPLACE RELAY OR REPAIR WIRING AS NECESSARY.
NOTE
1 IF F.C.A.U. TEST BOX IS AVAILABLE USE PROCEDURE FIG. 117.

M1-0000-27-1182

CR MIXER FAULT Light on FCAU On
CR Figure 104


ROLL SPEED BRAKE LIGHT (PILOTS ANNUNCIATOR PANEL) AND SPOILER L5 & 6 AND R5 & 6 PUSH LIGHTS (PFCS PANEL) ON ⚠2
PREREQUISITES
ALL SIX SPOILER SWITCHLIGHTS ON OVERHEAD PFCS PANEL DEPRESSED (IN).
HYDRAULIC POWER, SYSTEM A, B AND C (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB'S: CB1-B7, 1B8
CB2-J15, 2J16, 2J17, 2J18
CB3-G8, 3G9
WARNING
VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE
1 ARE FOLLOWING FAULT LIGHTS ON THE FCAU PANEL IN THE FESC ON?
SELECTOR FAULT, MIXER FAULT, SPOILER 1 FAULT.
ALL OFF
ALL ON
ONLY SELECTOR FAULT AND MIXER FAULT LIGHTS ON
2 IF FLAPS ARE EXTENDED RETRACT FLAPS. IF FLAPS ARE RETRACTED, EXTEND FLAPS.
DO FCAU PANEL FAULT LIGHTS COME ON?
NO
YES ⚠1
5 REPLACE FCAU (MM22-10-12).
IF FAULT PERSISTS, VERIFY 28V DC AT FCAU J1-27. REPAIR AS NECESSARY.
3 ON FCAU, DEPRESS AND HOLD MANUAL SWITCH AND FLAP TOGGLE SWITCH IN POSITION OPPOSITE TO ACTUAL FLAP POSITION FOR 10 SECONDS.
DO LIGHTS GO OFF?
YES
NO
6 REPLACE FLAP PDU SWITCHBOX NO. 2 (MM27-51-12).
IF FAULT PERSISTS, CHECK FOR CONTINUITY BETWEEN FCAU J3-23 AND J3-24 FOR FLAPS UP AND J3-12 AND J3-23 FOR FLAPS DOWN. REPAIR WIRING AS NECESSARY
ONLY SELECTOR FAULT AND MIXER FAULT LIGHTS ON
7 REPLACE FCAU (MM22-10-12).
IF FAULT PERSISTS, VERIFY 28V DC AT FCAU J1-27. REPAIR AS NECESSARY.
4 DEPRESS AND HOLD MANUAL SWITCH AND POSITION FLAPS SWITCH (ON FCAU) TO FLAP ACTUAL POSITION (UP OR DOWN).
DO MIXER FAULT AND SELECTOR FAULT LIGHTS GO OUT?
NO
YES
8 REPLACE FLAP PDU SWITCHBOX NO. 1 (MM27-51-12).
IF FAULT PERSISTS, CHECK WIRING FOR SWITCHBOX NO. 1 (SWITCH 14) AS FOLLOWS (SCHEM 3). CHECK FOR CONTINUITY BETWEEN FCAU J3-10 AND J3-11 FOR FLAPS UP AND J3-11 AND J3-21 FOR FLAPS DOWN. REPAIR AS NECESSARY.
9 REPLACE MIXER AND DRIVE SELECTOR RELAY (2761-K1 FOR FLAPS UP PROBLEM; 2761-K2 FOR FLAPS DOWN PROBLEM) (SCHEM 3).
IF FAULT PERSISTS, CHECK WIRING BETWEEN AFFECTED RELAY COIL PIN X1 AND THE FLAP PDU SWITCHBOX NO. 1 2751-P11 (J3) PIN 6 OR 18 AS APPLICABLE FOR OPEN CIRCUIT (SCHEM 3 AND MM27-61-01). REPAIR AS NECESSARY.
NOTE
⚠1 FLAP PDU SWITCHES HAVE BEEN KNOWN TO BE INTERMITTENT. OPERATE FLAPS TO ACTUATE PDU SWITCH NO. 14 AND CHECK SWITCH CONTINUITY SEVERAL TIMES
⚠2 IF F.C.A.U. TEST BOX IS AVAILABLE USE PROCEDURE FIG. 117
M1-0000-27-1183

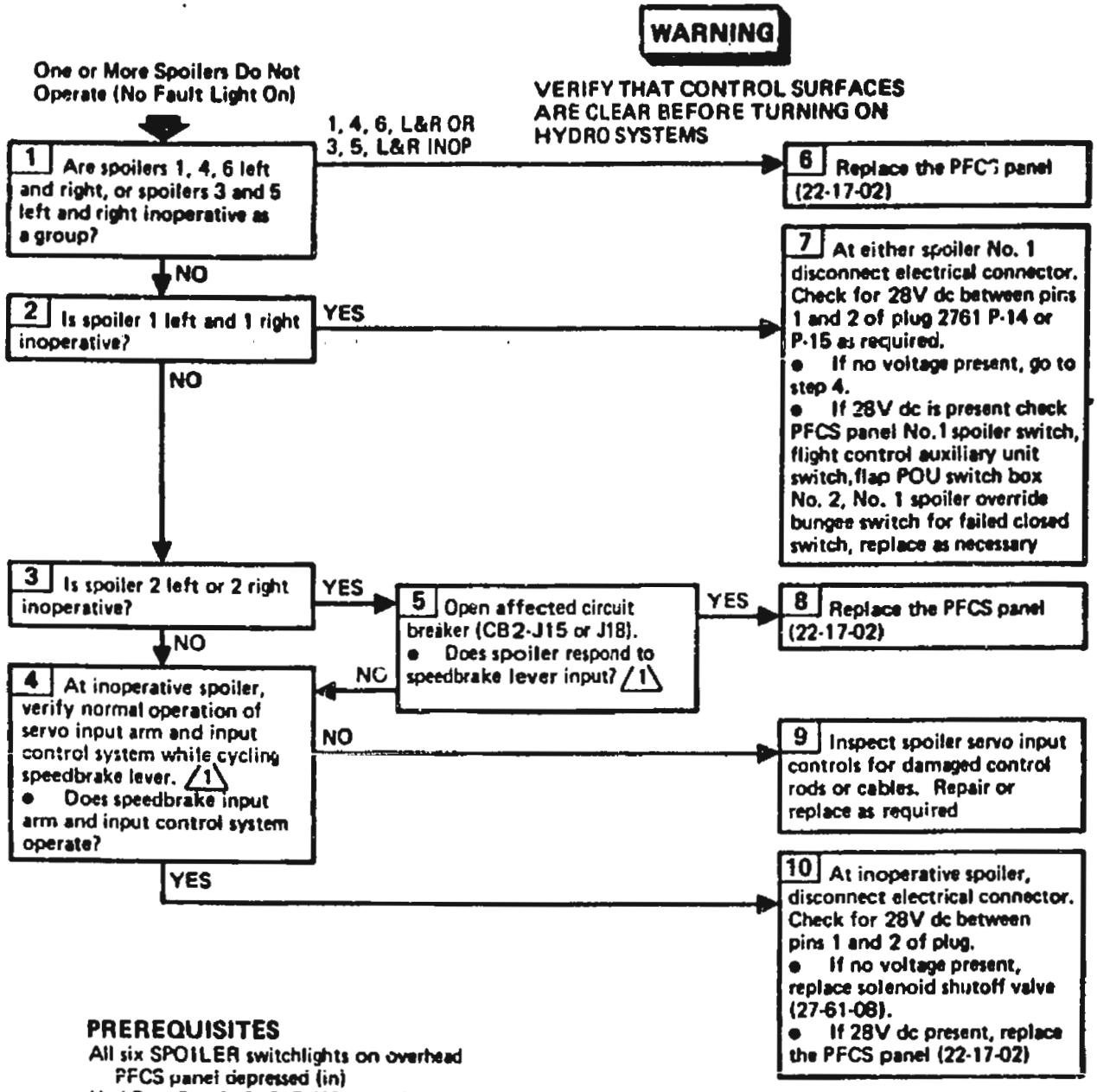
CR CR CR ROLL SPEED BRAKE Light (Pilots Annunciator Panel) and SPOILER L5 and 6 and R5 and 6 PUSH Light (PFCS Panel) On
Figure 105


WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS
Speedbrake Control Lever Operation Stiff or Notchy
1 Operate speedbrake lever from 0° to MAX and back to 0°. Speedbrake lever breakout force should be 3 to 5 pounds and force to operate lever through full travel should not exceed 5 pounds.
● Is speedbrake control lever force less than 5 pounds and is lever operation smooth?
NO
YES
2 System operational
3 In hydraulic service center, disconnect pushrod at DLC servo input arm (Ref. Fig. 501). Manually operate input arm through full servo stroke. Force to operate input arm must not exceed 2 pounds.
● Does DLC servo input arm operate smoothly and is operating force less than 2 pounds?
NO
4 Replace DLC servo (27-61-06)
YES
5 Check speedbrake lever, cable quadrant and cable loops for condition and freedom of operation (Ref. Fig. 501). Repair or replace as necessary

PREREQUISITES
Hyd Pwr, Sys A and B (29-11-00)

M1-0101-27-559

Speedbrake Control Lever Operation Stiff or Notchy
Figure 106


WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS
One or More Spoilers Do Not Operate (No Fault Light On)
1 Are spoilers 1, 4, 6 left and right, or spoilers 3 and 5 left and right inoperative as a group?
1, 4, 6, L&R OR 3, 5, L&R INOP
6 Replace the PFCS panel (22-17-02)
NO
2 Is spoiler 1 left and 1 right inoperative?
YES
7 At either spoiler No. 1 disconnect electrical connector. Check for 28V dc between pins 1 and 2 of plug 2761 P-14 or P-15 as required.
• If no voltage present, go to step 4.
• If 28V dc is present check PFCS panel No.1 spoiler switch, flight control auxiliary unit switch, flap POU switch box No. 2, No. 1 spoiler override bungee switch for failed closed switch, replace as necessary
NO
3 Is spoiler 2 left or 2 right inoperative?
YES
5 Open affected circuit breaker (CB2-J15 or J18).
• Does spoiler respond to speedbrake lever input? /1\
YES
8 Replace the PFCS panel (22-17-02)
NO
4 At inoperative spoiler, verify normal operation of servo input arm and input control system while cycling speedbrake lever. /1\
• Does speedbrake input arm and input control system operate?
NO
9 Inspect spoiler servo input controls for damaged control rods or cables. Repair or replace as required
YES
10 At inoperative spoiler, disconnect electrical connector. Check for 28V dc between pins 1 and 2 of plug.
• If no voltage present, replace solenoid shutoff valve (27-61-08).
• If 28V dc present, replace the PFCS panel (22-17-02)

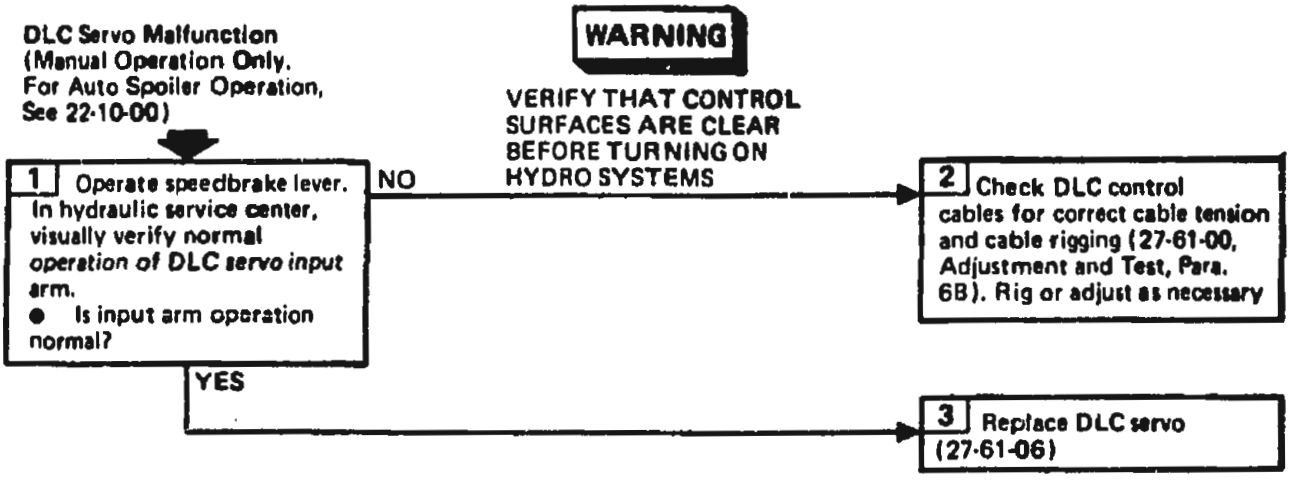
PREREQUISITES

All six SPOILER switchlights on overhead PFCS panel depressed (in)
Hyd Pwr, Sys A, B, C, D (29-11-00)
Elec Pwr (24-41-00)
CB's: CB1-B7, B8
CB2-J15, J16, J17, J18
CB3-G8, G9

/1\ **NOTE**
With flaps up, speedbrake lever operates spoilers 2 through 6. With flaps down (4 degrees or more), speedbrake lever operates spoilers 1 through 4

M1-0104-27-580

One or More Spoilers Do Not Operate
Figure 107


DLC Servo Malfunction
(Manual Operation Only.
For Auto Spoiler Operation,
See 22-10-00)
WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS
1 Operate speedbrake lever. In hydraulic service center, visually verify normal operation of DLC servo input arm.
● Is input arm operation normal?
NO
2 Check DLC control cables for correct cable tension and cable rigging (27-61-00, Adjustment and Test, Para. 6B). Rig or adjust as necessary
YES
3 Replace DLC servo (27-61-06)

PREREQUISITES
Hyd Pwr, Sys A and B (29-11-00)
Elec Pwr (24-41-00)
CB's: CB1-B5, B7, F11
CB2-H14, H15, J15, J16, J17, J18
CB3-G8, G9

M1-0101-27-664

DLC Servo Malfunction
Figure 108

ROLL SPEEDBRAKE LEGEND (PILOTS ANNUNCIATOR PANEL) ON (1)(2)

PREREQUISITES
ALL SIX SPOILER SWITCHLIGHTS ON OVERHEAD
PFCS PANEL LATCHED
ELECTRICAL POWER (MM 24-41-00)
HYDRAULIC POWER, SYSTEM B AND C (MM 29-11-00)
CB'S: CB1 B7, 1B8
CB2 J15, 2J16, 2J17, 2J18
CB3 G8, 3G9

1 WITH FLAPS FULLY RETRACTED, DID CIRCUIT BREAKER C82-J16 TRIP OPEN?

YES → **3** A SHORTED NO. 1 SPOILER SERVO SOLENOID COIL IS INDICATED. CHECK LEFT AND RIGHT NO. 1 SPOILER SOLENOID COILS FOR SHORT TO GROUND (SCHEM 1) SOLENOID COIL RESISTANCE IS APPROX 50 OHMS. REPLACE FAULTY SOLENOID COIL (MM27-61-08).

NO ↓

2 POSITION FLAPS IN REPORTED FAULTY POSITION (RETRACTED OR 4° FOR EXTENDED). CHECK FLIGHT CONTROL AUXILIARY UNIT (FCAU) PANEL ON BOTTOM SUB-SHELF OF CENTER RACK IN THE FESC.
IS SPOILER 1 FAULT LEGEND OR MIXER FAULT LEGEND ON?
NOTE
IF ROLL SPEEDBRAKE LEGEND COMES ON ONLY WHILE FLAPS ARE OPERATING, OPERATE FLAPS WHILE CHECKING FCAU PANEL.

SPOILER 1 FAULT LEGEND COMES ON – FLAPS EXTENDED → **4** SEE FIGURE 103, (SHEET 2) BLOCK 1.

SPOILER 1 FAULT LEGEND COMES ON – FLAPS RETRACTED → **5** SEE FIGURE 103, (SHEET 1) BLOCK 2.

MIXER FAULT LEGEND COMES ON – FLAPS EXTENDED → **6** SEE FIGURE 104, BLOCK 2.

MIXER FAULT LEGEND COMES ON –FLAPS RETRACTED → **7** SEE FIGURE 104, BLOCK 3.

NOTE

(1) ROLL SPEEDBRAKE LEGEND INDICATES THAT ONE OR BOTH NO. 1 SPOILERS OR MIXERS ARE NOT IN COMMANDED STATE

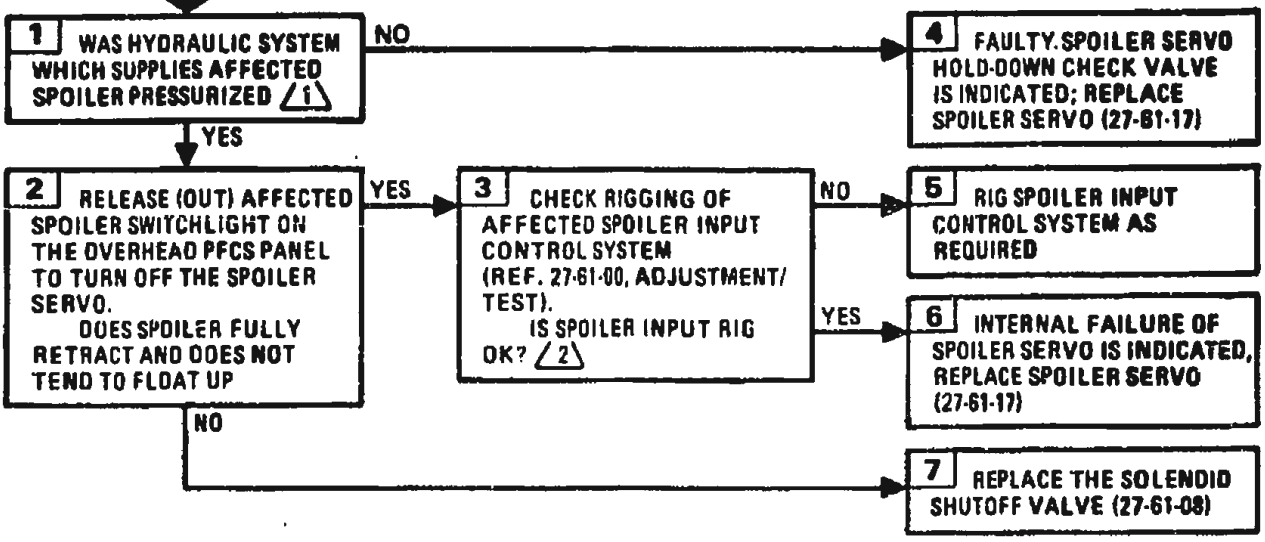
(2) IF F.C.A.U. TEST BOX IS AVAILABLE USE PROCEDURE FIG. 117

M1-0000-27-1184

CR ROLL SPEED BRAKE Legend On Pilots Annunciator Panel On
CR Figure 109

SPOILER FLOAT IN FLIGHT OR ON GROUND

PREREQUISITES
HYD PWR (29-11-00)


1 WAS HYDRAULIC SYSTEM WHICH SUPPLIES AFFECTED SPOILER PRESSURIZED /1\
NO
4 FAULTY SPOILER SERVO HOLD-DOWN CHECK VALVE IS INDICATED; REPLACE SPOILER SERVO (27-61-17)
YES
2 RELEASE (OUT) AFFECTED SPOILER SWITCHLIGHT ON THE OVERHEAD PFCS PANEL TO TURN OFF THE SPOILER SERVO.
DOES SPOILER FULLY RETRACT AND DOES NOT TEND TO FLOAT UP
YES
3 CHECK RIGGING OF AFFECTED SPOILER INPUT CONTROL SYSTEM (REF. 27-61-00, ADJUSTMENT/TEST).
IS SPOILER INPUT RIG OK? /2\
NO
5 RIG SPOILER INPUT CONTROL SYSTEM AS REQUIRED
YES
6 INTERNAL FAILURE OF SPOILER SERVO IS INDICATED, REPLACE SPOILER SERVO (27-61-17)
NO
7 REPLACE THE SOLENDID SHUTOFF VALVE (27-61-08)

WARNING

VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS

/1\ **NOTE**
SPOILER SERVE HYDRAULIC SUPPLY IS AS FOLLOWS:
HYD SYS A – SPOILER 2 LEFT WING
HYD SYS B – SPOILERS 1, 4, 6 BOTH WINGS
HYD SYS C – SPOILERS 3, 5 BOTH WINGS
HYD SYS D – SPOILER 2 RIGHT WING

/2\ IF SPOILER INPUT CONTROL SYSTEM RIG IS OK BUT SPOILER STILL TENDS TO FLOAT UP, ADJUST THE SPOILER SERVO INPUT ARM TO SERVO DOWN-STOP GAP TO THE MINIMUM DIMENSION ALLOWED

M1–0103–27–227

Spoiler Float in Flight
Figure 110

PREREQUISITES
ALL SIX SPOILER AND FOUR AILERON SWITCHLIGHTS
ON OVERHEAD PFCS PANEL DEPRESSED (IN)
HYDRAULIC POWER, SYSTEM B AND C (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB'S: CB1B7, 1B8
C82 J15, 2J16, 2J17, 2J18
CB3 G8, 3G9

SPOILER SWITCHLIGHT PUSH LEGENDS ON ⚠1

1 IS ONE SPOILER SWITCHLIGHT PUSH LEGEND ON WITH OTHER ANNUNCIATOR LEGENDS OFF?

YES → **4** REPLACE PFCS PANEL (MM22-17-02).

NO

2 WITH FLAPS FULL-UP, OPERATE SPEEDBRAKE LEVER. SPOILERS 5 AND 6 ON BOTH WINGS SHOULD OPERATE.
WITH FLAPS EXTENDED 4° OR MORE, OPERATE SPEEDBRAKE LEVER. SPOILERS 5 AND 6 ON BOTH WINGS SHOULD NOT OPERATE.
DO SPOILERS OPERATE CORRECTLY?

NO → **5** AT MULFUNCTIONING ACTUATOR, DISCONNECT ELECTRICAL PLUG. WITH FLAPS RETRACTED, THERE SHOULD BE 115V AC ON PIN 1. WITH FLAPS EXTENDED 4° OR MORE, THERE SHOULD BE 115V AC ON PIN 2 (SCHEM 3).
IF VOLTAGE IS OK, REPLACE SELECTOR DWELL ACTUATOR (MM26-51-25).
IF VOLTAGE IS NOT OK, REPLACE FAULTY MIXER AND DRIVE SELECTOR RELAY.
IF PROBLEM PERSISTS, CHECK WIRING BETWEEN RELAY AND SELECTOR ACTUATOR FOR AN OPEN CIRCUIT (SCHEM 2 AND MM27-61-01).

YES

3 CHECK FOR SELECTOR DWELL ACTUATOR POSITION SWITCH CONTINUITY AS FOLLOWS (REF. SCHEM 2):
EXTEND FLAPS TO 4 OR MORE DEGREES.
ON FCAU DISCONNECT CONNECTORS 2210-P72, P73 AND P74.
CHECK FOR CONTINUITY BETWEEN P72 PIN 23 AND THE FOLLOWING PINS:
P73 PINS 18 AND 35.
P74 PINS 4 AND 13.
RECONNECT FCAU CONNECTORS P72, P73 AND P74.
FULLY RETRACT FLAPS AND ALLOW SELECTOR DWELL ACTUATOR TO COMPLETE STROKE.
DISCONNECT FCAU CONNECTORS P72, P73 AND P74.
CHECK FOR CONTINUITY BETWEEN P72 PIN 23 AND THE FOLLOWING PINS:
P73 PINS 6 AND 32.
P74 PINS 12 AND 22.
ARE SELECTOR ACTUATOR POSITION SWITCHES OK?

NO → **6** REPLACE FAULTY SELECTOR DWELL ACTUATOR (MM27-61-25).
IF FAULT PERSISTS, CHECK WIRING BETWEEN ELECTRICAL ACTUATOR POSITION SWITCHES AND FCAU (SCHEM 2 AND MM27-61-02). REPAIR AS NECESSARY.

YES → **7** REPLACE FCAU (MM22-10-12).

WARNING
VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS

NOTE
⚠1 SPOILER L5 & 6 AND R5 & 6 SWITCHLIGHTS PUSH LEGEND ON WITH SELECTOR FAULT LEGEND ON FCAU ON INDICATE THAT ONE OR BOTH SPOILER SELECTORS NOT IN COMMANDED STATE

M1-0005-27-B65

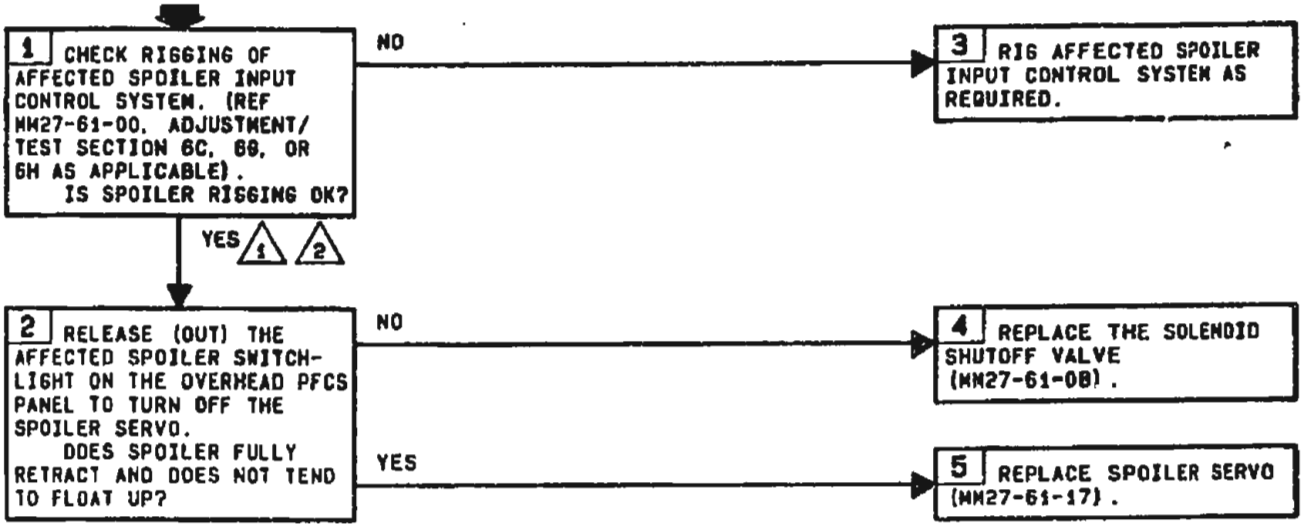
R R Spoiler Switchlight PUSH Legends On
Figure 111

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00)
CB'S: CB1 B7, B8
CB2 J15, J16, J17, J18
CB3 B8, B9

WARNING

VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRAULIC POWER

SPOILER DOES NOT FULLY RETRACT ON GROUND WITH SPEEDBRAKE LEVER FULL FORWARD


1 CHECK RIGGING OF AFFECTED SPOILER INPUT CONTROL SYSTEM. (REF MM27-61-00, ADJUSTMENT/ TEST SECTION 6C, 6G, OR 6H AS APPLICABLE).
IS SPOILER RIGGING OK?
NO
3 RIG AFFECTED SPOILER INPUT CONTROL SYSTEM AS REQUIRED.
YES
1
2
2 RELEASE (OUT) THE AFFECTED SPOILER SWITCH-LIGHT ON THE OVERHEAD PFCS PANEL TO TURN OFF THE SPOILER SERVO.
DOES SPOILER FULLY RETRACT AND DOES NOT TEND TO FLOAT UP?
NO
4 REPLACE THE SOLENOID SHUTOFF VALVE (MM27-61-08).
YES
5 REPLACE SPOILER SERVO (MM27-61-17).

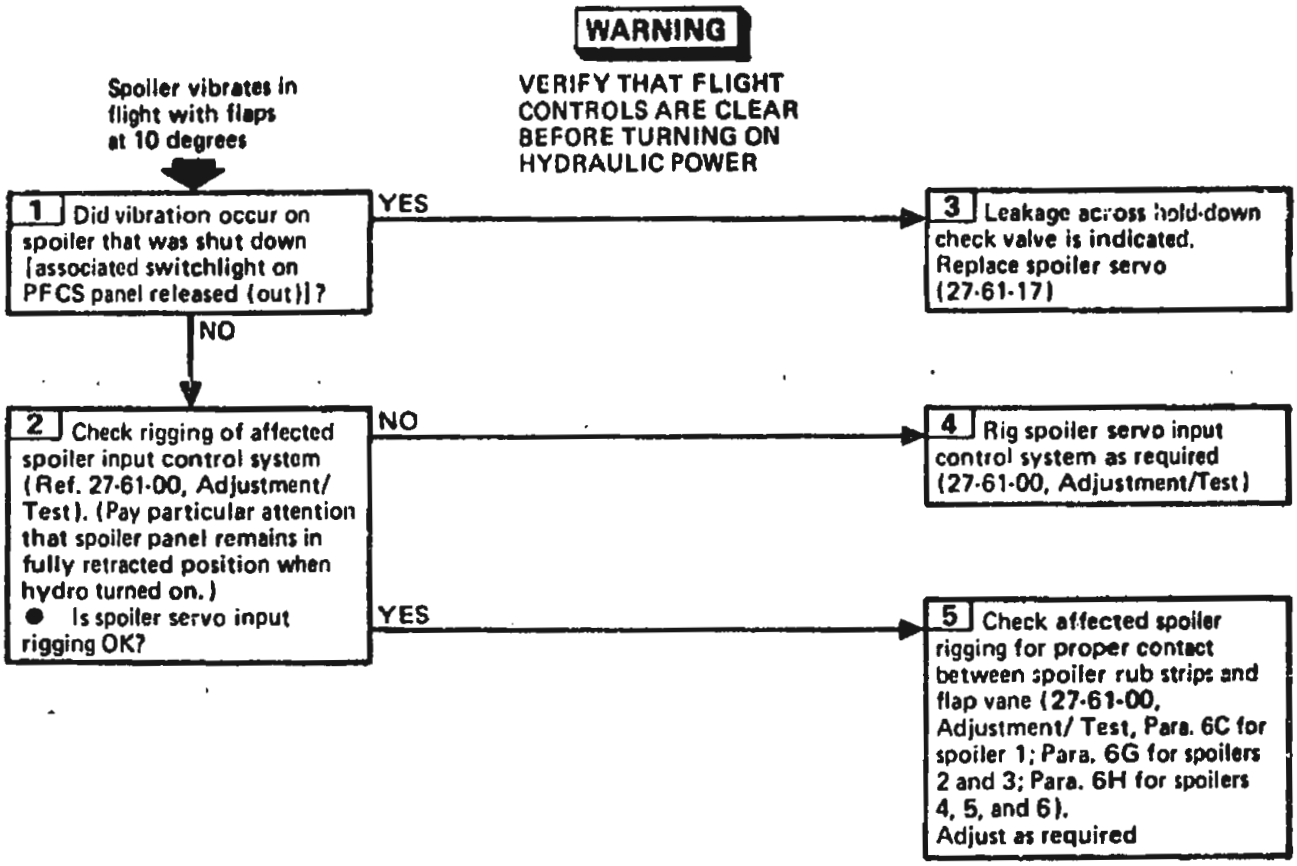
NOTE

1. IF SPOILER INPUT CONTROL SYSTEM RIG'S OK BUT SPOILER STILL TENDS TO FLOAT UP ADJUST THE SPOILER SERVO INPUT ARM TO SERVO DOWN STOP GAP TO THE MINIMUM DIMENSION ALLOWED.

2. BINDING IN SPOILER LINKAGE BEARINGS MAY CAUSE SPOILERS TO NOT FULLY RETURN. PROBLAM AREAS HAVE BEEN NUMBER 3 SCISSOR LINKAGES, NUMBER 4 SCISSOR LINKAGES AND THE SELECTOR MECHANISM.

M1-0000-27-1185

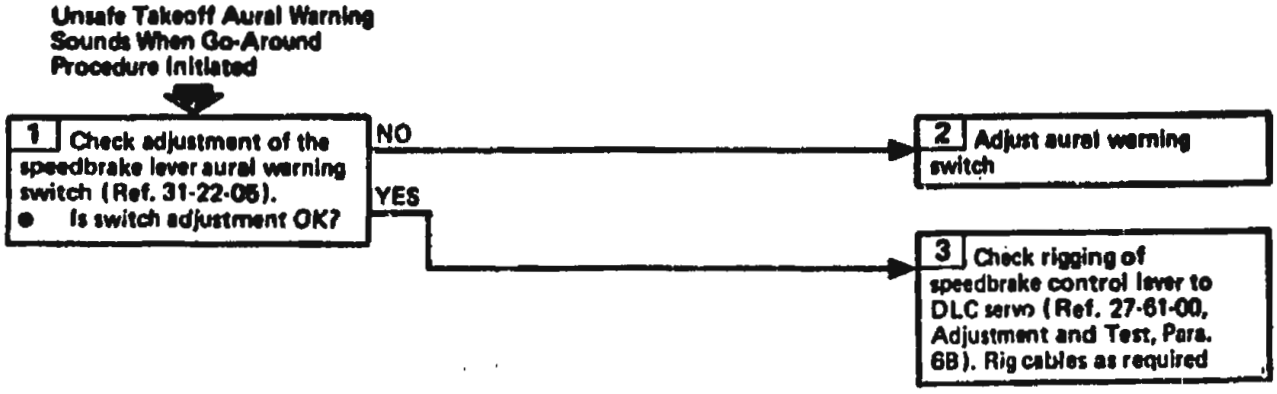
CR CR CR Spoiler Does Not Fully Retract on Ground With Speedbrake Lever Full Forward
Figure 112


WARNING
VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRAULIC POWER
Spoiler vibrates in flight with flaps at 10 degrees
1 Did vibration occur on spoiler that was shut down [associated switchlight on PFCS panel released (out)]?
YES
3 Leakage across hold-down check valve is indicated. Replace spoiler servo (27-61-17)
NO
2 Check rigging of affected spoiler input control system (Ref. 27-61-00, Adjustment/ Test). (Pay particular attention that spoiler panel remains in fully retracted position when hydro turned on.)
● Is spoiler servo input rigging OK?
NO
4 Rig spoiler servo input control system as required (27-61-00, Adjustment/Test)
YES
5 Check affected spoiler rigging for proper contact between spoiler rub strips and flap vane (27-61-00, Adjustment/ Test, Para. 6C for spoiler 1; Para. 6G for spoilers 2 and 3; Para. 6H for spoilers 4, 5, and 6).
Adjust as required

PREREQUISITES
Elec Pwr (24-41-00)
Hyd Pwr (29-11-00)
CB's: CB1-B7, B8
CB2-J15, J16, J17, J18
CB3-G8, G9

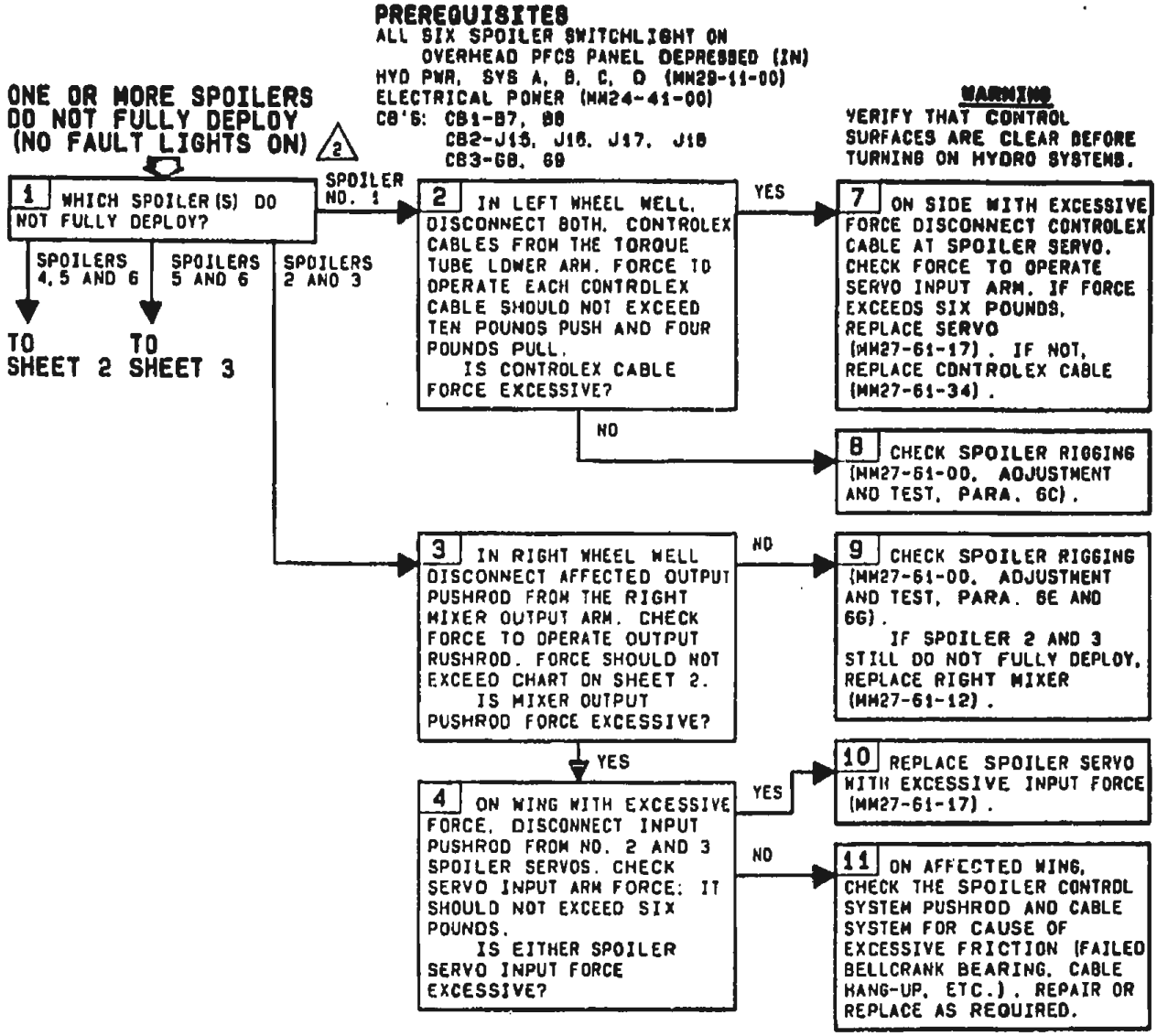
M1-0101-27-329

Spoiler Vibrates in Flight With Flaps at 10 Degrees
Figure 113


Unsafe Takeoff Aural Warning Sounds When Go-Around Procedure Initiated
1 Check adjustment of the speedbrake lever aural warning switch (Ref. 31-22-05).
● Is switch adjustment OK?
NO
YES
2 Adjust aural warning switch
3 Check rigging of speedbrake control lever to DLC servo (Ref. 27-61-00, Adjustment and Test, Para. 6B). Rig cables as required

M1-0003-27-062

Speedbrake Lever Does Not Fully Stow
After a DLC/AGS Landing
Figure 114


PREREQUISITES
ALL SIX SPOILER SWITCHLIGHT ON
OVERHEAD PFCS PANEL DEPRESSED (IN)
HYD PWR, SYS A, B, C, D (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB'S: CB1-B7, B8
CB2-J15, J16, J17, J18
CB3-G8, G9
ONE OR MORE SPOILERS DO NOT FULLY DEPLOY (NO FAULT LIGHTS ON) 2
1 WHICH SPOILER(S) DO NOT FULLY DEPLOY?
SPOILER NO. 1
SPOILERS 4, 5 AND 6
SPOILERS 5 AND 6
SPOILERS 2 AND 3
TO SHEET 2
TO SHEET 3
2 IN LEFT WHEEL WELL, DISCONNECT BOTH CONTROLEX CABLES FROM THE TORQUE TUBE LOWER ARM. FORCE TO OPERATE EACH CONTROLEX CABLE SHOULD NOT EXCEED TEN POUNDS PUSH AND FOUR POUNDS PULL.
IS CONTROLEX CABLE FORCE EXCESSIVE?
YES
NO
WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS.
7 ON SIDE WITH EXCESSIVE FORCE DISCONNECT CONTROLEX CABLE AT SPOILER SERVO. CHECK FORCE TO OPERATE SERVO INPUT ARM. IF FORCE EXCEEDS SIX POUNDS, REPLACE SERVO (MM27-61-17). IF NOT, REPLACE CONTROLEX CABLE (MM27-61-34).
8 CHECK SPOILER RIGGING (MM27-61-00, ADJUSTMENT AND TEST, PARA. 6C).
3 IN RIGHT WHEEL WELL DISCONNECT AFFECTED OUTPUT PUSHROD FROM THE RIGHT MIXER OUTPUT ARM. CHECK FORCE TO OPERATE OUTPUT RUSHROD. FORCE SHOULD NOT EXCEED CHART ON SHEET 2.
IS MIXER OUTPUT PUSHROD FORCE EXCESSIVE?
NO
YES
9 CHECK SPOILER RIGGING (MM27-61-00, ADJUSTMENT AND TEST, PARA. 6E AND 6G).
IF SPOILER 2 AND 3 STILL DO NOT FULLY DEPLOY, REPLACE RIGHT MIXER (MM27-61-12).
4 ON WING WITH EXCESSIVE FORCE, DISCONNECT INPUT PUSHROD FROM NO. 2 AND 3 SPOILER SERVOS. CHECK SERVO INPUT ARM FORCE: IT SHOULD NOT EXCEED SIX POUNDS.
IS EITHER SPOILER SERVO INPUT FORCE EXCESSIVE?
YES
NO
10 REPLACE SPOILER SERVO WITH EXCESSIVE INPUT FORCE (MM27-61-17).
11 ON AFFECTED WING, CHECK THE SPOILER CONTROL SYSTEM PUSHROD AND CABLE SYSTEM FOR CAUSE OF EXCESSIVE FRICTION (FAILED BELLCRANK BEARING, CABLE HANG-UP, ETC.). REPAIR OR REPLACE AS REQUIRED.

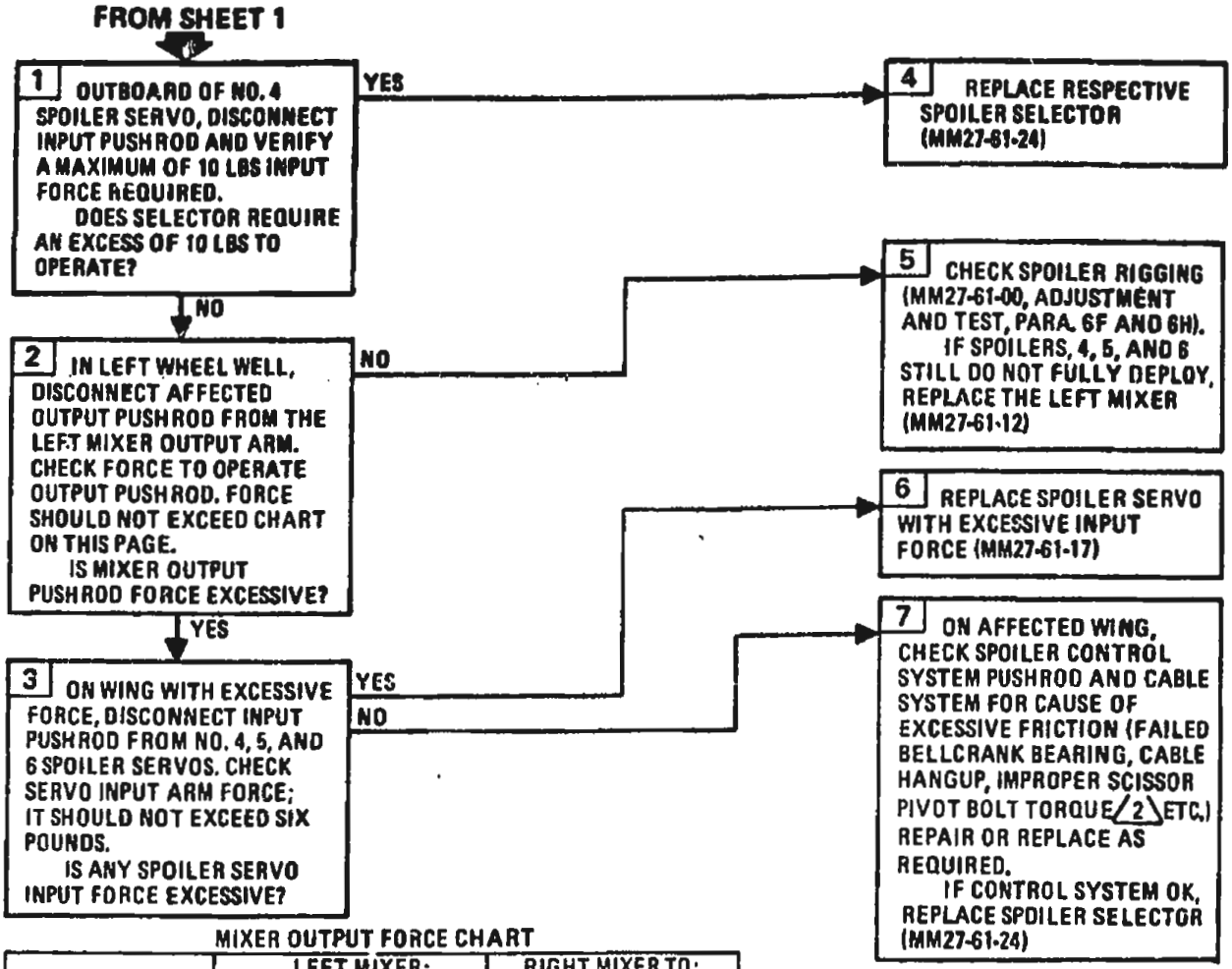
NOTE

1 OIL, VV-L-800 MAY BE USED TO TEMPORARILY FREE A STICKING SEALED BEARING. PART SHOULD BE REPAIRED OR REPLACED AT NEXT AVAILABLE REPAIR FACILITY.

2 WITH FLAPS UP, SPEEDBRAKE LEVER OPERATES SPOILERS 2 THROUGH 6. WITH FLAPS DOWN (4 DEGREES OR MORE), SPEEDBRAKE LEVER OPERATES SPOILERS 1 THROUGH 4.

M1-0003-27-033

R One or More Spoilers Do Not Fully Deploy
R Figure 115 (Sheet 1)


FROM SHEET 1
1 OUTBOARD OF NO. 4 SPOILER SERVO, DISCONNECT INPUT PUSHROD AND VERIFY A MAXIMUM OF 10 LBS INPUT FORCE REQUIRED.
DOES SELECTOR REQUIRE AN EXCESS OF 10 LBS TO OPERATE?
YES
4 REPLACE RESPECTIVE SPOILER SELECTOR (MM27-61-24)
NO
2 IN LEFT WHEEL WELL, DISCONNECT AFFECTED OUTPUT PUSHROD FROM THE LEFT MIXER OUTPUT ARM. CHECK FORCE TO OPERATE OUTPUT PUSHROD. FORCE SHOULD NOT EXCEED CHART ON THIS PAGE.
IS MIXER OUTPUT PUSHROD FORCE EXCESSIVE?
NO
5 CHECK SPOILER RIGGING (MM27-61-00, ADJUSTMENT AND TEST, PARA. 6F AND 6H).
IF SPOILERS, 4, 5, AND 6 STILL DO NOT FULLY DEPLOY, REPLACE THE LEFT MIXER (MM27-61-12)
YES
3 ON WING WITH EXCESSIVE FORCE, DISCONNECT INPUT PUSHROD FROM NO. 4, 5, AND 6 SPOILER SERVOS. CHECK SERVO INPUT ARM FORCE; IT SHOULD NOT EXCEED SIX POUNDS.
IS ANY SPOILER SERVO INPUT FORCE EXCESSIVE?
YES
6 REPLACE SPOILER SERVO WITH EXCESSIVE INPUT FORCE (MM27-61-17)
NO
7 ON AFFECTED WING, CHECK SPOILER CONTROL SYSTEM PUSHROD AND CABLE SYSTEM FOR CAUSE OF EXCESSIVE FRICTION (FAILED BELLCRANK BEARING, CABLE HANGUP, IMPROPER SCISSOR PIVOT BOLT TORQUE (2) ETC.) REPAIR OR REPLACE AS REQUIRED.
IF CONTROL SYSTEM OK, REPLACE SPOILER SELECTOR (MM27-61-24)

MIXER OUTPUT FORCE CHART

	LEFT MIXER:		RIGHT MIXER TO:	
	LEFT SPOILERS	RIGHT SPOILERS	LEFT SPOILERS	RIGHT SPOILERS
FLAP EXTENDED 4° OR MORE TO EXTEND– TO RETRACT FROM FULL UP–	8 LBS 5 LBS	10 LBS 7 LBS	12 LBS 7 LBS	11 LBS 6 LBS
FLAPS FULLY RETRACTED TO EXTEND– TO RETRACT FROM FULL UP–	22 LBS 4 LBS	24 LBS 7 LBS	12 LBS 7 LBS	11 LBS 5 LBS

NOTE

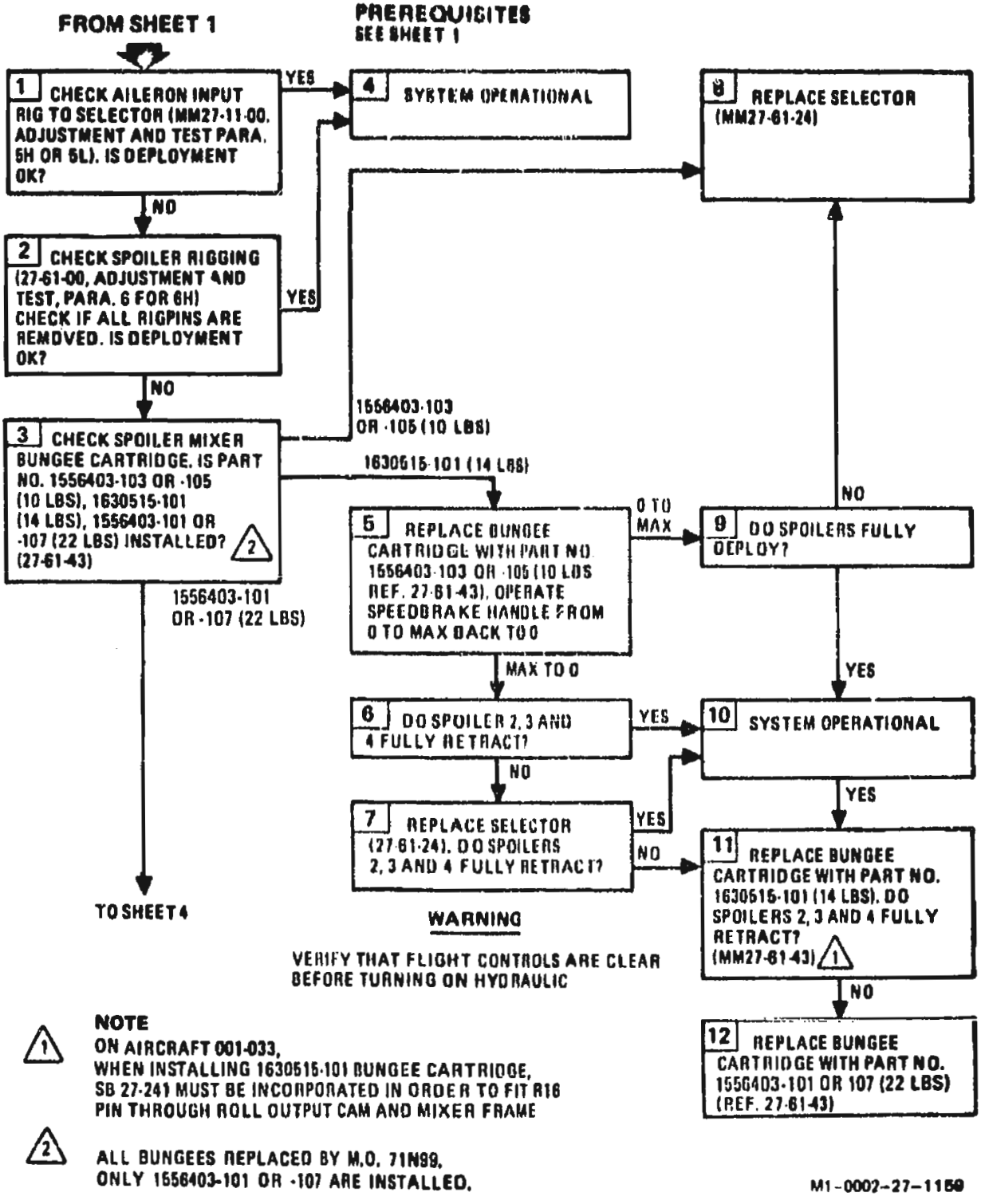
(1) OIL, VV-L-800 MAY BE USED TO TEMPORARILY FREE A STICKING SEALED BEARING. PART SHOULD BE REPAIRED OR REPLACED AT NEXT AVAILABLE REPAIR FACILITY.

(2) TORQUE NUT ON LARGER DIAMETER OUTER BOLT TO 70-80 LB-IN, THEN TORQUE NUT ON INNER BOLT TO 20-25 LB-IN.

THE ABOVE TABULATED VALUES IN THE EXTEND DIRECTION ARE RECOMMENDED VALUES. THE EXTEND FORCES MAY EXCEED THOSE LISTED BY 50%, HOWEVER, SPOILER UP-TRAVELS MUST MEET MINIMUM REQUIREMENTS SPECIFIED IN 27-61-00, ADJUSTMENT AND TEST, PARA. 6G AND 6H

M1-0005-27-661

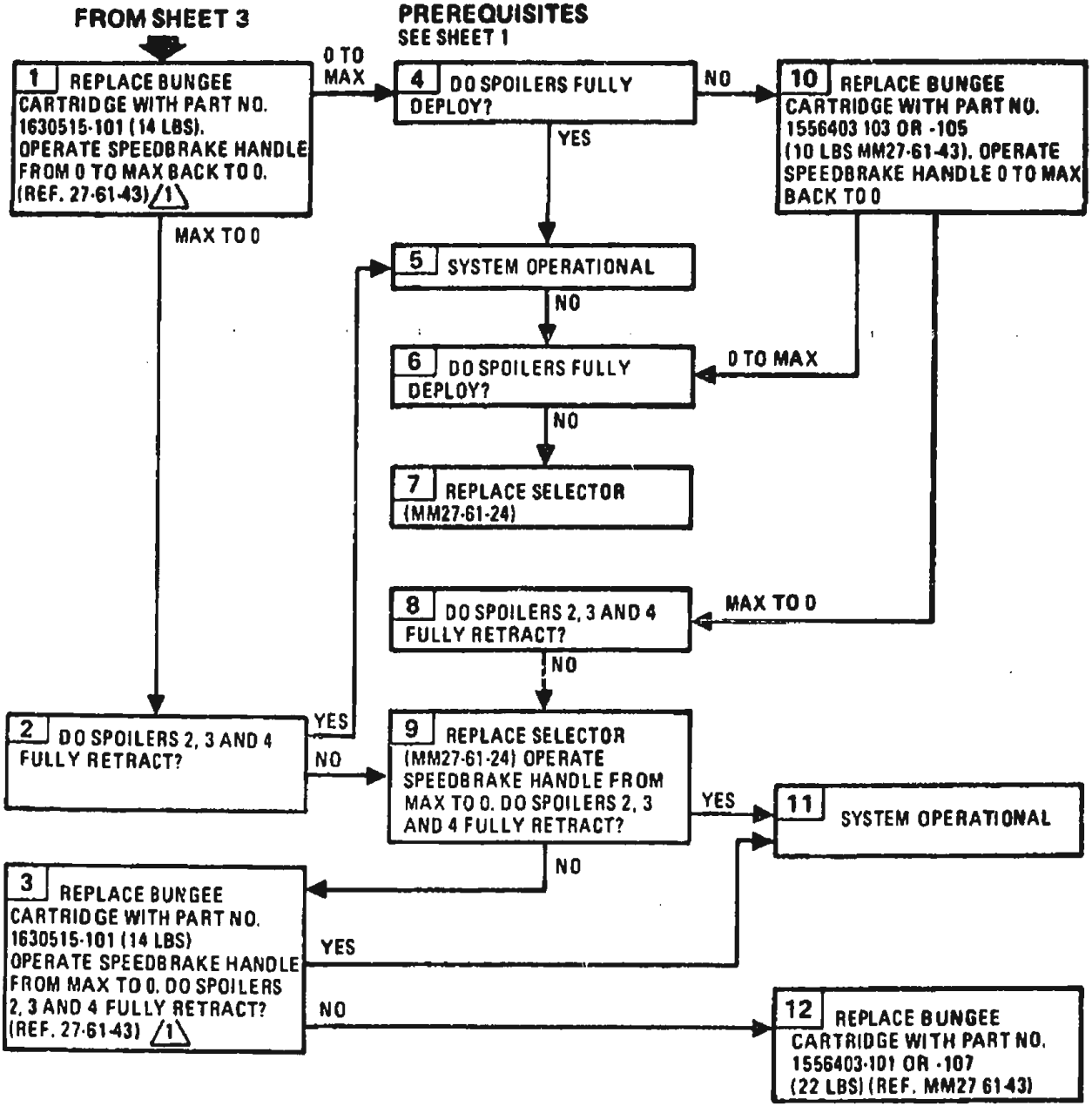
R One or More Spoilers Do Not Fully Deploy
R Figure 115 (Sheet 2)


FROM SHEET 1
PREREQUISITES
SEE SHEET 1
1 CHECK AILERON INPUT RIG TO SELECTOR (MM27-11-00, ADJUSTMENT AND TEST PARA. 5H OR 5L). IS DEPLOYMENT OK?
YES
4 SYSTEM OPERATIONAL
NO
2 CHECK SPOILER RIGGING (27-61-00, ADJUSTMENT AND TEST, PARA. 6 FOR 6H) CHECK IF ALL RIGPINS ARE REMOVED. IS DEPLOYMENT OK?
YES
NO
3 CHECK SPOILER MIXER BUNGEE CARTRIDGE. IS PART NO. 1556403-103 OR -105 (10 LBS), 1630515-101 (14 LBS), 1556403-101 OR -107 (22 LBS) INSTALLED? (27-61-43) 2
1556403-103 OR -105 (10 LBS)
1630515-101 (14 LBS)
1556403-101 OR -107 (22 LBS)
TO SHEET 4
5 REPLACE BUNGEE CARTRIDGE WITH PART NO. 1556403-103 OR -105 (10 LBS REF. 27-61-43). OPERATE SPEEDBRAKE HANDLE FROM 0 TO MAX BACK TO 0
0 TO MAX
MAX TO 0
6 DO SPOILER 2, 3 AND 4 FULLY RETRACT?
YES
NO
7 REPLACE SELECTOR (27-61-24). DO SPOILERS 2, 3 AND 4 FULLY RETRACT?
YES
NO
8 REPLACE SELECTOR (MM27-61-24)
9 DO SPOILERS FULLY DEPLOY?
NO
YES
10 SYSTEM OPERATIONAL
YES
11 REPLACE BUNGEE CARTRIDGE WITH PART NO. 1630515-101 (14 LBS). DO SPOILERS 2, 3 AND 4 FULLY RETRACT? (MM27-61-43) 1
NO
12 REPLACE BUNGEE CARTRIDGE WITH PART NO. 1556403-101 OR 107 (22 LBS) (REF. 27-61-43)
WARNING
VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRAULIC
1 NOTE
ON AIRCRAFT 001-033, WHEN INSTALLING 1630515-101 BUNGEE CARTRIDGE, SB 27-241 MUST BE INCORPORATED IN ORDER TO FIT R16 PIN THROUGH ROLL OUTPUT CAM AND MIXER FRAME
2 ALL BUNGEES REPLACED BY M.O. 71N99, ONLY 1556403-101 OR -107 ARE INSTALLED.
M1-0002-27-1159

CR One or More Spoilers Do Not Fully Deploy
CR Figure 115 (Sheet 3)

EFFECTIVITY: ALL

0018


FROM SHEET 3
PREREQUISITES
SEE SHEET 1
1 REPLACE BUNGEE CARTRIDGE WITH PART NO. 1630515-101 (14 LBS). OPERATE SPEEDBRAKE HANDLE FROM 0 TO MAX BACK TO 0. (REF. 27-61-43) /1\
0 TO MAX
4 DO SPOILERS FULLY DEPLOY?
NO
10 REPLACE BUNGEE CARTRIDGE WITH PART NO. 1556403 103 OR -105 (10 LBS MM27-61-43). OPERATE SPEEDBRAKE HANDLE 0 TO MAX BACK TO 0
YES
MAX TO 0
5 SYSTEM OPERATIONAL
NO
6 DO SPOILERS FULLY DEPLOY?
0 TO MAX
NO
7 REPLACE SELECTOR (MM27-61-24)
8 DO SPOILERS 2, 3 AND 4 FULLY RETRACT?
MAX TO 0
NO
2 DO SPOILERS 2, 3 AND 4 FULLY RETRACT?
YES
NO
9 REPLACE SELECTOR (MM27-61-24) OPERATE SPEEDBRAKE HANDLE FROM MAX TO 0. DO SPOILERS 2, 3 AND 4 FULLY RETRACT?
YES
11 SYSTEM OPERATIONAL
NO
3 REPLACE BUNGEE CARTRIDGE WITH PART NO. 1630515-101 (14 LBS) OPERATE SPEEDBRAKE HANDLE FROM MAX TO 0. DO SPOILERS 2, 3 AND 4 FULLY RETRACT? (REF. 27-61-43) /1\
YES
NO
12 REPLACE BUNGEE CARTRIDGE WITH PART NO. 1556403-101 OR -107 (22 LBS) (REF. MM27 61-43)

/1\ **NOTE**
ON AIRCRAFT 001-033, WHEN INSTALLING 1630515-101 BUNGEE CARTRIDGE, SB 27-241 MUST BE INCORPORATED IN ORDER TO FIT R16 PIN THROUGH ROLL OUTPUT CAM AND MIXER FRAME

WARNING

VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRAULIC POWER

M1-0000-27-1165

R One or More Spoilers Do Not Fully Deploy
R Figure 115 (Sheet 4)

EFFECTIVITY: ALL

001B

SPOILER FAULT MONITORING TROUBLE SHOOTING GUIDE

FOLLOWING FAULT LIGHTS CAUSED BY FOLLOWING FAULTY COMPONENTS						FAULTY COMPONENT
FAULT LIGHTS						
PILOTS ANNUNCIATOR PANEL		PILOTS OVERHEAD PFCS PANEL	FLIGHT CONTROL AUXILARY UNIT (FCAU) (LOCATED IN FORWARD ELECTRONIC SERVICE CENTER)			
ROLL SPEED BRAKE	FLT CONT PANEL	SPOILER L5 & 6 OFF PUSH R5 & 6 OFF PUSH	SELECTOR FAULT	MIXER FAULT	SPOILER 1 FAULT	
◇	◇	◇	◇	◇		1. NO. 1 PDU SWITCHBOX (SWITCH NO. 14) 2. MIXER AND DRIVE SELECTOR RELAY 3. FCAU SEE FIGURE 105
◇	◇	◇	◇	◇	◇	1. NO. 2 PDU SWITCHBOX (SWITCH NO. 14) 2. FCAU SEE FIGURE 105
	◇	◇	◇			1. SELECTOR DWELL ACTUATOR 2. FCAU SEE FIGURE 111
◇				◇		1. MIXER DWELL ACTUATOR 2. FCAU SEE FIGURE 104
◇					◇	1. PDU SWITCHBOX NO. 2 (SWITCH NO. 13) 2. SERVO SOLENOID SHUTOFF VALVE 3. SERVO PRESS SWITCH 4. SPOILER NO. 1 BUNGEE SWITCH 5. CONTROLEX CABLE 6. SPOILER SERVO (3) SEE FIGURE 103
ANY COMBINATION OF ABOVE						1. FCAU

NOTE

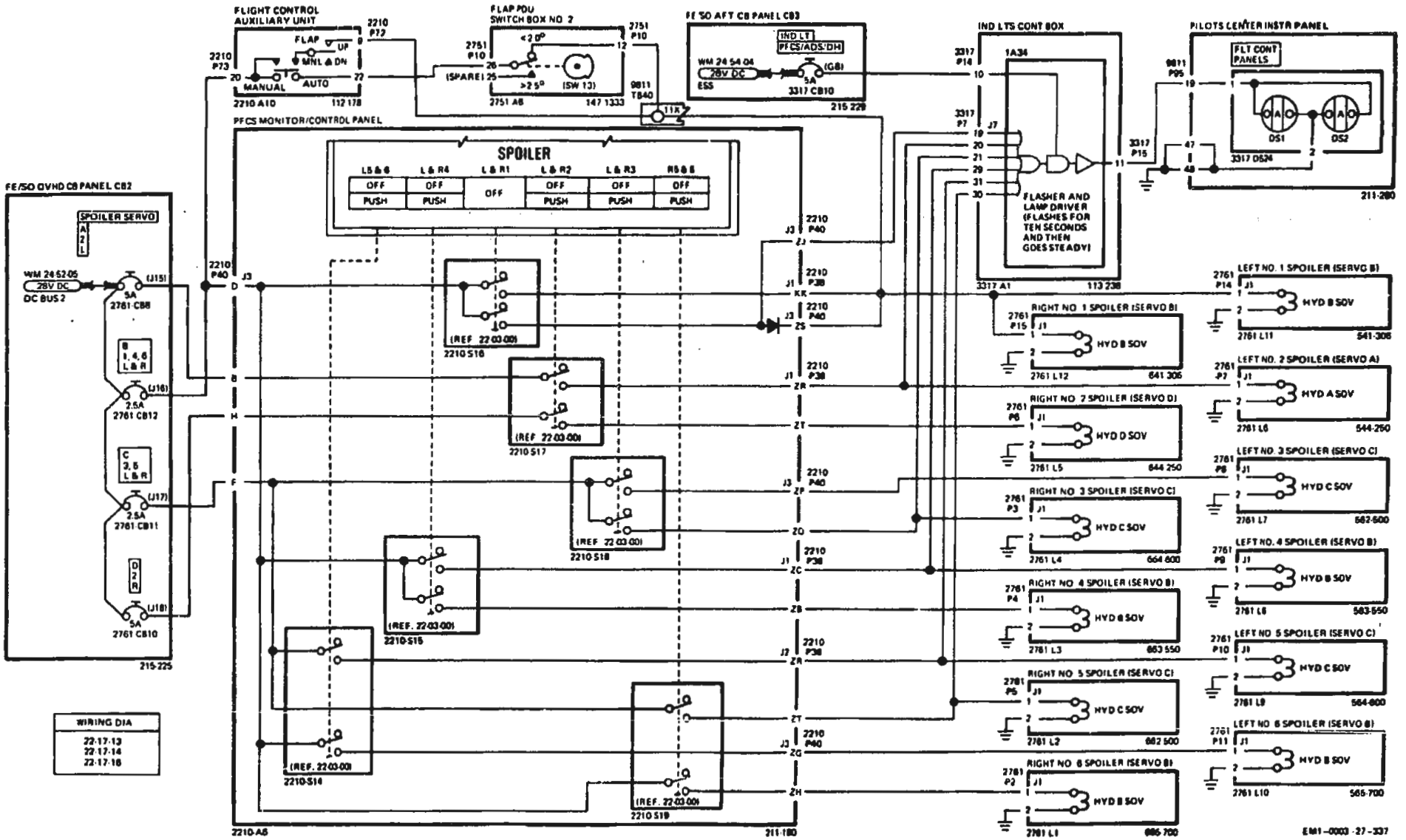
1 ROLL SPEED BRAKE LIGHT COMES ON WHEN MIXER OR NO. 1 SPOILER SERVO IS FAULTY. FCAU PANEL LIGHTS INDICATE WHICH COMPONENT IS FAULTY.

2 FCAU IS ONLY A FAULT MONITORING/ANNUNCIATING DEVICE. IT DOES NOT CONTROL SPOILER OPERATION. IF SPOILER OPERATION IS IMPROPER, FAULT IS DUE TO MIXER, SELECTOR, FLAP SWITCHES, OR NO. 1 SPOILER. IF SPOILER OPERATION IS OK, BUT FAULT LIGHTS ARE ON, A FAULTY FCAU IS INDICATED.

(3) IF BOTH NO. 1 SPOILERS ARE IN WRONG STATE, REPLACE FLAP PDU SWITCHBOX NO. 2. IF ONE NO. 1 SPOILER IS IN WRONG STATE, REPLACE AFFECTED SPOILER SHUTOFF VALVE. IF BOTH NO. 1 SPOILERS ARE IN CORRECT STATE, TROUBLESHOOT NO. 1 SPOILER PRESSURE SWITCHES.

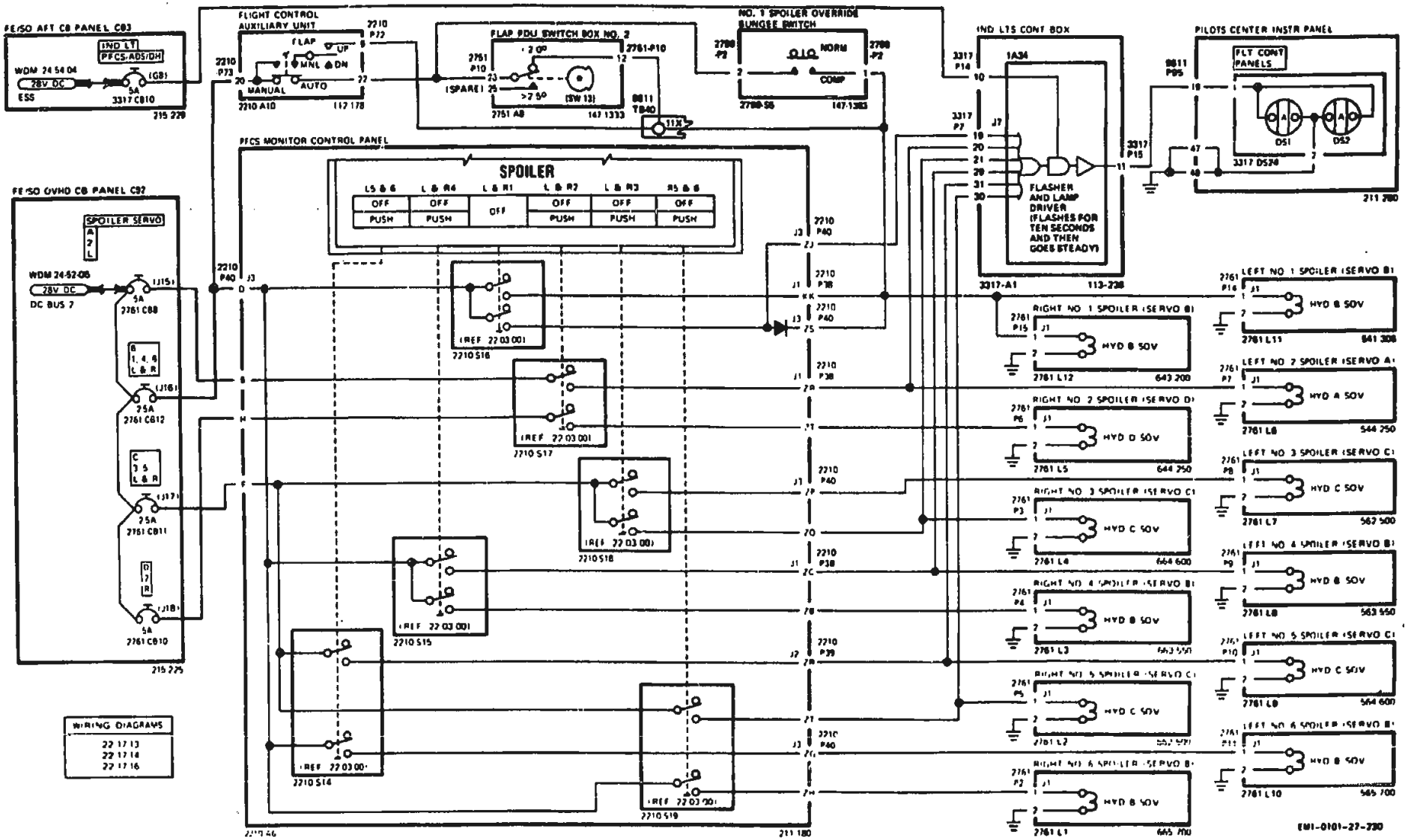
M1-0003-27-249

Spoiler Fault Monitoring Trouble Shooting Guide
Figure 116



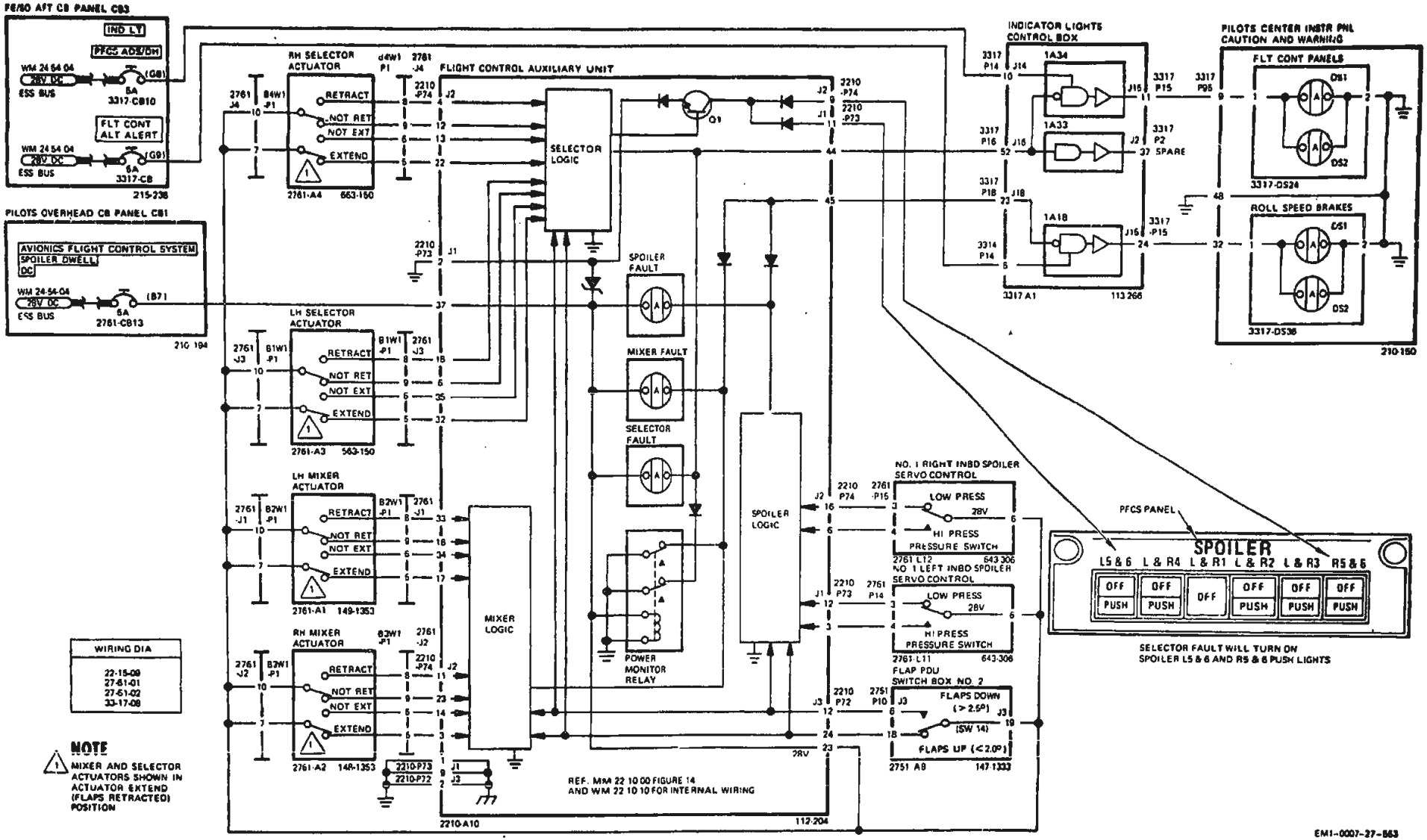
Spoiler Servo Control Electrical Schematic
SCHEM 1

R EFFECTIVITY: 001-026 WITHOUT SB27-101
R
001B



Spoiler Servo Control Electrical Schematic
SCHEM 1

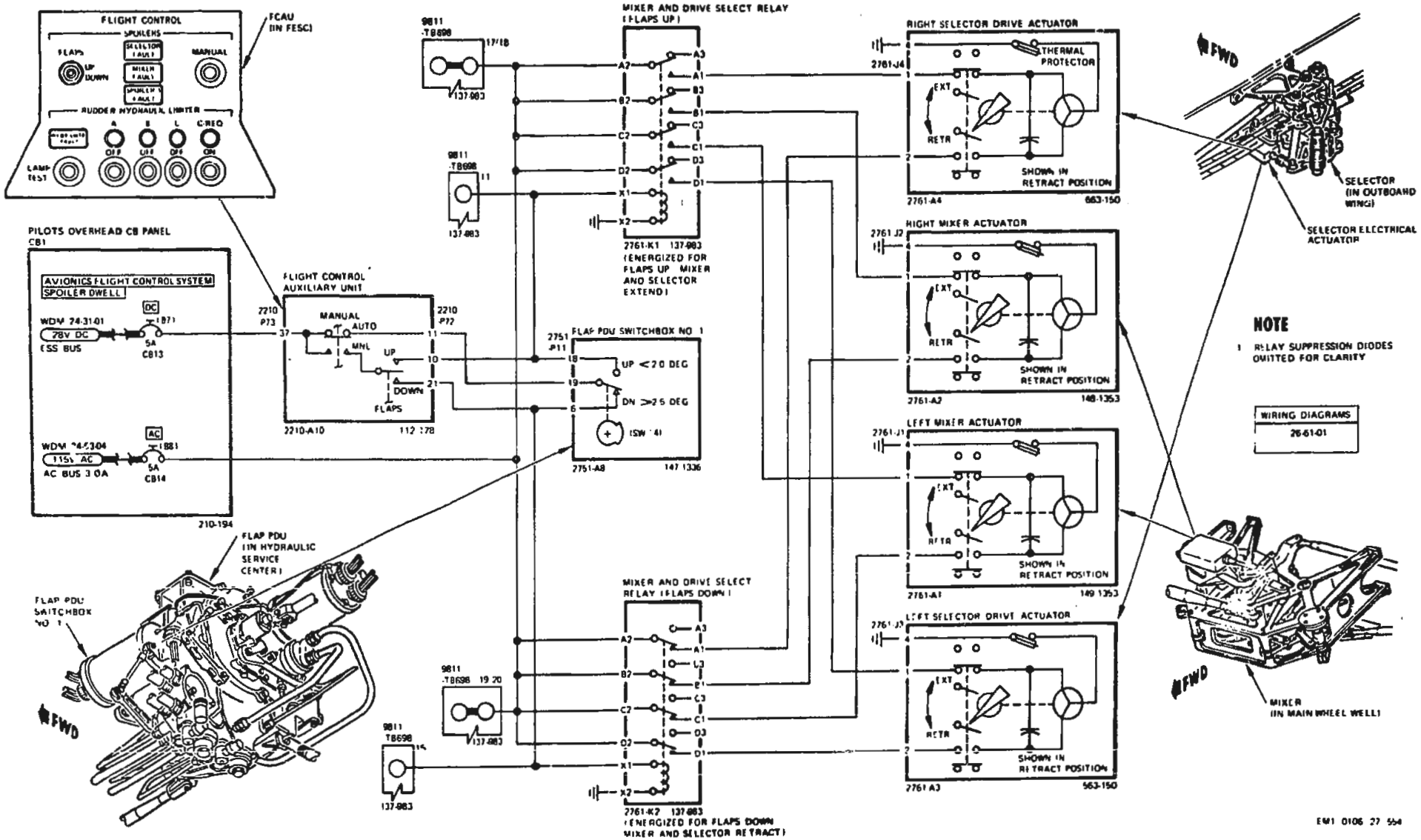
R
R
001B EFFECTIVITY: 001-026 WITH SB27-101 AND 027-999



R Spoiler Fault Monitoring Electrical Schematic
R SCHEM 2

EFFECTIVITY: ALL

001B



Spoiler Mixer and Selector Control Electrical Schematic
SCHEM 3

CR TROUBLESHOOTING WITH FLIGHT CONTROLS
CR AUXILIARY UNIT BREAKOUT BOX
CR Tool Part Number 22-10-12-0013
CR Figure 117

CR GENERAL:

CR The F.C.A.U. breakout box monitors the spoiler control system CR through light indicators to allow the technician to have a CR visual presentation of system operation. The breakout box is CR installed between the F.C.A.U and ships's wiring.

CR Troubleshooting Procedure

CR 1. Breakout Box Installation

CR A. Open C/B's CB1B7 and CB2J16.

CR B. In the F.E.S.C., remove connector plugs P-72, P-73, and CR P-74 from F.C.A.U.

CR C. Connect breakout box between the F.C.A.U. and the CR ship's connectors removed in Step 1.B. above.

CR 2. Test Procedure

CR A. Close C/B's CB1B7, CB1B8, and check CB2J16 is closed.

CR B. Press "LIGHTS TEST" on breakout box. All blue lights CR should illuminate (Lamp stock number 41-5861).

CR WARNING: CLEAR PERSONNEL AND EQUIPMENT FROM ALL FLIGHT CR CONTROL SURFACES PRIOR TO APPLYING HYDRAULIC CR PRESSURE.

CR C. Release (OUT) leading edge slats lockout switch on CR flight engineer's panel.

CR D. Apply hydraulic pressure.

CR E. Position flap handle to full up position.

CR F. All blue lights on upper half of breakout box should CR illuminate.

CR G. Position flap handle to the 4 degree detent.

CR H. All blue lights on lower half of breakout box should CR illuminate.

I. Replace the unit on which light does not illuminate at the selected flap position.

	Maintenance Manual	Stock Number
Spoiler P/S	27-61-38	73-5867
-Gasket		73-6176
-O-Ring		42-9407
-Allen Screw		32-5797
Dwell Actuator	27-61-25	10265
P.D.U. Switch Can	27-51-12	37915

3. Return Aircraft to Normal

A. Open C/B's CB1B7 and CB2J16.

B. Disconnect breakout box.

C. Connect ship's plugs P-72, P-73, and P-74 on F.C.A.U.

D. Close C/B's CB1B7 and CB2J16.

E. Depress (IN) leading edge slats lockout switch on flight engineer's panel. L/E and T/E devices up.

F. Perform following test:

(1) Apply full hydraulic power.

(2) On F.C.A.U. all lights should extinguish.

(3) On F.C.A.U. depress one at a time A, B, C, and C-REG push buttons. The respective blue light should illuminate; amber RUD HYD fault light should also illuminate.

(4) Depress manual test button and hold.

(5) With flaps select switch, select switch position opposite of existing flap position.

(6) After a short time delay, amber SELECTOR, MIXER, and SPOILER 1 fault lights should illuminate.

(7) Release test switches; amber lights should extinguish.

CR G. Remove hydraulic power.

SPOILER AND SPEEDBRAKE CONTROL SYSTEM - MAINTENANCE PRACTICES

1. General

WARNING: WHEN WORK IS PERFORMED IN THE AREA OF THE SPOILERS WITH SPOILERS EXTENDED, THE SPEEDBRAKE LEVER LOCK AND SPOILER SAFETY LOCKS MUST BE INSTALLED.

This section contains the following procedures:

A. Installation of Speedbrake Lever Lock and Spoiler Safety Lock

B. Remove of Speedbrake Lever Lock and Spoiler Safety Lock

R C. Installation of Spoiler Control Cable Idler Arm/Bellcrank Bolt Retainer

2. Equipment and Materials

Cotter Pin, MS24665-151 , or equivalent

Lockwire, QQ-W-390 .032 inch, or equivalent

Spoiler Actuators Safety Lock Set G/ITEL PN BG12-103, or equivalent

Speedbrake Lever Lock Assembly, PN 1309655-101, or equivalent

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Maintenance Practices

A. Installation of Speedbrake Lever Lock and Spoiler Actuator Safety Lock

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on all four hydraulic systems (use ATM's) (Ref. 29-11-00).

(3) Position flaps to full up (to enable spoilers 5 and 6).

(4) On pilots overhead circuit breaker panel, CB1, zone 210: open and tag circuit breakers SPOILER DWELL DC and AC (B7 and B8).

R (5) Extend flaps to 10 degrees.

(6) Raise all spoilers by positioning speedbrake lever full
R aft. Install Speedbrake Lever Lock (Ref. Fig. 203).

(7) On Flight Engineer/Second Officers overhead circuit breaker panel, CB2, zone 215, open and tag circuit breakers SPOILER SERVO A, B, C, and D (J15 through J18).

WARNING: IF BOTH HYDRAULIC SYSTEMS A AND B ARE TURNED OFF, THE BIAS SPRING IN THE DLC SERVO WILL DRIVE THE SPEEDBRAKE LEVER FORWARD (SPOILERS DOWN).

R IF SPEEDBRAKE LEVER LOCK IS NOT AVAILABLE, ENSURE BOTH HYDRAULIC SYSTEMS A AND B ARE NOT SHUT OFF WHILE SPOILER LOCKS ARE BEING INSTALLED OR SPOILERS WILL COME DOWN.

(8) Install spoiler locks (Ref. Fig. 201).

R WARNING: VERIFY SPOILER LOCK RED STREAMERS ARE INSTALLED ON
R SPOILER LOCKS AND STREAMERS ARE READILY VISIBLE FROM GROUND.

(9) Turn off all hydraulic pressure.

WARNING: TAG PILOTS CONTROL WHEEL NOTING THAT SPOILER LOCKS ARE INSTALLED.

(10) Spoiler area is now safe for maintenance.

R B. Removal of Speedbrake Lever Lock and Spoiler Actuator Safety
R Lock.

R (1) Verify circuit breakers opened in Steps 4A(4) and (7)
R are still open.

R (2) Verify speedbrake lever lock is installed to hold
R speedbrake lever in full aft (full spoiler extended)
R position.

R (3) Verify flaps are extended 4 degrees or more.

R (4) Verify hydraulic power is turned off.

R WARNING: IF SPEEDBRAKE LEVER LOCK IS NOT USED, SPEEDBRAKE
R LEVER WILL BE FORWARD. WITH SPEEDBRAKE LEVER FORWARD, SPOILERS WILL BE POWERED TOWARDS DOWN IF HYDRAULIC POWER IS TURNED ON. TAKE NECESSARY PRECAUTIONS TO ENSURE HYDRAULIC POWER IS NOT TURNED ON UNTIL ALL SPOILER LOCKS ARE REMOVED.

R (5) Remove all spoiler locks.

R (6) Remove warning tag from pilots control wheel.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (7) Turn on electrical power (Ref. 24-41-00).

WARNING: WHEN HYDRAULIC POWER IS TURNED ON, SPOILERS WILL MOVE TO SPEEDBRAKE LEVER POSITION.

R (8) Turn on all four hydraulic systems (Ref. 29-11-00).

(9) Remove speedbrake lever lock.

(10) Position speedbrake lever full forward to retract all spoilers.

WARNING: BY VISUAL OBSERVANCE OF SPOILER PANELS, VERIFY THAT ALL SPOILERS ON BOTH WINGS ARE FULLY RETRACTED.

(11) Position flaps full up.

(12) Remove tags and close circuit breakers opened in Steps 4A(4) and (7) (CB1-B7 and B8, CB2-J15 through J18).

(13) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(14) Turn off electrical power if no longer required (Ref. 24-41-00).

R C. Installation of Spoiler Control Cable Idler Arm/Bellcrank
R Bolt Retainer (Ref. Fig. 202)

R NOTE: Spoiler Control Cable Idler Arm/Bellcrank retainers
R are installed on the bottom of upper Idler Arm and
R upper Bellcrank and on the top of lower Idler Arm.
R Lower Bellcrank does not have retainers installed.

R (1) Verify cable-to-idler arm bolt is properly installed
R and safetied with cotter pin.

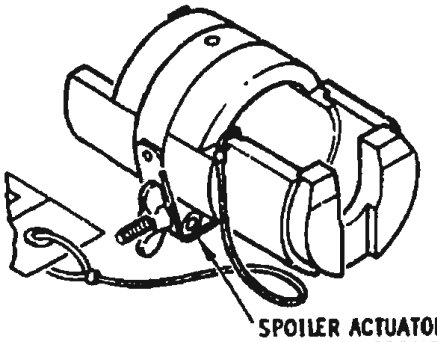
R (2) Verify retainer hinge pin (cotter pin) is installed
R through retainer and idler arm hinge.

R (3) Rotate retainer over flush head bolt and against idler
R arm.

R CAUTION: FAILURE TO PROPERLY LOCK-WIRE RETAINER TO IDLER
R ARM/BELLCRANK CAN JAM SPOILER CONTROLS.

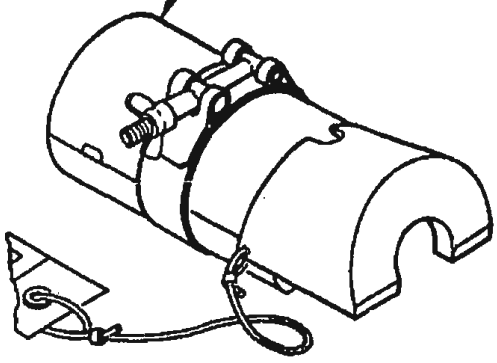
R (4) Lock-wire retainer to idler arm.

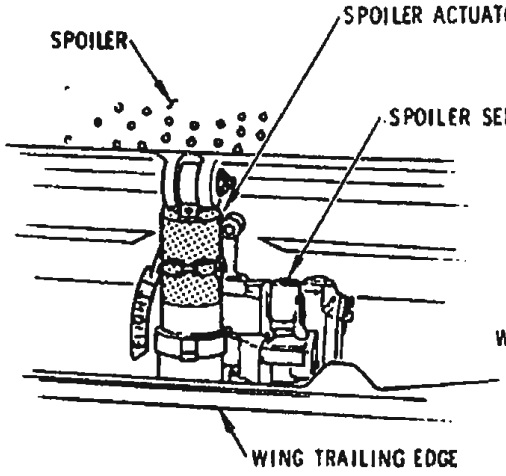
SPOILER LOCK SET (BG12) CONSISTS OF FOUR LOCK CONFIGURATIONS TO FIT 12 LOCATIONS ON AIRCRAFT
PN 1309656 FITS SPOILER 1
PN 1309663 FITS SPOILER 2
PN 1304843 FITS SPOILER 3 AND 4
PN 1304842 FITS SPOILER 5 AND 6



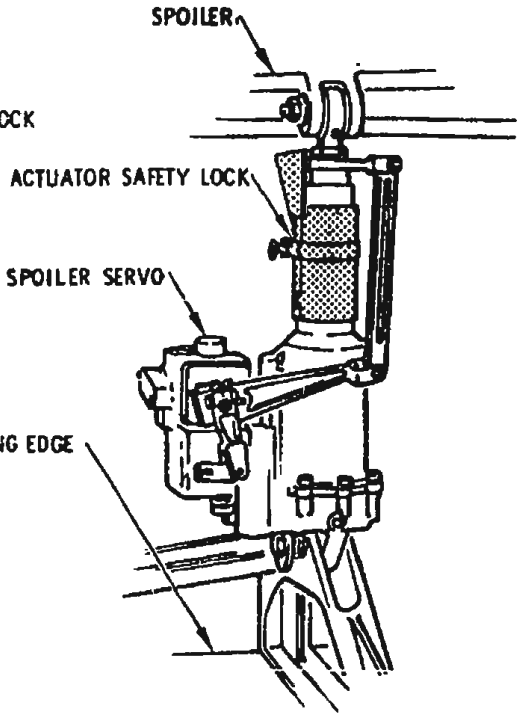
SPOILER ACTUATOR SAFETY LOCK (FOR SPOILERS 2 THROUGH 6)

SPOILER ACTUATOR SAFETY LOCK (FOR SPOILER 1)





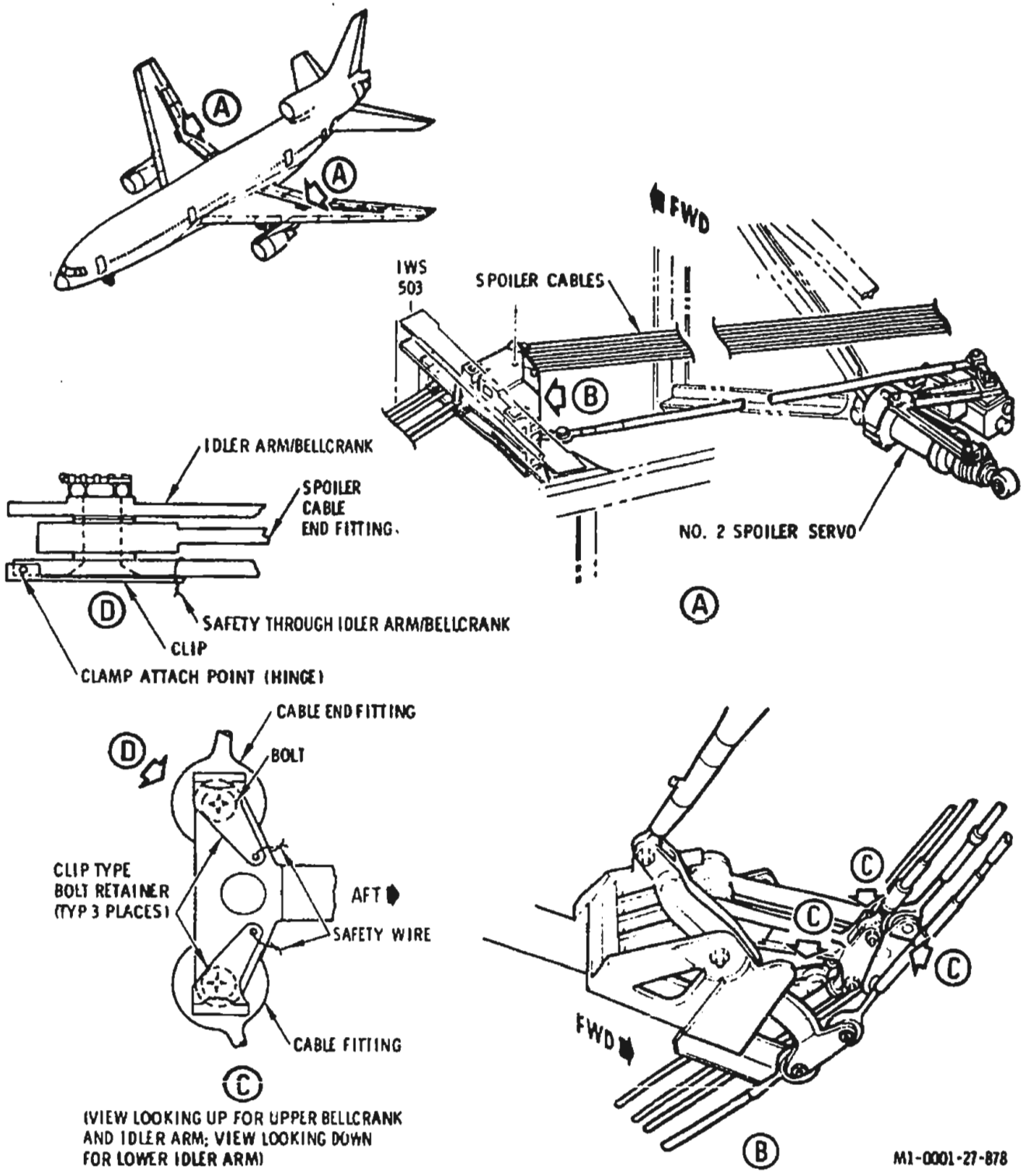
SPOILER LOCK SHOWN INSTALLED ON SPOILER 2 THROUGH 6 (VIEW LOOKING UP)



SPOILER LOCK SHOWN INSTALLED ON SPOILER 1 (VIEW LOOKING UP)

M1-0002-27-495

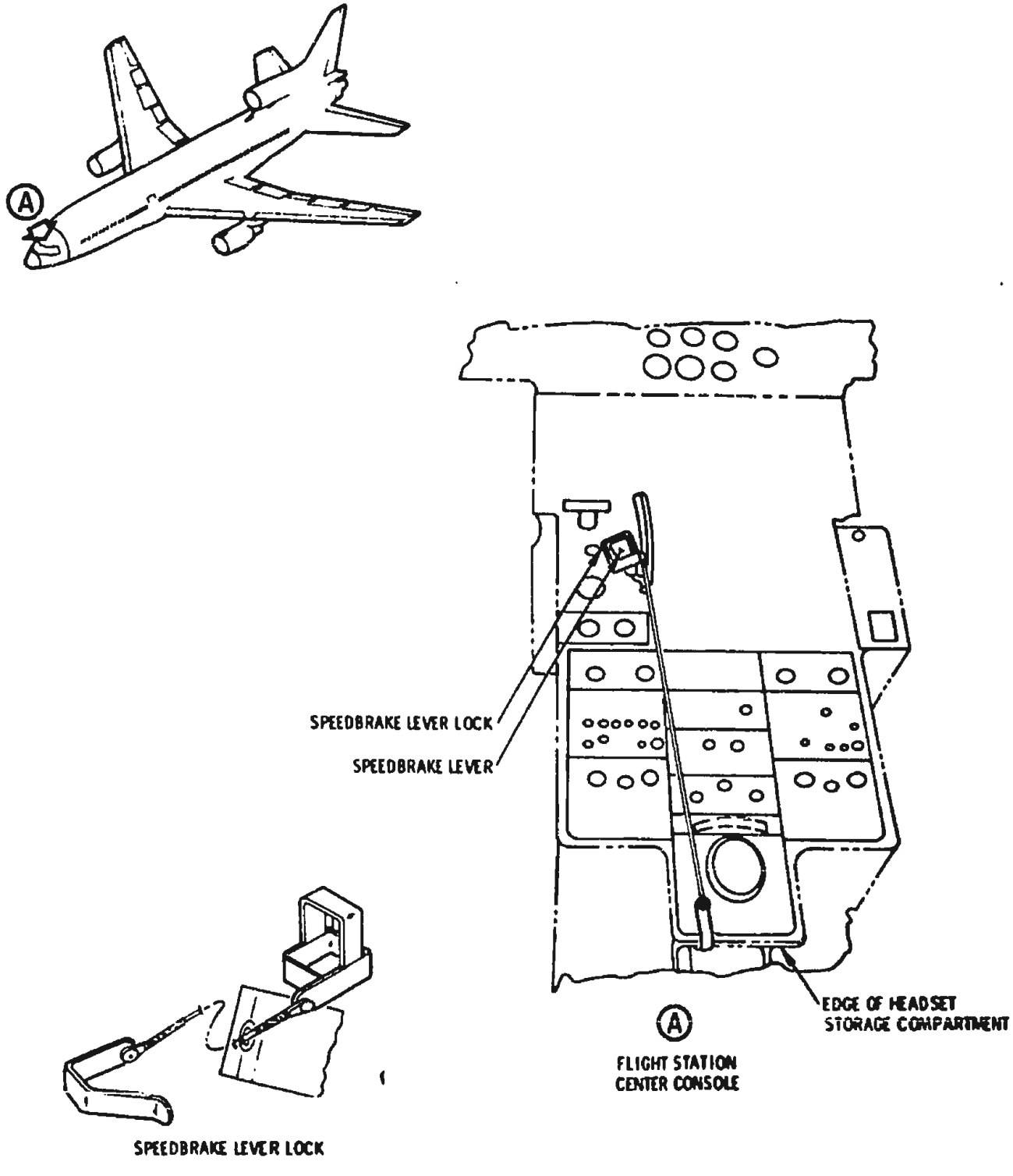
R Spoiler Safety Lock Installation
R Figure 201



R Spoiler Control Cable Idler Arm Bolt Retainer Installation
R Figure 202

EFFECTIVITY: ALL

001B



M1-0000-27-887

R R Speedbrake Lever Lock Removal and Installation
Figure 203

R R 001B EFFECTIVITY: ALL

SPOILER AND SPEEDBRAKE CONTROL SYSTEM - ADJUSTMENT AND TEST

1. General

This section contains procedures for BITE, operational, and functional tests (Ref. Para. 4) a quick rigging check (Ref. Para. 5), and a rigging check and adjustment (Ref. Para. 6).

2. Equipment and Materials

Tensiometer, Pacific Scientific PN 1601009-03, or equivalent

Aileron Support Tool, BF90, or equivalent

R Steel rule, 36 inch, or equivalent

Sealant, GE RTV 154 (conforming to Lockheed Material Spec. LCM 30-2085B, Type I), or equivalent.

Rig Pin Kit (wing control surface), PN B735, or equivalent

NOTE: Rig pin kit consists of the following 5/16-inch-diameter pins [except for R6A which is a stepped rig pin (5/16- and 3/16-inch diameter) and R6B (1/4-inch diameter) used on spoiler selector]:

RIG PIN	GRIP LENGTH (INCHES)	COLOR
R2	2	Red
R3	3	Green
R4	4	Yellow
R5	5	Brown
R6	6	Orange
R6A	6	
R6B	6	
R7	7	Black
R8	8	Clear

Lock-wire, Fed. Spec QQ-W-390, Cond A, 0.032 inch diameter, or equivalent

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	6-50-00	Interior Access Doors and Panels
	10-10-00	Parking - Maintenance Practices
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	27-51-00	Flap Control System - Adjustment and Test
	27-51-17	Flap Vane - Removal and Installation
	27-61-17	Spoiler Servo Control - Removal and Installation
	27-61-40	Spoiler No. 1, 2, and 3 Limiter Stop Assembly - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices
	29-21-00	Ram Air Turbine - Maintenance Practices

4. Adjustment/Test

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS IN SPOILER SERVO AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW HYDRAULIC SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS; OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

NOTE: With speedbrake lever full aft, and flaps positioned 4 degrees or more, if the control wheels are rotated to full left or right roll, a "bump" may be felt at the control wheel. This "bump" is normal and is caused by the spoiler mixer output linkage going overcenter. Note that conditions to cause this "bump" are normally only experienced during ground test procedures.

This section contains following procedures:

Spoiler Mode Control BITE Test, Para. 4A

Spoiler and Speedbrake Control System Operational test, Para. 4B

Spoiler Servo Shutdown Functional Test, Para. 4C

DLC Servo Manual Mode Operational Test, Para. 4D

DLC Null Functional Test, Para. 4E

4A. Spoiler Mode Control BITE Test

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breakers SPOILER DWELL - DC and AC (B7 and B8) are closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breakers PFCS ADS/DH (G8) and FLT CONT ALT ALERT (G9) are closed.

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN LANDING GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A, B, C, D (Ref. 29-11-00).

CAUTION: PRIOR TO GROUND OPERATION OF WING FLAPS, OBSERVE FOLLOWING TO PREVENT SPOILER SELECTOR DWELL ACTUATOR STALL:

AILERONS FAIRED ±10 DEGREES.

SPEED BRAKE LEVER WITHIN 2 INCHES OF 0 DEGREES.

(4) Verify that speedbrake handle is at 0 degrees (full forward).

(5) Position flap handle to 0 degrees (full forward).

(a) Verify that flaps are full up.

R (6) On overhead PFCS panel, verify all SPOILER switchlights are latched and switchlight OFF lights are off.

(7) Gain access to forward electronic service center and locate flight control auxiliary unit (FCAU) on lowest shelf of center rack.

(a) Verify the three SPOILER fault lights are off.

NOTE: In the following steps, hold switches in the selected position at least 20 seconds before considering the test a failure.

(8) On FCAU control panel, depress and hold MANUAL switch, then position and hold FLAP toggle switch to UP.

(a) Verify the three SPOILER fault lights stay out.

(9) While holding MANUAL switch depressed, position and hold FLAP toggle switch to DOWN; verify following:

(a) On FCAU panel: all three SPOILER fault lights come on (SELECTOR FAULT, MIXER FAULT, and SPOILER FAULT).

(b) On pilots caution and warning panel: the ROLL SPD BRAKES and FLT CONT PANELS lights flash for ten seconds and then go steady.

(c) On pilots overhead PFCS panel: SPOILER L5 & 6 and R5 & 6 PUSH lights come on.

(10) On FCAU, release MANUAL switch and FLAP switch. All lights that came on in Step 4A(9) must go off.

NOTE: FLT CONT PANELS light might not go off as light is energized from approximately 30 sources and a fault in any one of sources will keep this light on.

(11) Position flap handle to 4 degrees or more. Slats will fully extend and flaps will move to selected position.

(12) On FCAU, depress and hold MANUAL switch, then position and hold the FLAP toggle switch to DOWN. Verify all three SPOILER fault lights stay off.

(13) While holding MANUAL switch depressed, position and hold FLAP toggle switch to UP. Verify that lights which came on in Step 4A(9) come on again.

(14) Release MANUAL and FLAP switch. All lights that came on in Step 4A(9) must go off.

(15) Position flap handle to 0 degrees.

(16) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(17) Turn off electrical power if no longer required (Ref. 24-41-00).

4B. Spoiler and Speedbrake Control System Operational Test

This test determines if the spoilers are responding properly to speedbrake and roll inputs. Measurement of spoiler deflection is not required. However, minimum spoiler deflections are presented for information only.

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

SPOILER DWELL - DC and AC (B7 and B8)

26 VAC NAV EXCITATION

SURF POS IND (J23)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that following circuit breakers are closed:

SPOILER SERVO

A (2L) (J15)

B (1, 4, 6L&R) (J16)

C (3, 5L&R) (J17)

D (2R) (J18)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that following circuit breakers are closed:

IND LT

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN LANDING DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A, B, C, and D (Ref. 29-11-00).

(4) On pilots overhead panel, zone 210, verify that 6 SPOILER switchlights on PFCS panel are depressed (latched in).

(5) Verify flap handle is in 0-degree (full up) position.

(6) Move speedbrake lever fully aft to MAX position. Verify that spoilers 2 through 6 on both wings extend fully (55 to 63 degrees) and that spoiler pointers on surface position indicator (main instrument panel) follow spoiler extension.

(7) Move speedbrake lever fully forward to 0-degree position.

(a) Verify spoilers that extended in Step 4B(6) fully retract.

(8) Apply full left roll with control wheel and hold.

(a) Verify all spoilers on both wings remain fully down.

(9) Apply full right roll with control wheel and hold.

(a) Verify all spoilers on both wings remain fully down.

(b) Center control wheel.

(10) Position flap control handle to 4 degrees or more. Flaps will extend to selected position and slats will extend fully.

(11) Apply full left roll with control wheel and hold. Verify spoilers 2 through 6 on left wing extend, and all spoilers on right wing remain down.

(12) Apply full right roll with control wheel and hold. Verify spoilers 2 through 6 on left wing fully retract and spoilers 2 through 6 on right wing extend.

(13) Center control wheel. Verify spoilers 2 through 6 on right wing fully retract.

(14) Move speedbrake lever full aft to the MAX position. Verify spoilers 1 through 4 on both wings extend, and spoilers 5 and 6 on both wings remain down. (Full speedbrake will extend spoiler a minimum of 55 degrees.)

(15) Return speedbrake lever to full forward position. Verify spoilers 1 through 4 on both wings fully retract.

(16) Position flap handle to 0 degrees. Flaps and slats will fully retract.

(17) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(18) Turn off electrical power if no longer required (Ref. 24-41-00).

4C. Spoiler Servo Shutdown Functional Test

This test determines that solenoid shutoff valve on each spoiler servo is functioning properly.

(1) Accomplish Steps 4B(1) through 4B(4) to prepare spoiler system for operation.

(2) Verify speedbrake lever is full forward. All spoilers must be full down.

(3) Position flap handle to 4 degrees or more. Slats will fully extend and flaps will extend to selected position.

(4) Position speedbrake lever full aft to MAX.

(a) Verify spoilers 1 thru 4 on both wings fully extend.

(5) Position speedbrake lever full forward to zero.

(a) Spoilers 1 thru 4 on both wings must fully retract.

(6) On PFCS panel, release (out) SPOILER switchlights L&R1, L&R2, L&R3, and L&R4 to disable spoilers 1 thru 4 on both wings. Verify following:

(a) SPOILER switchlight L&R1, L&R2, L&R3, and L&R4 OFF light comes on.

(b) FLT CONT PANELS light on pilots caution and warning panel flashes.

(7) Move speedbrake lever fully aft to MAX.

(a) Verify Spoilers 1 thru 6 on both wings remain fully down.

NOTE: Spoilers 1 thru 4 on both wings are disabled by the solenoid shutoff valves. Spoilers 5 and 6 on both wings are dwelled (uncoupled) by the left and right selectors.

(8) Move speedbrake lever full forward.

(a) Verify all spoilers are fully retracted.

(9) On PFCS panel, depress (in) SPOILER switchlights L&R1, L&R2, L&R3, and L&R4.

(a) Verify that SPOILER switchlight L&R1, L&R2, L&R3 and L&R4 OFF lights go off.

(10) Position speedbrake lever full aft to MAX.

(a) Verify spoilers 1 thru 4 on both wings fully extend.

(11) Position speedbrake lever full forward to zero.

(a) Verify all spoilers are fully retracted.

(12) Fully retract flaps to couple spoilers 5 and 6 to speedbrake system. Wait 10 seconds for dwell actuators to cycle.

R (13) Move speedbrake lever full aft to MAX. Verify spoilers 2 through 6 on both wings extend.

(14) Move speedbrake lever full forward.

(a) Verify all spoilers are fully retracted.

(15) On PFCS panel, release SPOILER switchlights L5&6 and R5&6. Verify following:

(a) SPOILER switchlights L5&6 and R5&6 OFF lights come on.

(b) FLT CONT PANELS light flashes.

(16) Move speedbrake lever full aft to MAX. Verify following:

(a) Spoilers 5 and 6 on both wings remain fully down.

(b) Spoilers 2, 3, and 4 on both wings extend.

(17) Move speedbrake lever full forward.

(a) Verify all spoilers are fully retracted.

(18) On PFCS panel, depress SPOILER switchlights L5&6 and R5&6.

(a) Verify spoiler switchlights L5&6 and R5&6 OFF lights go off.

(19) Move speedbrake lever full aft to MAX.

(a) Verify spoilers 2 through 6 on both wings extend.

(20) Move speedbrake lever full forward to zero.

(a) Verify all spoilers are fully retracted.

(21) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(22) Turn off electrical power if no longer required (Ref. 24-41-00).

4D. DLC Servo Manual Mode Operational Test

Normally, speedbrake control lever movement is hydraulically boosted in the Direct Lift Control (DLC) servo to position spoiler servos. Manual position inputs can be provided to the spoiler servos (through the DLC) and in the event

hydraulic systems A and B are lost, or the pilot shuts off hydraulic systems A and B supply to the DLC servo by depressing the pushbutton switch on top of the speedbrake lever. This test determines if manual mode override function of the DLC servo is operating properly.

NOTE: If the speedbrake lever is positioned full aft and the pushbutton switch on the speedbrake lever is depressed, the DLC servo will position speedbrake lever full forward; however, the speedbrake lever may require a slight forward push to return it to its stowed position.

(1) On pilots overhead circuit breaker panel CB1, verify the following circuit breakers are closed:

FCES COMPUTER - DC and AC & L AOA (B4,B5)

SPOILER DWELL - DC and AC (B7,B8)

SURF POSN IND (J23)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify all four SPOILER SERVO circuit breakers are closed (K15 through K18).

On Flight Engineer/Second Officers aft circuit breaker panel CB3, verify circuit breakers PFCS ADS/DH (G8), and FLT CONT ALT ALERT (G9) are closed.

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on all four hydraulic systems (Ref. 29-11-00).

(4) Verify engine power control levers are at idle (fully aft).

(5) Verify flaps are extended 4 degrees or more.

(6) On overhead PFCS panel, verify all SPOILER pushlights are depressed (in).

(7) Verify lights on top of the speedbrake lever are off.

(8) Position speedbrake lever from 0 to MAX (spoilers 1 through 4 on both wings will fully extend). Note force to move speedbrake lever is approximately 3 to 5 pounds.

(9) Return speedbrake lever to 0 degrees. (Spoilers 1 through 4 on both wings will fully retract).

(10) Depress and release pushbutton switch on top of speedbrake lever.

(a) Lights on speedbrake lever must come on, indicating hydraulic systems A and B to DLC servo have been shut off.

(11) Move speedbrake lever from 0 degrees to MAX (spoilers 1 through 4 on both wings will fully extend). Note force to move speedbrake lever has increased (force to move lever will be approximately 20 pounds at 0 degrees and increase to 35 pounds maximum at MAX position). Due to system frictions, spoilers may not extend as far as specified in Step 4D(8).

NOTE: With flaps fully retracted, force to move the speedbrake lever will be approximately 21 pounds at zero and increase to 46 pounds maximum at MAX position. This is caused by additional spoiler servos being controlled with flaps full up.

(12) Return speedbrake lever to 0 degrees (spoilers 1 through 4 on both wings will fully retract).

(13) Depress and release pushbutton switch on speedbrake lever.

(a) Lights on speedbrake lever must go off.

(14) Cycle speedbrake lever from 0 degrees to MAX and back to 0 degrees.

(a) Verify force to operate speedbrake lever returns to normal (3 to 5 pounds).

(15) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(16) Turn off electrical power if no longer required (Ref. 24-41-00).

R 4E. DLC Null Functional Test

R This test determines whether or not DLC spoiler panels are deflecting to their required tolerance with DLC/AUTO SPLR selected. Measurements of spoiler deflection will be needed to determine if system adjustments or rerigging are necessary.

R (1) Install landing gear down lock safety pins (Ref. 10-10-00).

R (2) Install RAT safety lock (Ref. 29-21-00).

R (3) On Flight Control Electronic System (FCES) panel, unlatch DLC/AUTO SPLR switchlights 1 and 2.

R (4) Verify flap handle is in zero degree (full up) position.

R (5) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

R SPOILER DWELL - DC (B7) and AC (B8)

R SURF POS IND (J23)

R On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

R MANUAL CABIN PRESS CONTROL - FWD (H1) and AFT (H2)

R AIR OVBD (J14)

R RAT AUTO DEPLOY (L3)

R On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify the following circuit breakers are closed:

R DLC SERVO A (H14)

R 2L (J15)

R 1, 4, 6 L&R (J16)

R 3, 5 L&R (J17)

R 2R (J18)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following circuit breakers:

TRUCK LEVEL (F16)

DLC SERVO B (H15)

BAT CHG INTLK (L6)

MLG GRD SENSE (L8)

RUD FUS SYS (L16)

NOTE: Opening MLG GRD SENSE circuit breaker will simulate an aircraft airborne condition.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify the following circuit breakers are closed:

PFCS ADS/DH (G8)

FLT CONT ALT ALERT (G9)

(6) Apply electrical power (Ref. 24-41-00).

C WARNING: THE STALL WARNING SYSTEM MAY INHIBIT FURTHER
C COMPLETION OF THE DLC NULL FUNCTION TEST DUE TO
C THE AOA (ANGLE-OF-ATTACK) SENSOR OUTPUT TO THE
C DLC.

C REF: 22-17-00 PG 2 THRU 11, STALL WARNING SYSTEM
C AND PAR 2B(2).

C NOTE: Observe warning on AOA (Angle-of-Attack) Sensor
C Handling 22-17-05, Pg 509. Position left probe until
C forward edge of probe (mid point between rows of
C holes) is full up, (no stall).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

C NOTE: 1) The horizontal stabilizer must be rigged and
C operational prior to performing the test.

C 2) Remove the +1 pins, control column lock, apply A
C through D hydraulic system pressure and cycle
C stabilizer five times, then move stabilizer to "0"
C degree position.

C 3) Spoilers will not deploy within limits as

C specified in 27-61-00 page 512, paragraph 4E if the
C above procedure is not followed.

WARNING: PITCH TRIM WHEEL SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN LANDING GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Apply hydraulic pressure to systems A through D (Ref. 29-11-00).

CAUTION: WHEN EXTENDING OR RETRACTING WING FLAPS (OR WHEN OPERATING FLAP UP/DOWN SWITCH ON FLIGHT CONTROL AUXILIARY UNIT), AILERONS MUST BE HYDRAULICALLY "ON" AND IN NEUTRAL POSITION TO PREVENT ACTUATOR BURNOUT ON SPOILER MIXER AND SELECTOR UNITS.

(8) Place flap handle to 33 degree position (flaps and slats will extend).

(9) Verify throttle levers are at idle position.

(10) On FCES panel, activate (latch in) DLC AUTO/SPLR switchlight 1.

NOTE: The speedbrake lever will move to middle of DLC range (DLC Null) as indicated by the rear edge of the speedbrake lever, then stop.

(11) Verify DLC spoiler panels 1 through 4 on both wings deploy as follows:

(a) Number 1 to 6.5 (+1) (-0.9) degrees.

(b) Numbers 2 through 4 to 7.0 (±1) degrees.

(c) Spoiler Surface Position Indicator will indicate approximate middle of DLC range.

(d) DLC/AUTO SPLR system 1 FAIL light is off.

R NOTE: It is permissable to displace the control
R column and return it to the trim position
R to obtain the required spoiler panel
R displacement.

Should spoiler panels fail to deploy within their required tolerances, system adjustments or rerigging may be necessary (Ref. 27-61-00, 501 Step 6I).

(12) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, remove tag and close circuit breaker DLC SERVO B (H15) and open and tag circuit breaker DLC SERVO A (H14).

(13) On FCES panel, latch in DLC/AUTO SPLR switch 2.

NOTE: The speedbrake lever will move to middle of DLC range (DLC Null) as indicated by the rear of the speedbrake lever, then stop.

(14) Verify DLC spoiler panels 1 through 4 on both wings deploy as follows:

(a) Number 1 to 6.5 (+1) (-1.5) degrees.

(b) Numbers 2 through 4 to 7.0 (+1) (-1.6) degrees.

(c) Spoiler Surface Position Indicator will indicate approximate middle of DLC range.

(d) DLC/AUTO SPLR system 2 FAIL light is off.

R R R R NOTE: It is permissable to displace the control column and return it to the trim position to obtain the required spoiler panel displacement.

Should spoiler panels fail to deploy within their required tolerances, system adjustments or rerigging may be necessary (Ref. 27-61-00, 501 Step 6I).

(15) Position flap handle to zero degree (full up) position (flaps and slats will fully retract).

NOTE: Speedbrake handle will return to its full forward position when flaps retract to less than 30 degrees.

(16) Verify spoiler panels 1 through 4 on both wings are fully down.

(17) Remove tags and close all circuit breakers opened in Step 4E(5).

(18) Remove hydraulic power if no longer required (Ref. 29-11-00).

(19) Remove electrical power if no longer required (Ref. 24-41-00).

(20) Remove RAT safety lock (Ref. 29-21-00).

(21) Remove landing gear down lock safety pins (Ref. 10-10-00).

5. Quick Rigging Check

A quick rigging check is provided to determine, in a minimum number of steps, if spoilers are in acceptable rig condition. If spoiler full down position or spoiler minimum extended position is out of rig, perform the associated detailed rigging check and adjustment procedures, Section 6A through 6I.

A. Spoiler Quick Rigging Check

(1) Verify that following circuit breakers are closed:

(a) On the pilots overhead circuit breaker panel CB1, zone 210:

SPOILER DWELL - DC and AC (B7 and B8)

SURF POS IND (J23)

(b) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

SPOILER SERVO A, B, C, and D (J15 through J18)

(c) On the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

PFCS/ADS/DH (G8)

FLT CONT ALT ALERT (G9)

(2) Turn on electrical power (Ref. 24-41-00).

(3) For spoiler measuring reference, mark the torque box adjacent to each spoiler on both wings just opposite the junction point of spoiler trailing edge and three-inch trailing edge metal seal. For spoilers 1 and 2, use torque box No. 2 for measuring reference (outboard edge for No. 1 spoiler; inboard edge for No. 2 spoiler). For aileron measuring reference, mark the

inboard aileron inboard lower edge directly opposite index mark (red paint-filled dimple) on No. 3 flap torque box of both left and right inboard ailerons.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on all four hydraulic systems (Ref. 29-11-00).

R (5) Position flaps to 10 degrees.

(6) Verify roll trim wheel is set at zero.

(7) Verify that DLC lights on speedbrake lever are off (DLC active).

(8) Operate speedbrake lever from zero to MAX three times to stabilize control system.

(a) Return speedbrake lever to zero.

WARNING: DO NOT MOVE CONTROLS THAT MAY CAUSE FLIGHT CONTROL SURFACE MOVEMENT WHILE SPOILER MEASUREMENTS ARE BEING MADE. CONTROLS THAT MAY CAUSE DANGEROUS SURFACE MOVEMENTS INCLUDE CONTROL WHEEL, FLAP AND SPEEDBRAKE LEVERS, CIRCUIT BREAKERS AND SWITCHES ON THE FLIGHT CONTROL AUXILIARY UNIT (FCAU).

(9) On spoilers 1 and 2 verify light contact between flap vane and spoiler rub strip. On spoilers 3 through 6 verify the gap between flap vane and spoiler is 0.20 inch minimum at the outboard end of spoilers 3 and 5 and inboard end of spoilers 4 and 6.

(10) Position flaps full down.

(11) On Pilots overhead PFCS panel, unlatch all spoiler switchlights.

(12) Verify spoiler trailing edge upper contour on panels 1 and 2 on both wings are 0.12 to 0.18 inch below flap
C torque box upper skin contour. Verify spoiler trailing
C edge upper contour on panels 3 thru 6 on both wings are
C 0.12 to 0.18 inch below flap torque box upper contour.
C Spoiler panels 3 thru 6 may be rigged above the 0.12
C inch position in order to maintain the 0.20 inch
C minimum clearance with the flap vane [Ref. Step 5A(9)
C above]. Record full down dimension for any spoilers.

(13) On Pilots overhead PFCS panel, latch all spoiler switchlights.

NOTE: On spoiler panels 1 and 2, spoiler panel twist may prevent maintaining 0.12 to 0.18 inch dimension on both ends; check low end only for
CR 0.12 to 0.18 inch dimension. The opposite end
CR of the spoiler panel may protrude a maximum of
CR 1.25 inches above contour for in-service
CR aircraft.

(14) Check extension of spoilers 2 thru 6 in roll mode as follows:

(a) Rotate control wheel full left; verify that spoiler panels 2 thru 4 on left wing extend a minimum of 40 degrees and a maximum of 54 degrees and spoiler panels 5 and 6 on left wing extend a minimum of 38.5 degrees and a maximum of 54 degrees.

NOTE: Measure spoiler deflection from junction point of spoiler trailing edge and metal seal to reference mark on flap torque box.

• Linear dimension for spoiler deflection of 40 degrees is as follows: spoiler 2 is 21.6 inches; spoiler 3 is 18.8 inches; spoiler 4 is 15.5 inches.

• Linear dimension for spoiler deflection of 38.5 degrees is as follows: spoiler 5 is 14.6 inches; spoiler 6 is 12.4 inches.

• Linear dimension for spoiler deflection of 54 degrees is as follows: spoiler 2 is 28.7 inches; spoiler 3 is 24.9 inches; spoiler 4 is 20.5 inches; spoiler 5 is 20.1 inches; spoiler 6 is 17.1 inches.

(b) Rotate control wheel to full right; verify that spoiler panels 2 thru 4 on right wing extend a

minimum of 40 degrees and a maximum of 54 degrees and spoiler panels 5 and 6 on right wing extend a minimum of 38.5 degrees and a maximum of 54 degrees.

(c) Allow control wheel to return to neutral.

(15) Check extension of spoiler panels 1 thru 6 in the speedbrake mode as follows:

(a) With flaps positioned full down, move speedbrake lever aft to MAX position. Verify that No. 1 spoiler panel on both wings extends a minimum of 55 degrees (29.2 inches).

(b) Return speedbrake lever to full forward position.

(c) On FCAU place FLAPS UP/DOWN switch in UP position and depress and hold FCAU MANUAL test switch. Switch must remain depressed until Step 5A(15)(e) is completed. Wait 10 seconds for mixer and selector actuators to cycle before proceeding to next step.

NOTE: Flaps must remain extended to 10 or more degrees.

(d) Move speedbrake lever to MAX position. Verify minimum extension of spoilers as follows:

SPOILER (L & R)	MINIMUM DEFLECTION ANGLE (DEGREES)	MINIMUM DIMENSION BETWEEN SPOILER T.E. AND FLAP TORQUE BOX REFERENCE MARK (INCHES)
2	55	29.2
3	55	25.4
4	54	20.5
5	50	18.75
6	50	15.8

(e) Return speedbrake lever to full forward position.

(f) On FCAU release MANUAL test switch.

(16) Check spoiler full down position. Verify that spoiler panel full down position recorded in Step 5A(12) has not changed. If spoilers 1, 2, 5 or 6 move up from

recorded position of Step 5A(12), accomplish Flap Vane-to-Spoiler Contact Check (Ref. 27-51-00, Adjustment and Test).

(17) If any one of the four spoiler requirements are not met (spoiler full down position, minimum spoiler extension in roll mode, maximum spoiler extension in roll mode, or minimum spoiler extension in speedbrake mode), perform detailed rigging check and adjustment procedure for affected spoilers (Ref. Paragraph 6). If spoiler No. 1 is out of rig, accomplish Paragraph 6C. If spoiler No. 2 or 3 is out of rig, accomplish Paragraph 6G. If spoiler No. 4, 5, or 6 is out of rig, accomplish Paragraph 6H.

(18) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(19) Shut off electrical power if no longer required (Ref. 24-41-00).

6. Rigging Check and Adjustment

Rigging check and adjustment procedures are presented separately for each part of the spoiler and speedbrake control system. The procedure for each part may be performed without disturbing other parts of the system. However, the completion check procedure must be performed after any rigging check or adjustment. The procedures for individual parts are as follows:

PROCEDURES	PARAGRAPH
Preparation	6A
Speed Brake Control Lever to DLC Servo	6B
DLC SERVO to Spoiler No. 1 Servos	6C
DLC SERVO to Left and Right Mixers	6D
Right Mixer Output to Spoilers 2 and 3, Fuselage Area	6E
Left Mixer Output to Spoilers 4, 5, and 6, Fuselage Area	6F
Right Mixer to Spoilers 2 and 3, Wing Area	6G
Left Mixer to Spoilers 4, 5, and 6, Wing Area	6H

PROCEDURES	PARAGRAPH
DLC Null Adjustment	6I
Completion Check	6J

WARNING: PROPER OPERATION OF SPOILER MIXER ASSEMBLY DEPENDS ON CORRECT ASSEMBLY AND ADJUSTMENT OF THE MIXER ASSEMBLY IN THE OVERHAUL SHOP. DO NOT TAMPER WITH OR MAKE ANY ADJUSTMENT ON THE MIXER ASSEMBLY UNLESS SPECIFICALLY DIRECTED BY MAINTENANCE MANUAL.

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

NOTE: Aircraft structure and cable temperatures must be stabilized.

The spoilers may be rigged with aircraft on or off jacks.

The spoilers may be rigged with or without both wing engines or simulated engine weights installed. The spoilers should not be rigged with only one wing engine or simulated engine weight installed.

Do not operate air conditioning equipment when cables are to be rigged.

After a cable adjustment, operate speedbrake lever through a minimum of five cycles to stabilize cable system, before making final rigging check.

Some cables are covered with polyolefin clear tubing to protect cables from corrosive spillage. When checking cable tension, verify that tensiometer is NOT positioned on polyolefin tubing area of the cable or results will be erroneous.

Rig Pin Requirements:

Spoiler system rigging is normally accomplished with hydraulic power off for safety reasons. Rig pin fit requirements during rigging usually specifies a free rig pin fit. However, when hydraulic power is turned on, some of the rig pins may not fit freely into their

respective bellcranks. Except for the DLC servo-to-mixer rigging (where a free rig pin fit is mandatory), a free rig pin fit is desirable but not mandatory during final spoiler rigging. In those positions where the 5/16-inch rig pin can be freely inserted with hydraulic power off but not with it on, if spoiler full down position and spoiler minimum extensions are within tolerance, it is acceptable if a 9/32-inch rig pin can be freely inserted.

Hydraulic Power Requirements:

Turning off hydraulic power to rig the spoiler system may be impractical in some cases as other system technicians may need hydraulic power to complete their tasks. All spoiler rigging can be accomplished with hydraulic power on, however, extreme precautions should be taken; they include:

(a) Tag speedbrake handle, flap handle and control wheel to prevent inadvertent movement.

(b) Verify that travel areas of affected spoilers are clear of personnel and equipment.

(c) Operate disconnected control system with extreme care as small control inputs can cause large spoiler deflections.

(d) Verify that all rig pins are removed before operating system.

6A. Preparation

(1) Shut off all four hydraulic systems (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

6B. Speed Brake Control Lever to DLC SERVO - Rigging Check and Adjustment

(1) Open access door 112AB to forward electronic service center and access door from galley to mid electrical service center.

(2) Remove control cable access panels in forward cargo compartment ceiling at the following locations (Ref. 6-50-00):

(a) FS 499, left BL 36 (125DL)

(b) FS 519, left BL 33 (125EL)

(c) FS 557, left BL 36 (125PL)

(3) Remove control cable access panels in galley ceiling at the following locations:

(a) FS 799, left BL 36 (135BL)

(b) FS 819, left BL 33 (135DL)

(c) FS 931, left BL 36 (135FL)

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(4) Manually hold speedbrake control lever full forward against stop (0-degree position). Rig pin R3 must fit freely through cable quadrant (1) (Ref. Fig. 501). If not, adjust pushrod (2).

(5) With rig pin in cable quadrant (1), rig pin R3 must fit freely through cable quadrant (3), and cable tension must conform to chart of Fig. 501. If not, adjust turnbuckles (4) and (5) in forward cargo compartment.

NOTE: After a cable adjustment, operate speedbrake lever through a minimum of three cycles to stabilize cable system, before making final rigging check.

(6) With rig pin installed in cable quadrant (1) and (3), rig pin R3 must fit freely through cable quadrant (6), and cable tension must conform to chart of Fig. 501. If not, adjust turnbuckles (7) and (8).

(7) Remove rig pin from cable quadrant (3).

(8) With rig pin installed in cable quadrant (1) and (6), rig pin R3 must fit freely through aft cable quadrant (9) in hydraulic service center, and cable tension must conform to chart of Fig. 501. If not, adjust turnbuckles (10) and (11) in mid electrical service center.

(9) Remove all rig pins. Verify that all turnbuckles are safetied.

(10) On Flight Engineer/Second Officers circuit breaker panel CB2, zone 215, verify that circuit breakers DLC SERVO - A and B (H14 and H15) are closed.

(11) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN LANDING DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(12) Turn on hydraulic system A and B (Ref. 29-11-00).

(13) Verify that speedbrake control lever on pilots center console is full forward (0-degree spoilers).

(14) Verify that DLC is in a normal hydro-powered mode. Indicator lights on speedbrake lever must be off. If lights on the lever are on, indicating DLC in manual override, depress button on speedbrake lever and release; lights on speedbrake lever must go off.

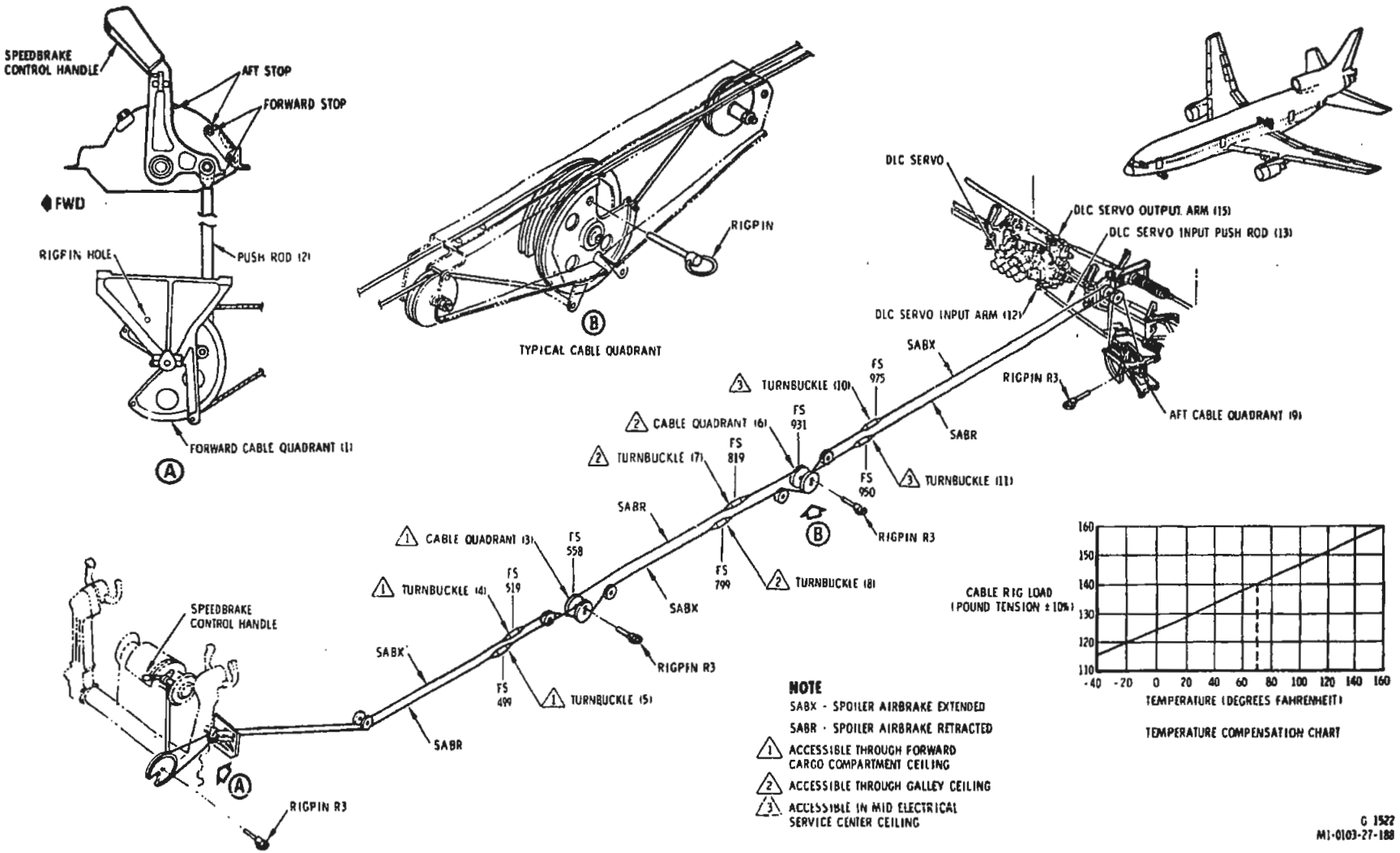
(15) In hydraulic service center, insert rig pin R3 in bracket and aft cable quadrant (9).

(16) Remove bolt and disconnect DLC servo input pushrod (13) from DLC servo input arm (12).

(17) Manually rotate DLC input arm (12) slowly towards spoiler up position (clockwise, looking up). Determine when the DLC output arm located on top of DLC servo starts to move. Slowly rotate DLC input arm towards spoiler down position (counterclockwise, looking up) 0.06 to 0.10 inch back from threshold. Bolt must now slip freely through DLC input arm and input pushrod. If not, adjust pushrod to meet above requirements. Reconnect pushrod to DLC input arm (12).

NOTE: An alternate method is to adjust pushrod to position DLC input arm so that DLC output arm is just at threshold, then lengthen pushrod 1.5 turns.

(18) Remove all rig pins.



Speedbrake Control Lever to DLC Servo
Rigging check and Adjustment
Figure 501

R EFFECTIVITY: ALL
R
001B

NOTE: Following any rigging adjustment to the spoiler system, perform a DLC Null Functional Test to ensure DLC Null Angles are within limits (Ref. 27-61-00 Para. 4E).

(19) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(20) Close access panels and doors opened in Steps 5B(1), 5B(2), and 5B(3).

6C. DLC Servo to Spoiler No. 1 Servos - Rigging Check and Adjustment

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN LANDING DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic system A and B (Ref. 29-11-00).

(2) Verify speedbrake control lever on the pilots center console is in the 0-degree position and flaps are fully extended.

(3) Open access panels 541CB and 641CB to gain access to No. 1 spoiler servos in each wing (Ref. 6-40-00).

(4) Verify spoiler No. 1 on each wing is in full down position (servo piston bottomed).

(5) Verify there is clearance between servo input arm and servo down stop. If not, disconnect controlex cable from arm on servo making contact with stop (Ref. Fig. 502, Sheet 1, View D).

(6) Verify DLC servo output arm is against DLC internal down stop as follows:

Interrupt DLC hydraulic power by depressing and releasing the override button on speedbrake lever twice. Verify that DLC output arm does not move. If

DLC output arm moves, check speedbrake lever to DLC servo rigging (Ref. Para. 6B).

C NOTE: Switching of power to the DLC by depressing and releasing the speedbrake lever override button may cause a slight oscillation or pulsing to the output arm during turn-on.

(7) Turn off hydraulic power.

(8) With DLC output arm (15) against internal downstop, rig pin R3 must fit freely through torque tube lower arm (16) and bracket. If not, adjust pushrod (17) (Ref. Fig. 502, Sheet 1).

NOTE: Rig pin in arm (16) must be a free fit to ensure mixer bias spring load (of approximately 40 pounds) is supported by the DLC-to-mixer linkage. This ensures all lost motion is removed from DLC-to-mixer linkage.

(9) With rig pin installed in torque tube lower arm (16), rig pin R3 must fit freely through torque tube lower arm (18) in left main wheel well. If not, adjust bungee (19) length. Remove rig pin from arm (18).

(10) With rig pin installed in torque tube lower arm (16), and No. 1 spoiler servo actuators fully retracted (piston bottomed), input arm (21) (left and right wings) must be 0.008 (±0.005) inch from spoiler servo external downstop (clockwise stop, viewed from bottom). If not, adjust locknuts (20) that clamp controlex cable to wing bracket.

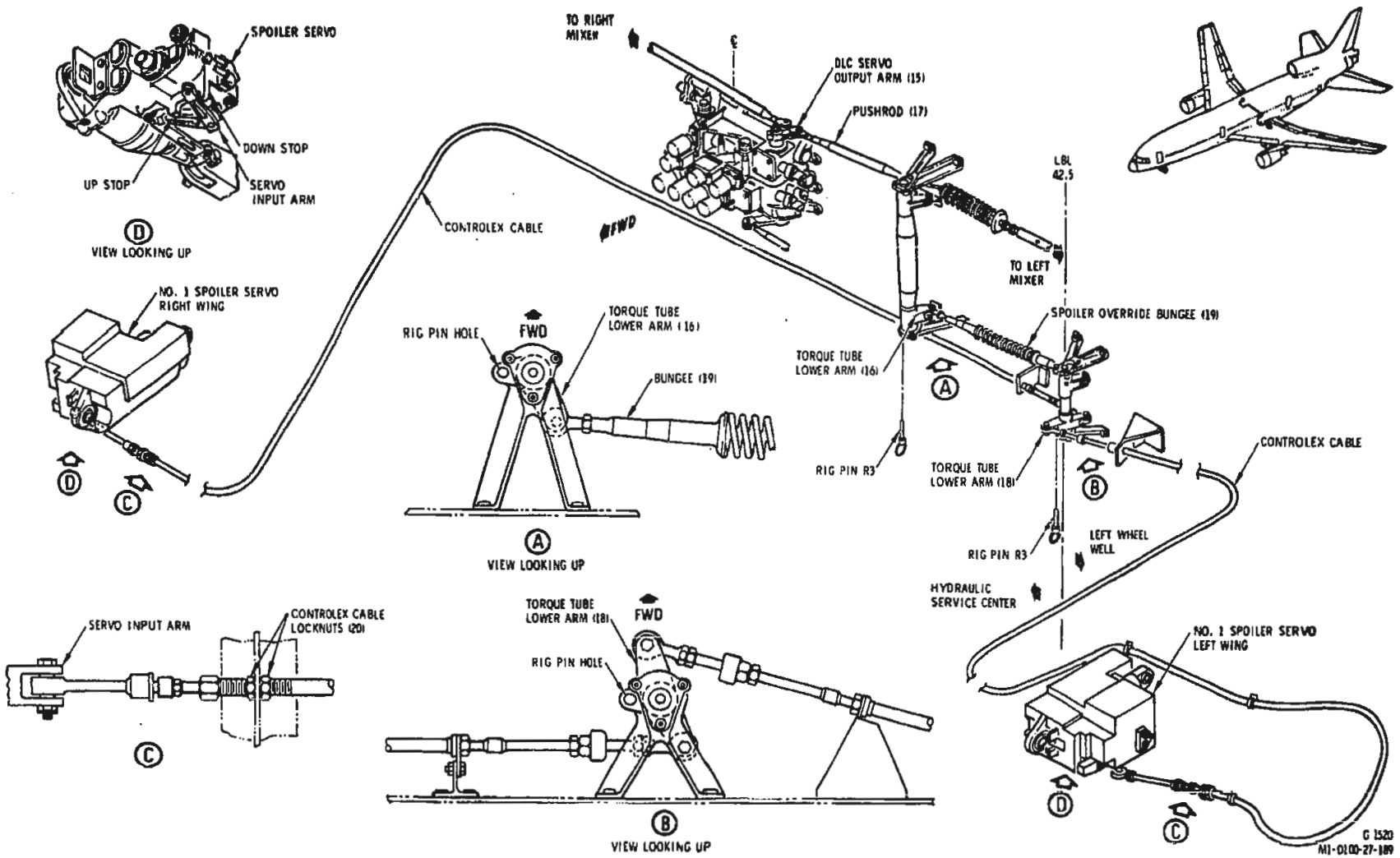
NOTE: If controlex cable was disconnected from servo arm in Step 6C(5), adjust controlex cable to meet requirements of Step 6C(10) with controlex cable reconnected to servo input arm.

(11) Remove all rig pins.

CAUTION: DO NOT RELEASE ANY SPOILER SWITCHLIGHTS ON OVERHEAD PFCS PANEL WITH SPOILERS EXTENDED AND HYDRAULIC PRESSURE ON. RAPID RETRACTION OF SPOILERS WITH NO LOAD CAN DAMAGE SPOILER SERVO.

(12) Turn on hydraulic systems A and B (Ref. 29-11-00). Verify following:

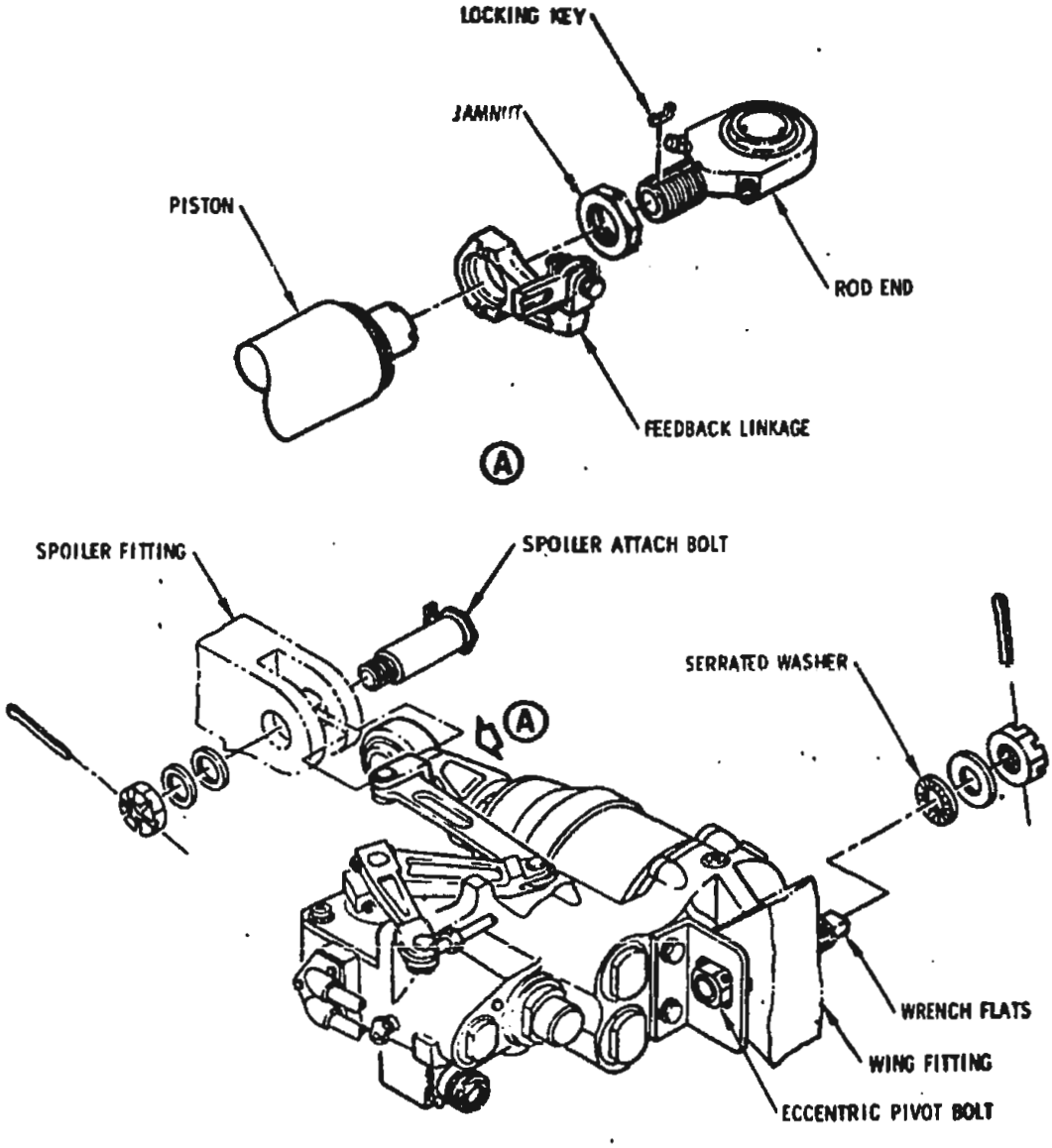
(a) No. 1 spoiler servos must not retract or extend (spoiler panel trailing edge must not move up or down from the hydraulic-off rigged position).



CR DLC Servo to Spoiler No. 1 Servos - Rigging Check and Adjustment
CR Figure 502 (Sheet 1)

EFFECTIVITY: ALL

001B

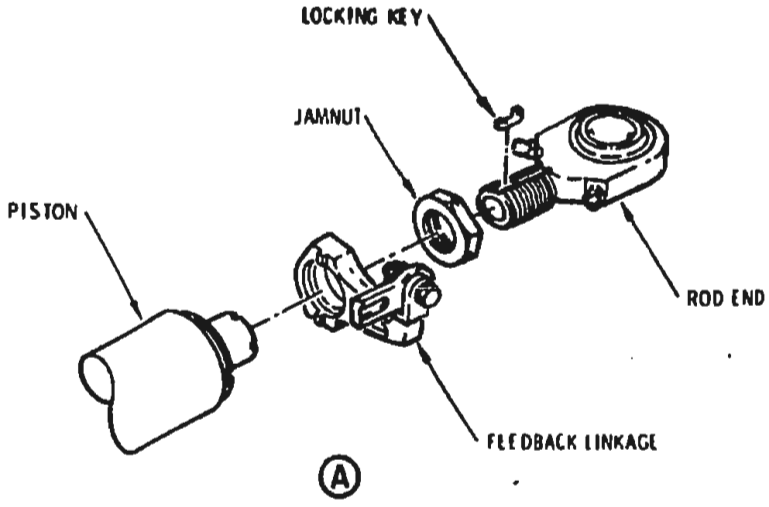


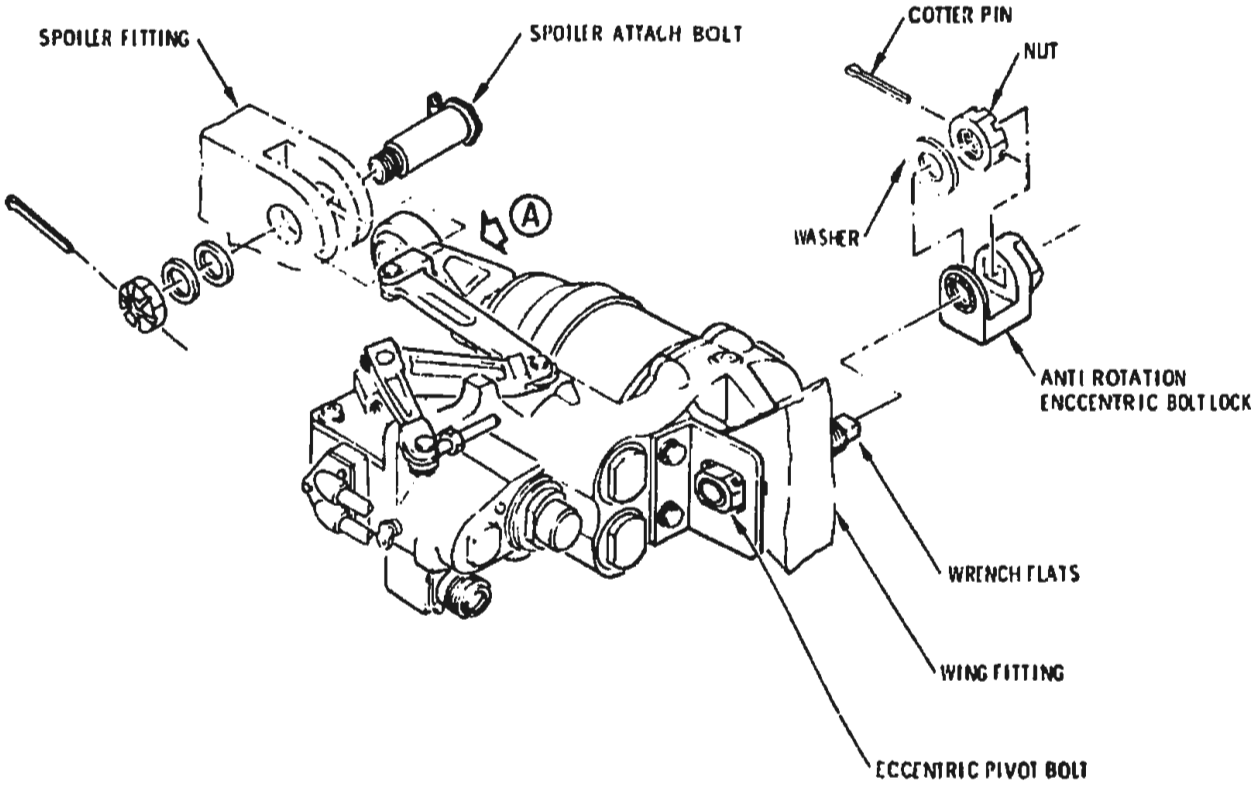
M1-0103-27-335

CR DLC Servo to Spoiler No. 1 Servos - Rigging Check and Adjustement
CR Figure 502 (Sheet 2)

EFFECTIVITY: WITHOUT SB27-245

001B





M1-0000-27-1131

CR DLC Servo to Spoiler No. 1 Servos - Riggin Check and Adjustment
CR Figure 502 (Sheet 2)

EFFECTIVITY: WITH SB27-245

(b) On PFCS panel, release (out) SPOILER L&R1 switchlight. No. 1 spoiler panel trailing edge must not move down more than 0.06 inch. Depress (in) SPOILER switchlight L&R1.

(c) If requirements of Steps 6C(12)(a) and 6C(12)(b) cannot be met, recheck spoiler rigging per Steps 6C(1) through 6C(11). If rigging checks out correctly, replace spoiler servo (Ref. 27-61-17).

(13) Verify speedbrake control lever on pilots center console is full forward (0-degree position) and flaps are fully extended (use system C for flap operation).

(14) With servo input arm (21) 0.008 (±0.005) inch from servo downstop, verify spoiler trailing edge upper contour is 0.12 to 0.18 inch below flap torque box upper contour. If not, adjust as follows:

NOTE: If 0.12 to 0.18 dimension cannot be held on both ends of spoiler, rig low end only to this dimension. Do not use three-inch metal trailing edge seal on spoiler for checking contour.

C The inboard rub strip may be moved 8 inches
C inboard from the original position to raise the
C spoiler inboard end.

(a) Shut off hydraulic power (Ref. 29-11-00).

(b) Remove eccentric pivot bolt cotter pin (Ref. Fig. 502, Sheet 2).

(c) Loosen castellated nut and disengage serrated washers (or on aircraft with SB27-245, serrations on anti-rotation eccentric bolt lock).

C (d) Rotate eccentric bolt to bring spoiler into the
C lowest possible position.

C NOTE: The spoiler is set full down with the
C eccentric bolt and adjusted with the
C actuator rod end. This assures
C spoiler-to-vane clearance in the case the
C bolt lock washer fails.

(e) Engage serrated washers (or on aircraft with SB27-245, serrations on anti-rotation eccentric bolt lock).

(f) While holding eccentric bolt in position, torque nut 270 to 300 lb in. Install cotter pin.

C (g) Adjust spoiler to the proper position per Step
C (15).

(15) If eccentric bolt does not bring spoiler into contour, adjust servo rod end as follows:

(a) Loosen rod end jam nut until locking key is disengaged (Ref. Fig. 502, Sheet 2). While loosening jamnut, hold piston rod against rotation (use wrench flats on feed back link next to rod end).

(b) Remove servo to spoiler attach bolt.

(c) Rotate rod end one half to a maximum of two turns to lengthen or shorten, as needed, to bring spoiler into contour. Do not allow piston to
CR rotate and twist feedback linkage. Final rod end
CR adjustment must be within the range of minus 1 to
CR plus 5 threads showing through jamnut. Minimum
C thread engagement must be maintained. If
C necessary, the spoiler eccentric bolt may be
C adjusted to set spoiler with respect to the torque
C box.

(d) Reinstall servo to spoiler attach bolt, washer, and nut. Install cotter pin.

NOTE: To prevent water from entering piston rod, apply sealant (GE RTV 154) to interface between feedback arm and piston rod, between jamnut and feedback arm, and between rod-end thread and jamnut face. Sealant should be applied uniformly.

(e) Reengage locking key. While holding piston rod against rotation, torque jamnut 85 to 100 lb ft.

(16) Turn on hydraulic system A and B.

(17) Verify that flaps are positioned to 4 degrees or more to deenergize spoiler No. 1 solenoid shutoff valve.

(18) For measuring reference, mark flap torque box structure directly opposite spoiler No. 1 outboard trailing edge.

NOTE: Spoiler trailing edge reference is the junction point of the spoiler trailing edge and spoiler trailing edge three-inch metal seal.

(19) Move speedbrake lever full aft to MAX position.

(a) Verify No. 1 spoilers extend between 55 and 63 degrees (29.2 to 33.0 inches, measured from spoiler trailing edge reference to reference mark on flap torque box).

(20) Check for proper contact between No. 1 spoiler rub strips and vane (Ref. 27-51-00).

(21) With spoilers full down, retract flaps fully. Check for clearance between flap vane carriage fittings and spoiler panel lower surface while retracting flaps.

NOTE: Following any rigging adjustment to the spoiler system, perform a DLC Null Functional Test to ensure DLC Null Angles are within limits (Ref. 27-61-00 Para. 4E).

(22) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(23) Close access panels opened in Step 6C(3).

6D. DLC SERVO to Left and Right Mixers - Rigging Check and Adjustment

(1) Verify speedbrake control lever on pilots center console is full forward (0-degree position). With speedbrake lever full forward, DLC output arm on top of DLC servo should be against DLC internal down stop. Verify as follows:

With hydraulic systems A and B on and electrical power on, depress and release pushbutton on top of speedbrake lever twice to turn DLC servo off and on. Verify DLC output arm does not move. If output arm moves, check speedbrake control lever to DLC rigging (Ref. Para. 6B).

(2) Extend flaps to 4 degrees or more (Ref. 27-51-00).

(3) Turn hydraulic power off.

(4) Manually position both inboard ailerons to faired (±0.12 inch) and install aileron support tool (Ref. 27-11-00).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or

reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron is neutral with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(5) Verify that electrical actuator on both mixers are in retracted position. (Retracted dimension of actuator is 7.03 (±0.10) inches between attaching bolt centers.)

NOTE: Both mixer speedbrake input arms require a force of approximately 40 pounds to position the mixer input arm to rigged position (spoilers full down) so rig pin can be freely inserted in the mixer speedbrake link (30). (Load is produced by bias spring cartridge on mixer output arms on bottom of mixer.)

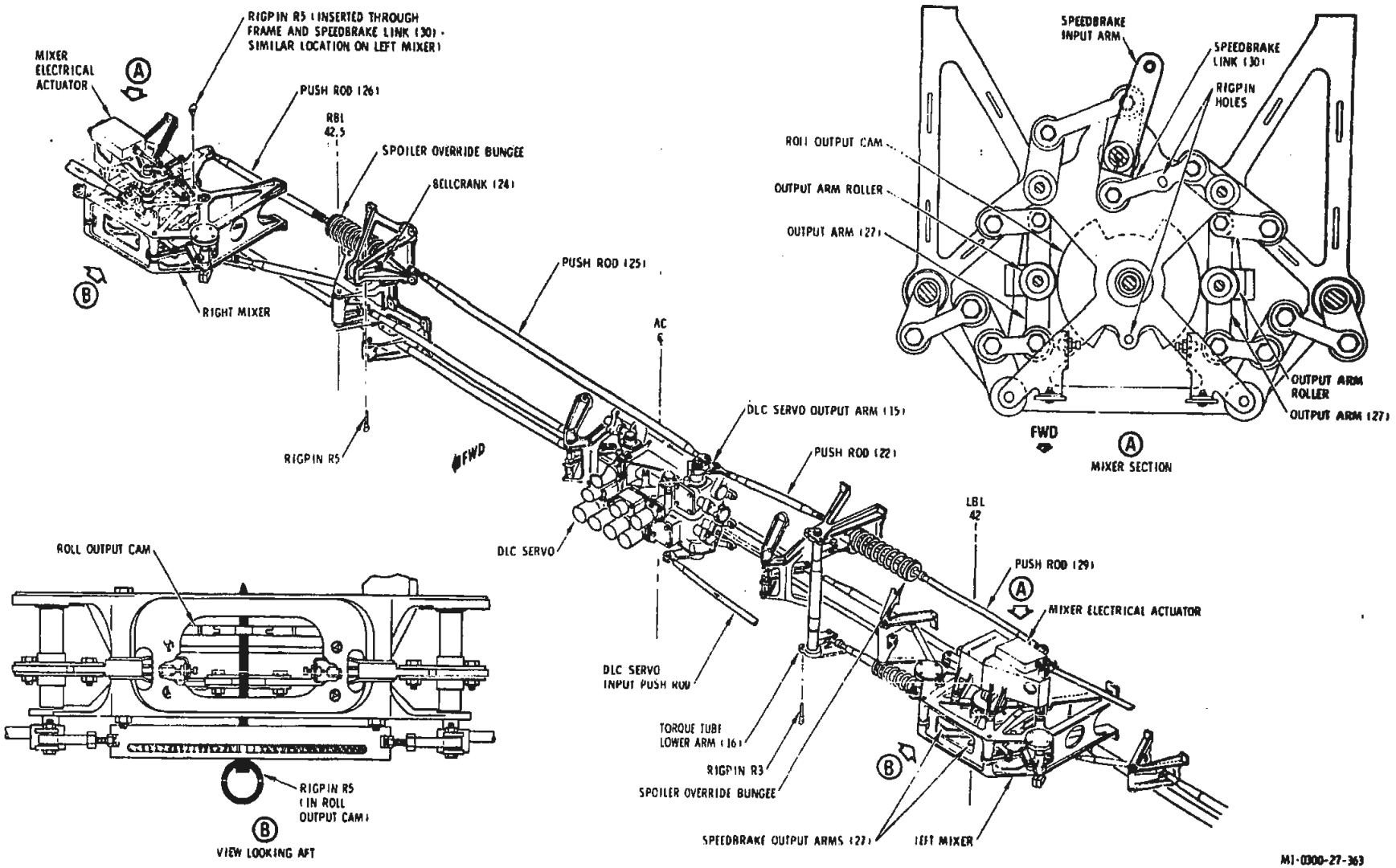
When adjusting pushrods between the DLC servo and mixer, it will require a 40 pound force to position bellcrank (24) on right side, torque tube lower arm (16) on left side, and both mixer input arms to allow free insertion of rig pins.

In the following rigging steps, it is important that all rig pins are a free fit to ensure that the 40 pound preload is maintained on the mixer input arms. This ensures that all lost motion between the DLC and mixers is eliminated.

(6) With the DLC servo output arm (15) against the DLC servo internal downstop, rig pin R3 must fit freely through the torque tube lower arm (16). If not, adjust pushrod (22).

(7) With rig pin installed in torque tube lower arm (16), rig pin R5 must fit freely through left mixer frame and speedbrake link (30) at rear of mixer (Ref. Fig. 503, View A). If not, adjust pushrod (29). Verify rig pins in arm (16) and mixer speedbrake link (30) are still a free fit. If not, recheck per Step 6D(6) and 6D(7).

(8) With DLC servo output arm (15) against DLC servo internal downstop, rig pin R5 must fit freely through right bungee bellcrank (24). If not, adjust pushrod (25).



DLC Servo to Left and Right Mixer - Rigging Check and Adjustment
Figure 503

R EFFECTIVITY: ALL
R
0018

(9) With rig pin installed in bellcrank (24), rig pin R5 must fit freely through right mixer frame and speedbrake link (30) at rear of mixer. If not, adjust pushrod (26). Verify that rig pins in bellcrank (24) and mixer speedbrake link (30) are still a free fit. If not, recheck per Step 6D(8) and 6D (9).

(10) Remove all rig pins.

(11) Remove aileron support tool if no additional rigging will be done.

NOTE: Following any rigging adjustment to the spoiler system, perform a DLC Null Functional Test to ensure DLC Null Angles are within limits (Ref. 27-61-00 Para. 4E).

6E. Right Mixer Output to Spoilers 2 and 3, Fuselage Area - Rigging Check and Adjustment

(1) Verify that speedbrake control lever on pilots center console is full forward (0-degree position).

(2) Extend flaps to 4 degrees or more (Ref. 27-51-00).

(3) Verify that all hydraulic power is turned off.

(4) Manually position both inboard ailerons to neutral (±0.12 inch) and install aileron support tool (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron is neutral with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(5) Verify electrical actuator on right mixer is in the retracted position. (Actuator retract dimension is 7.03 (±0.10) inches between attaching bolt centers.)

(6) On spoilers 2 and 3 on both wings, verify there is clearance between spoiler servo input arm and servo down stop (Ref. Fig. 506). On any servo where there is no clearance, disconnect servo input pushrod from servo arm.

(7) Install rig pin R5 through right mixer frame and the roll output cam (Ref. Fig. 504, Sheet 3).

(8) Install rig pin R5 through right mixer frame and speedbrake link (30) (Ref. Fig. 503).

NOTE: Rig pin R5 through right mixer frame and speedbrake link (30) must be a free fit. If rig pin is tight or drags, check rigging (Ref. Para. 6D, DLC Servo to Left and Right Mixers).

(9) With rig pins installed in right mixer roll output cam and speedbrake link, rig pin R4 must fit through right idler bellcrank (37)(just to right of right mixer). If not, adjust pushrod (38).

NOTE: Mixer right cutput roller must be contacting roll output cam.

(a) Verify roller contact by noting that slight rotation of roller when finger moves cam.

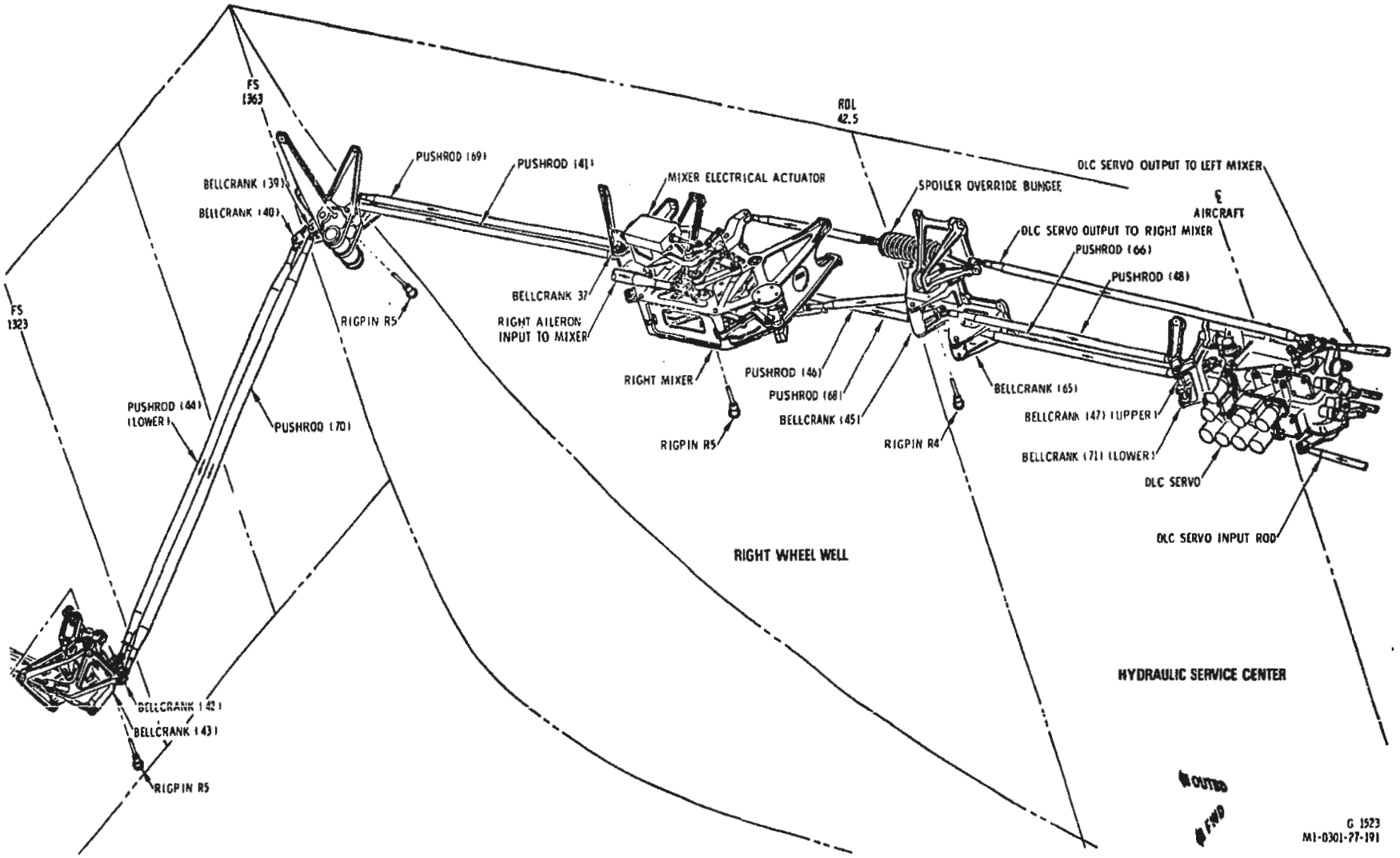
(10) With rig pin installed in right idler bellcrank (37), rig pin R5 must fit freely through stacked bellcranks (39) and (40) in aft corner of right wheel well. If not, adjust pushrod (41).

NOTE: Upper bellcrank (39) is part of left mixer control system. If necessary, position bellcrank (39) to install rig pin in bellcrank (40).

(11) With rig pin installed in bellcrank (40), rig pin R5 must fit through stacked scissor linkage bellcranks (42) and (43) in right wheel well. If not, adjust lower pushrod (44) (Ref. Fig. 504, Sheet 1).

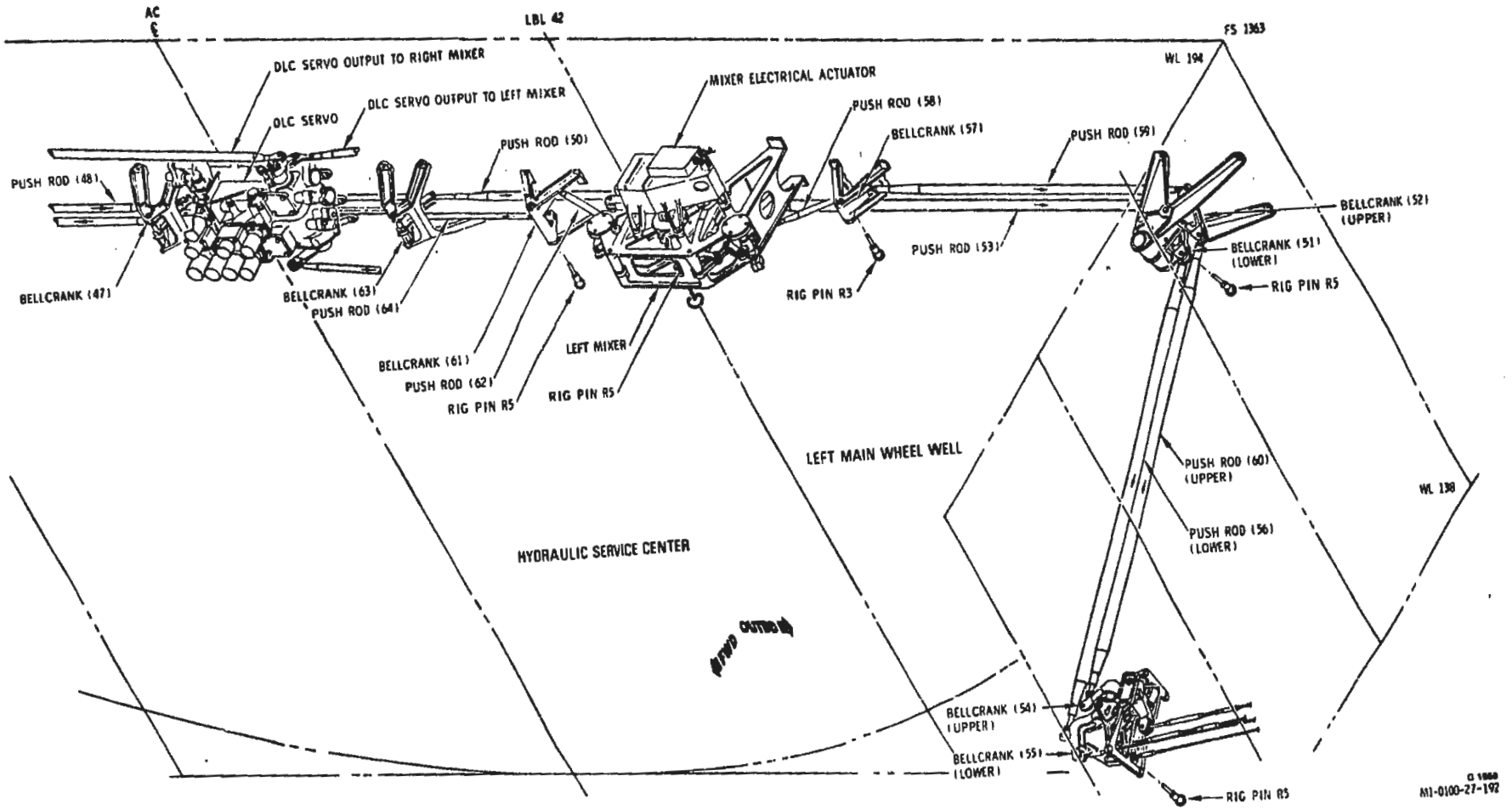
NOTE: Upper bellcrank (42) is part of left mixer control system. If necessary, position bellcrank (42) to install rig pin in bellcrank (43).

(12) With rig pins installed in the right mixer roll output cam and the speedbrake link rig pin R4 must fit through left idler bellcrank (45) in hydraulic service center if not, adjust pushrod (46).



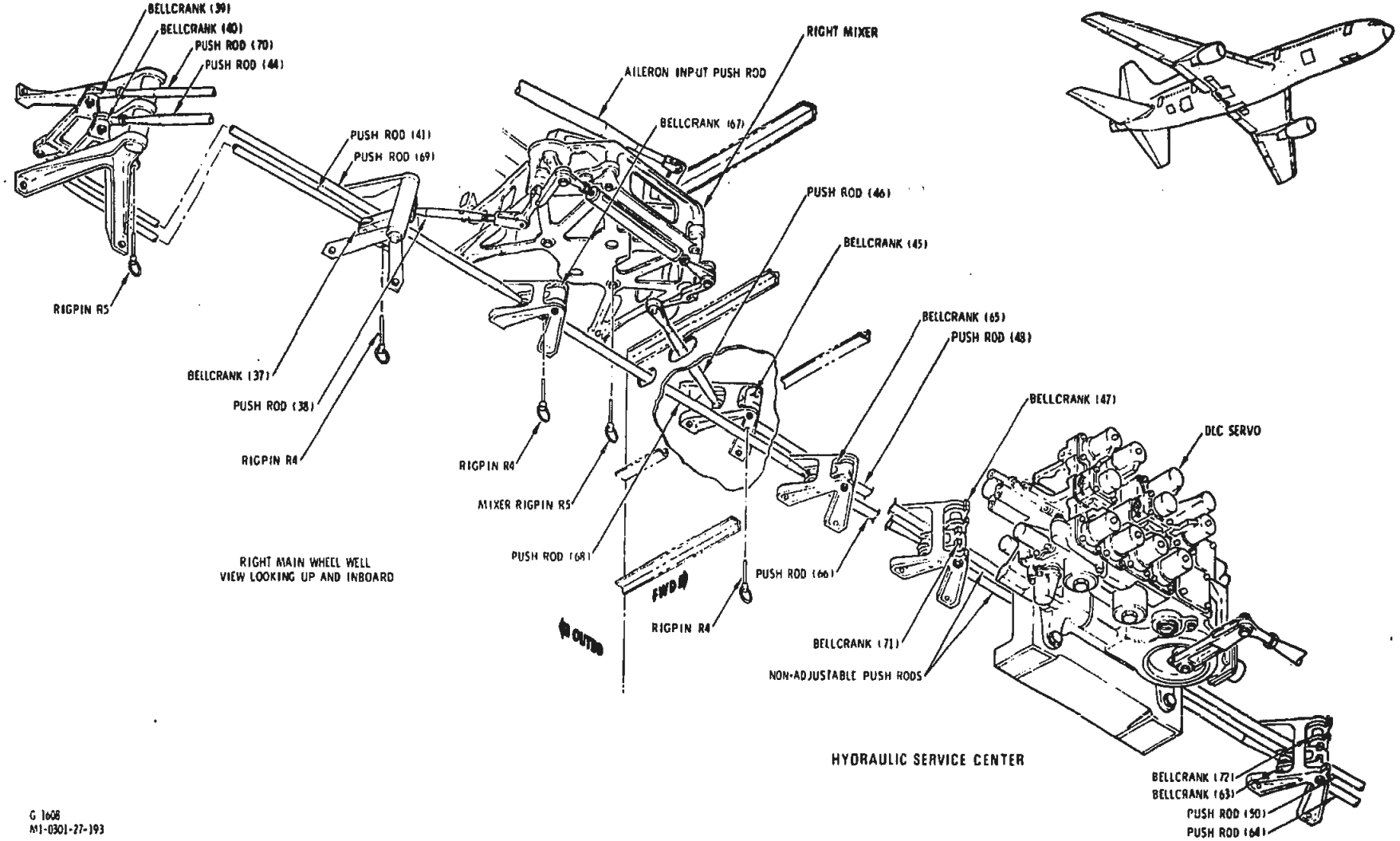
Mixer Output to Spoilers, Fuselage Area
Rigging Check and Adjustment
Figure 504 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



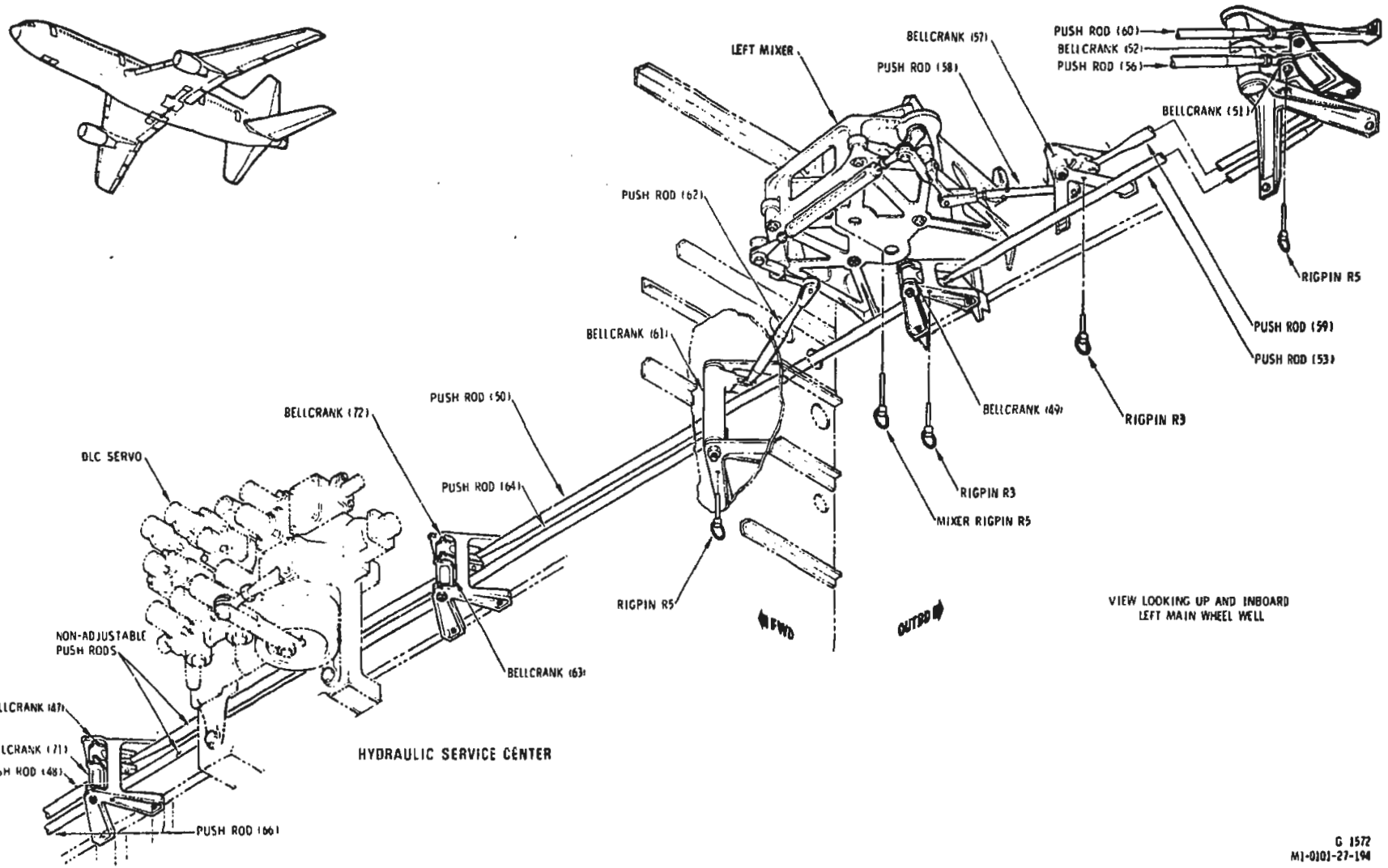
Mixer Output to Spoilers, Fuselage Area
Rigging Check and Adjustment
Figure 504 (Sheet 2)

R
R
001B EFFECTIVITY: ALL



Mixer Output to Spoilers, Fuselage Area
Rigging Check and Adjustment
Figure 504 (Sheet 3)

R EFFECTIVITY: ALL
R
001B



Mixer Output to Spoilers, Fuselage Area
Rigging Check and Adjustment
Figure 504 (Sheet 4)

NOTE: Mixer left output roller must be contacting roll output cam.

(13) With rig pin installed in bellcrank (45), verify following:

(a) Rig pin R3 fits through bellcrank (49) under left mixer.

(b) Centerline of bellcrank (47) (to right of DLC servo) must be 60 (±5) degrees from FS 1363 bulkhead (bellcrank pointing towards DLC servo).

(c) Centerline of bellcrank (72) (to left of DLC servo) must be 60 (±5) degrees from FS 1363 bulkhead (bellcrank pointing away from DLC servo).

NOTE Adjust pushrods (48) and (50) to meet above requirements.

(14) With rig pin installed in bellcrank (49), rig pin R5 must fit through bellcranks (51) and (52) in left wheel well. If not, adjust pushrod (53).

NOTE: Upper bellcrank (52) is part of left mixer control system. If necessary, position bellcrank (52) to install rig pin in bellcrank (51).

(15) With rig pin installed in bellcranks (51) and (52), rig pin R5 must fit through stacked scissor linkage bellcranks (54) and (55) in left wheel well. If not, adjust pushrod (56).

NOTE: Upper bellcrank (54) is part of left mixer control system. If necessary, position bellcrank (54) to install rig pin in bellcrank (55).

(16) If servo input pushrod was disconnected in Step 6E(6), rig that spoiler servo in accordance with Paragraph 6G.

(17) Remove all rig pins.

(18) Remove aileron support tool if no further rigging will be accomplished.

NOTE: Following any rigging adjustment to the spoiler system, perform a DLC Null Functional Test to ensure DLC Null Angles are within limits (Ref. 27-61-00 Para. 4G).

6F. Left Mixer Output to Spoilers 4, 5, and 6, Fuselage Area - Rigging Check and Adjustment

(1) Verify speedbrake control lever on pilots center console is full forward (0-degree) position.

(2) Position flaps to 4 degrees or more (Ref. 27-51-00).

(3) Verify that all hydraulic power is turned off.

(4) Manually position both inboard ailerons to faired (±0.12 inch) and install aileron support tool (Ref. 27-11-00).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron is neutral with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(5) Verify that electrical actuator on left mixer is in the retracted position. (Actuator retract dimension is 7.03 (±0.10) inches between attaching bolt centers.)

(6) On spoilers 4, 5, and 6 on both wings, verify there is clearance between spoiler servo input arm and spoiler servo down stop (Ref. Fig. 506). On any servo where there is no clearance, disconnect servo input pushrod from servo arm.

(7) Install rig pin R5 through left mixer frame and roll output cam (Ref. Fig. 504).

(8) Install rig pin R5 through left mixer frame and speedbrake link (30) (Ref. Fig. 503).

NOTE: Rig pin R5 through left mixer frame and speedbrake link (30) must be a free fit. If rig pin is tight or drags, check rigging (Ref. Para. 6D, DLC Servo to Left and Right Mixers).

(9) With rig pin installed in left mixer roll output cam and speedbrake link, rig pin R3 must through idler bellcrank (57) to left of mixer. If not, adjust pushrod (58).

NOTE: Mixer left output roller must be contacting roll output cam. Verify roller contact by noting that slight rotation of roller when finger moves cam.

(10) With rig pin installed in bellcrank (57), rig pin R5 must fit through stacked bellcranks (51) and (52) in aft corner of left wheel well. If not, adjust pushrod (59).

NOTE: Lower bellcrank (51) is part of right mixer control system. If necessary, position bellcrank (51) to allow installation of rig pin in bellcrank (52).

(11) With rig pin installed in stacked bellcranks (51) and (52) in aft corner of left wheel well, rig pin R5 must fit through stacked scissor linkage bellcranks (54) and (55) in left wheel well. If not, adjust pushrod (60).

NOTE: Lower bellcrank (55) is part of right mixer control system. If necessary, position bellcrank (55) to install rig pin in bellcrank (54).

(12) With rig pins in left mixer roll output cam and speedbrake link rig pin R5 must fit through idler bellcrank (61) in hydraulic service center. If not, adjust pushrod (62).

NOTE: Mixer right output roller must be contacting roll output cam.

(13) With rig pin installed in bellcrank (61), verify following:

(a) Centerline of bellcrank (63) (to left of DLC servo) must be 60 (±5) degrees from FS 1363 bulkhead (bellcrank pointing towards DLC servo).

(b) Centerline of bellcrank (71) (to right of DLC servo) must be 60 (±5) degrees from FS 1363 bulkhead (bellcrank pointing away from DLC servo).

(c) Index mark on bellcrank (65) must be aligned with bracket index mark.

NOTE: Adjust pushrods (64) and (66) to meet above requirements.

(14) With bellcrank (65) index marks aligned, verify the following:

(a) Rig pin R4 fits through bellcrank (67) below right mixer.

NOTE: On aircraft 001-006, bellcrank (67) does not have rig pin holes. On these aircraft the centerline of bellcrank (67) must be 60 (±5) degrees from FS 1363 bulkhead (bellcrank pointing outboard).

(b) Rig pin R5 fits through stacked bellcranks (39) and (40). [Lower bellcrank (40) is part of right mixer control system; if necessary, position bellcrank (40) to install rig pin in bellcrank (39).]

(c) Adjust pushrods (68) and (69) to meet requirements of Steps 6F(14)(a) and (b).

(15) With rig pin installed in bellcranks (39) and (40), rig pin R5 must fit through stacked scissor linkage bellcranks (42) and (43) in right wheel well. If not, adjust pushrod (70).

NOTE: Lower bellcrank (43) is part of right mixer control system. If necessary, position bellcrank (43) to install rig pin in bellcrank (42).

(16) If servo input pushrod was disconnected in Step 6F(6), rig that spoiler servo in accordance with Paragraph 6H.

(17) Remove all rig pins.

(18) Remove aileron support tool if no further rigging will be accomplished.

NOTE: Following any rigging adjustment to the spoiler system, perform a DLC Null Functional Test to ensure DLC Null Angles are within limits (Ref. 27-61-00 Para. 4E).

6G. Right Mixer to Spoilers 2 and 3, Wing Area - Rigging Check and Adjustment

NOTE: This rigging procedure is identical for both wings.

(1) Verify that speedbrake control lever on pilots center console is full forward (0-degree position).

(2) Verify that flaps are fully down.

(3) Open following access panels (Ref. 6-40-00):

R (a) Left wing: 541FB, 541GB, 561BB

R (b) Right wing: 641FB, 641GB, 661BB

(4) Verify spoiler panels 2 and 3 on both wings are fully down (servo piston bottomed).

(5) On spoiler panels 2 and 3 on both wings, verify there is clearance between spoiler servo input arm and servo down stop (Ref. Fig. 506). On any servo where there is no clearance, disconnect input pushrod from servo arm.

(6) Verify that electrical actuator on right mixer is in retracted position (flaps extended 4 degrees or more).

NOTE: Electrical actuator retract dimension between attaching bolt centers is 7.03 (±0.10) inches.

(7) Verify that all hydraulic power is turned off.

(8) Manually position both inboard ailerons to faired (±0.12 inch) and install aileron support tools (Ref. 27-11-00).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron is neutral with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(9) Install rig pin R5 through stacked scissor linkage bellcranks in main wheel well (Ref. Fig. 505): left wing: (54) and (55); right wing (42) and (43).

(10) With rig pin installed in accordance with Step 6G(9), check the following:

(a) Rig pin R6 must fit through spoiler No. 3 scissor linkage bellcrank (80)(just inboard of No. 3 spoiler servo).

NOTE: Spoiler scissor linkage is the lower of two stacked scissor linkages.

(b) Rig pin R6 must fit through cable bellcranks (81) and (84)(at IWS 503, just inboard of inboard aileron).

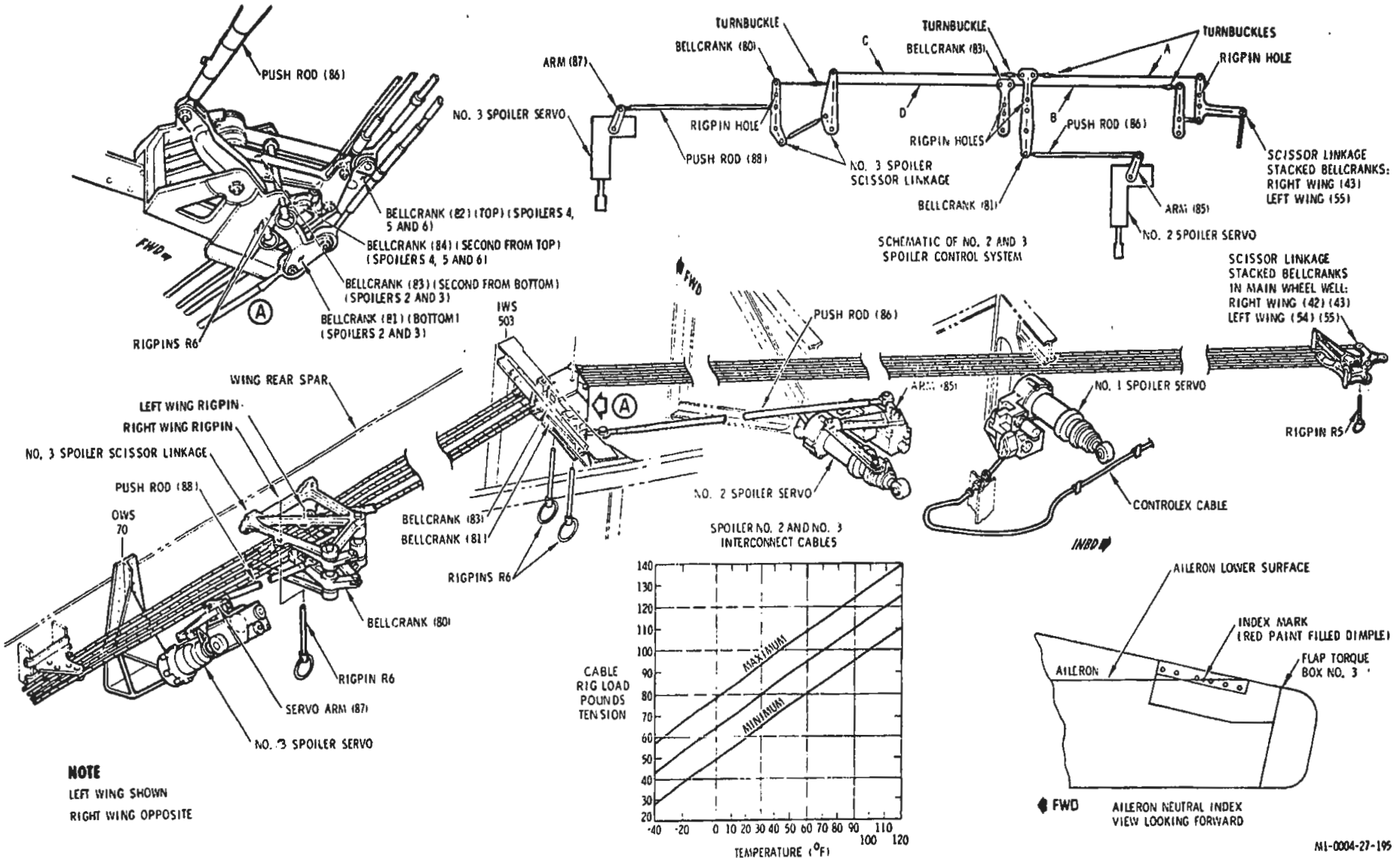
(c) Rig pin R6 must fit through cable bellcranks (82) and (83)(at IWS 503).

NOTE: The four bellcranks stacked together are numbered (82), (84), (83) and (81) from top to bottom. Upper bellcranks (82) and (84) are part of left mixer (spoilers 4, 5 and 6) control system. If necessary, position bellcranks (82) and (84) to install rig pins in bellcranks (81) and (83).

(d) Cable tension must conform to temperature compensation chart of Figure 505. If any of the four conditions cannot be met, adjust cable turnbuckles as required.

NOTE: On aircraft 001-006, the turnbarrel locking clip slots may not be located correctly to prevent Lockclad cable twist and cause the cable terminal bearings to have heavy contact with bellcrank clevises. On only the above aircraft, check for this condition. Light contact is permissible if static clearance can be shown simultaneously on both ends of cable assembly by hand rotation of cable. If terminal bearing has heavy contact, readjust cable to maintain rig but eliminate cable twist. If turnbuckle locking clip slots do not line up without causing cable twist, ignore these locking slots and safety with lock-wire.

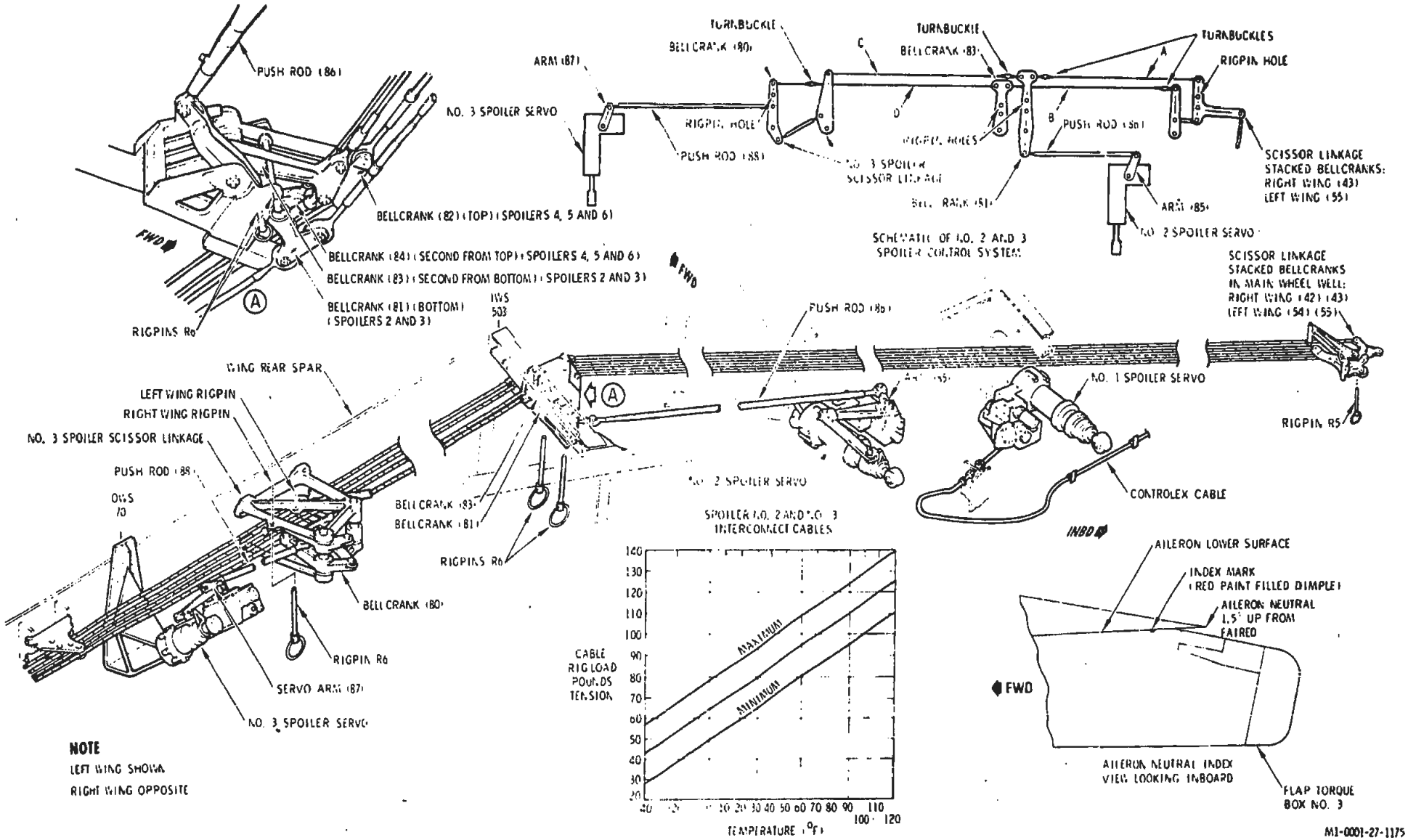
(11) With rig pin installed in bellcrank (81), the No. 2 spoiler servo input arm (85) must be 0.008 (±0.005) inch from servo downstop (clockwise stop, viewed from top). If not, adjust pushrod (86).



NOTE
LEFT WING SHOWN
RIGHT WING OPPOSITE

Right Mixer to Spoilers 2 and 3, Wing Area
Rigging Check and Adjustment
Figure 505

R
R
001B EFFECTIVITY: WITHOUT SB27-162



NOTE
LEFT WING SHOWN
RIGHT WING OPPOSITE

Right Mixer to Spoilers 2 and 3, Wing Area
Rigging Check and Adjustment
Figure 505

R EFFECTIVITY: WITH SB27-162
R
001B

NOTE: If servo input pushrod was disconnected from servo arm in Step 6G(5), reconnect pushrod to servo after accomplishing associated Step 6G(11) or 6G(12).

(12) With rig pin installed in spoiler No. 3 scissor linkage bellcrank (80), the No. 3 spoiler servo input arm (87) must be 0.008 (±0.005) inch from the servo downstop (clockwise stop, viewed from top). If not, adjust pushrod (88).

(13) Remove all rig pins.

(a) Verify all turnbuckles are safetied.

(14) Remove aileron support tool.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: DO NOT RELEASE (OUT) ANY SPOILER SWITCHLIGHT ON PFCS PANEL WITH SPOILERS EXTENDED AND HYDRAULIC PRESSURE ON. RAPID RETRACTION OF SPOILERS WITH NO LOAD CAN DAMAGE SPOILER SERVO.

(15) Turn on hydraulic systems A, C, and D (Ref. 29-11-00). Verify following:

(a) The No. 2 and 3 spoiler servos must not retract or extend (spoiler panel trailing edge must not move up or down from the hydraulic off rigged position).

(b) On PFCS panel, release (out) SPOILER L&R2 and L&R3 switchlights. Spoiler panel trailing edge must not move down more than 0.06 inch. Depress (in) SPOILER switchlights L&R2 and L&R3.

(c) If requirements of Steps 6G(15)(a) and 6G(15)(b) cannot be met, recheck spoiler rigging per Steps

6G(1) thru 6G(14). If rigging checks out correctly, replace spoiler servo (Ref. 27-61-17).

(16) Operate speedbrake lever from 0 to MAX three times to stabilize control system.

(17) Position speedbrake lever full forward to 0-degree position.

(a) Verify, 0.008 (±0.005) inch gap between servo input arm and servo down stop.

(18) Verify spoiler panel 2 trailing edge upper contour is 0.12 to 0.18 inch below the flap torque box upper skin contour. (Ignore spoiler three-inch trailing edge metal seal when checking contour.)

NOTE: On spoiler panel No. 2, if 0.12 to 0.18 dimension cannot be held on both ends of spoiler panel, rig low end only to 0.12 to 0.18 dimension.

Verify spoiler panel 3 trailing edge upper contour is 0.12 to 0.18 inch below the flap torque box upper skin contour if possible while maintaining required clearance between spoiler and vane. If vane is rigged higher than 0.12 inch below torque box upper contour, verify spoiler is rigged as close as possible to the 0.20 inch minimum between spoiler and vane (Ref. 27-51-00, 501). If not, adjust as follows:

(a) Shut off hydraulic power (Ref. 29-11-00).

(b) Remove eccentric pivot bolt cotter pin (Ref. Fig. 502 Sheet 2).

(c) Loosen catellated nut and disengage serrated washers (or on aircraft with SB27-245, serrations on anti-rotation eccentric bolt lock).

C (d) Rotate eccentric bolt to bring spoiler into the
C lowest possible position.

C NOTE: The spoiler is set full down with the
C eccentric bolt and adjusted with the
C actuator rod end. This assures
C spoiler-to-vane clearance in the case the
C bolt lock washer fails.

(e) Engage serrated washers (or on aircraft with SB27-245, serrations on anti-rotation eccentric bolt lock).

(f) While holding eccentric bolt in position, torque nut 270 to 300 lb in. Install cotter pin.

C (g) Adjust spoiler to the proper position per step
C (19).

(19) If eccentric bolt does not bring spoiler into contour, adjust servo rod end as follows:

(a) Loosen rod end jamnut until locking key is disengaged while loosening jamnut, hold piston rod against rotation (use wrench flats on feedback link next to rod end).

(b) Remove servo-to-spoiler attach bolt.

(c) Rotate rod end one half to a maximum of two turns to lengthen or shorten, as needed, to bring
CR spoiler into contour. Final rod end adjustment
CR must be within the range minus 1 to plus 5 threads
C showing through jamnut. Minimum thread engagement
C must be maintained. If necessary, the spoiler
C eccentric bolt may be adjusted to set spoiler with
C respect to the torque box.

(d) Reinstall servo-to-spoiler attach bolt, washer, and nut.

(e) Install pin.

NOTE: To prevent water from entering piston rod, apply sealant (GE RTV 154) to interface between feedback arm and piston rod, between jamnut and feedback arm, and between rod-end thread and jamnut face. Sealant should be applied uniformly.

(e) Reengage locking key and torque jamnut 85 to 100 lb ft.

(f) Lock-wire jamnut.

(20) Verify that hydraulic systems A, C, and D are turned on.

(21) For spoiler measuring reference, mark flap torque box structure directly opposite spoilers 2 and 3 inboard trailing edge.

NOTE: Spoiler trailing edge reference is the junction point of the spoiler trailing edge and spoiler trailing edge three-inch metal seal.

For aileron measuring reference, mark inboard aileron inboard edge directly opposite index mark (red paint-filled dimple) on flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(22) Position flaps to full down.

(23) Check for minimum and maximum spoiler deflection in the roll mode as follows:

(a) Rotate control wheel to full left position. Verify spoiler panels 2 and 3 on left wing extend a minimum of 40 degrees and a maximum of 54 degrees.

NOTE: Linear dimension for spoiler deflection of 40 degrees is as follows: spoiler 2 is 21.6 inches; spoiler 3 is 18.8 inches.

Linear dimension for spoiler deflection of 54 degrees is as follows: spoiler 2 is 28.7 inches; spoiler 3 is 24.9 inches.

Measure spoiler deflection from spoiler trailing edge reference to reference mark on flap torque box No. 3.

(b) Return control wheel to neutral.

(c) Rotate control wheel to full right position. Verify spoiler panels 2 and 3 on right wing extend a minimum of 40 degrees and a maximum of 54 degrees.

(24) Return control wheel to neutral.

(25) Check spoiler deflection in speedbrake mode as follows:

(a) Move speedbrake lever full aft to MAX. Verify that spoiler panels 2 and 3 extend 55 to 63 degrees (spoiler 2: 29.2 to 33.0 inches; spoiler 3: 25.4 to 28.7 inches).

(26) Check for proper contact between spoiler No. 2 rub strip and associated flap vane, and spoiler No. 3 and associated flap vane (Ref. 27-51-00).

(27) With spoilers fully down, retract flaps fully. Check for positive clearance between flap vane carriage fittings and spoiler panel lower surface while retracting flaps.

NOTE: Following any rigging adjustment to the spoiler system, perform a DLC Null Functional Test to ensure DLC Null Angles are within limits (Ref. 27-61-00 Para. 4E).

(28) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(29) Close access panels opened in Step 6G(3).

6H. Left Mixer to Spoiler 4, 5, and 6, Wing Area - Rigging Check and Adjustment

NOTE: This rigging procedure is identical for both wings.

(1) Verify speedbrake control handle on pilots center console is full forward (0-degree position).

(2) Verify spoiler panels 4, 5, and 6 on both wings are fully down (servo piston bottomed).

(3) Verify flaps are fully down.

(4) Open following access panels (Ref. 6-40-00):

R (a) Left wing: 541GB, 561BB, 561CB

R (b) Right wing: 641GB, 661BB, 661CB

(5) On spoiler panels 4, 5, and 6 on both wings, verify there is clearance between spoiler servo input arm and servo down stop (Ref. Fig. 506). On any servo where there is no clearance, disconnect input pushrod from spoiler servo arm.

(6) Verify electrical actuator on left mixer is in retracted position (flaps extended 4 degrees or more).

NOTE: Electrical actuator retract dimension between attaching bolt centers is 7.03 (±0.10) inches.

(7) Verify that all hydraulic power is turned off.

(8) Manually position both inboard ailerons to faired (±0.12 inch) and install aileron support tools (Ref. 27-11-00, Adjustment and Test, Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, *Maintenance Practices*.

On aircraft without SB27-162, inboard aileron is neutral with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(9) Install rig pin R5 in stacked scissor linkage bellcranks in main wheel well (Ref. Fig. 506): left wing: (54) and (55); right wing: (42) and (43).

(10) With rig pin installed in accordance with Step 6H(9), check for the following:

(a) Rig pin R5 must fit through spoiler No. 4 scissor linkage bellcrank (93) (just inboard of No. 4 spoiler servo).

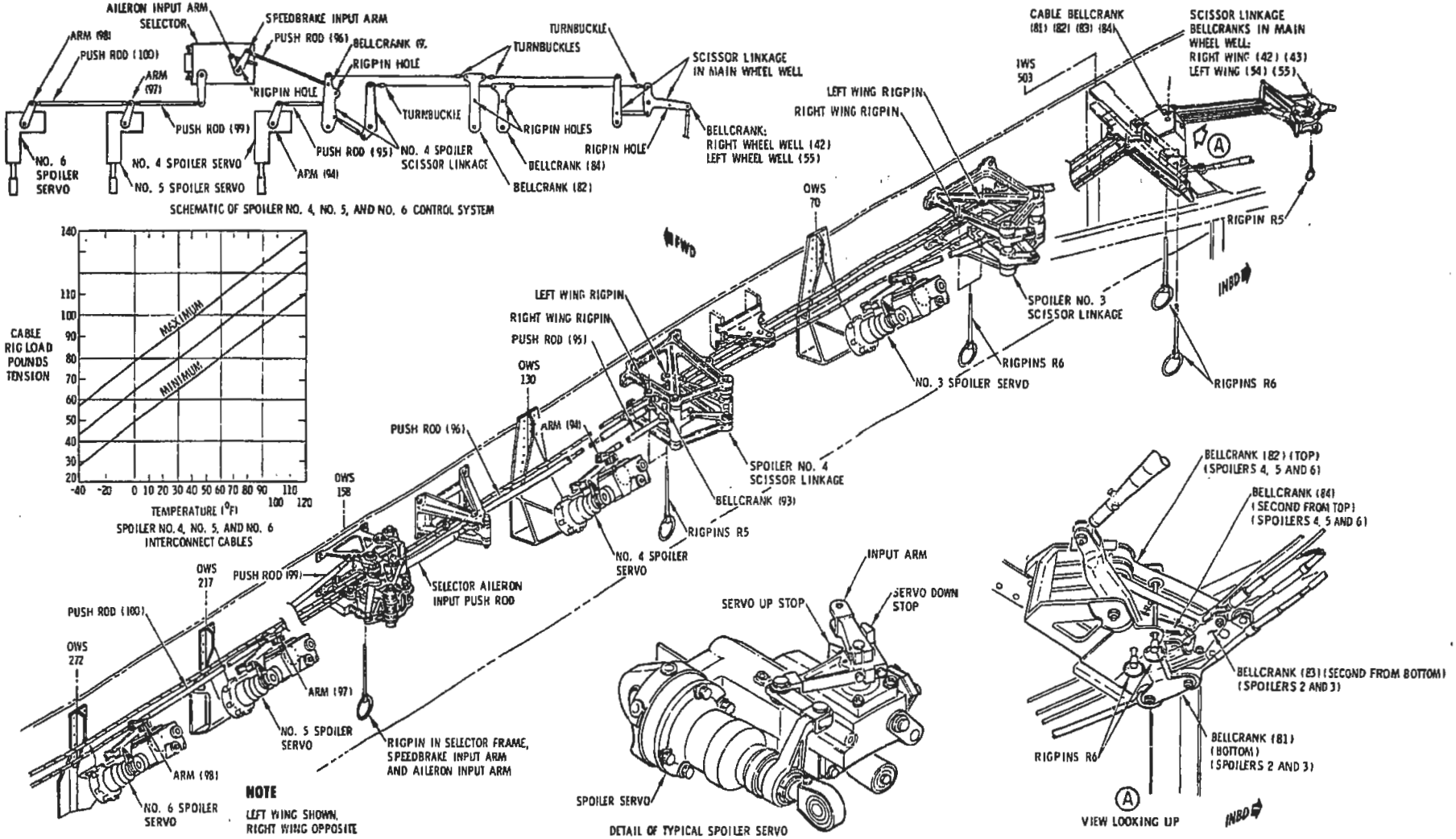
(b) Rig pin R6 must fit through cable bellcranks (81) and (84) (just inboard of inboard aileron).

(c) Rig pin R6 must fit through cable bellcranks (82) and (83).

NOTE: The four bellcranks stacked together are numbered (82), (84), (83) and (81) from top to bottom. Lower bellcranks (81) and (83) are part of right mixer (spoilers 2 and 3) control system. If necessary, position bellcranks (81) and (83) to install rig pins in bellcranks (82) and (84).

(d) Cable tension must conform to chart of Figure 506. If any of four conditions cannot be met, adjust cable turnbuckles as required.

NOTE: On aircraft 001-006, the turnbarrel locking clip slots may not be located correctly to prevent Lockclad cable twist and cause the cable terminal bearings to ride hard against the bellcrank clevises. On only the above aircraft, check for this condition. Light contact is



M1-0003-27-196

R Left Mixer to Spoilers 4, 5, and 6, Wing Area
R Rigging Check and Adjustment
R Figure 506

EFFECTIVITY: ALL

001B

permissible if static clearance can be shown simultaneously on both ends of cable assembly by hand rotation of cable. If terminal bearing is riding hard, readjust cable to maintain rig but eliminate cable twist. If the turnbuckle locking clip slots do not line up without causing cable twist, ignore these locking slots and safety with lock-wire.

(11) With rig pin installed in No. 4 spoiler scissor linkage bellcrank (93), (just inboard of No. 4 spoiler servo), the No. 4 spoiler servo input arm (94) must be 0.008 (±0.005) inch from the servo downstop (clockwise stop, viewed from top). If not, adjust pushrod (95).

NOTE: If servo input pushrod was disconnected from servo arm in Step 6H(5), reconnect pushrod to servo after accomplishing associated step to rig servo input arm.

(12) On aircraft 001-026,
with rig pin installed in No. 4 spoiler scissor linkage bellcrank (93), rig pin R6 must fit through spoiler selector frame, speedbrake input arm, and aileron input arm. If not, adjust speedbrake input pushrod (96). [The inboard aileron may have to be jiggled to align aileron input arm as aileron input arm rigging is not being accomplished at this time (accomplished in 27-11-00).]

NOTE: If selector dash number is 121 or higher (1506801-121), use the stepped rig pin R6A (5/16- and 3/16-inch diameter).

(12) On aircraft 027-999,
with rig pin installed in No. 4 spoiler scissor linkage bellcrank (93), rig pin R6A (stepped rig pin, 5/16- and 3/16-inch diameter) must fit through spoiler selector frame, speedbrake input arm, and aileron input arm. If not, adjust speedbrake input pushrod (96). [The inboard aileron may have to be jiggled to align aileron input arm as aileron input arm rigging is not being accomplished at this time (accomplished in 27-11-00).]

(13) With rig pin installed in spoiler selector frame, speedbrake input arm and aileron input arm, the No. 5 and 6 spoiler servo input arms (97) and (98) must be 0.008 (±0.005) inch from the associated servo downstop (clockwise stop, viewed from top). If not, adjust pushrods (99) and (100).

NOTE: Selector output arm roller must be contacting output cam.

If pushrod (99) is adjusted, check rigging of No. 6 spoiler [pushrod (100)].

(14) Remove all rig pins.

(a) Verify that all turnbuckles are safetied.

(15) Remove aileron support tools.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN LANDING GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: DO NOT RELEASE ANY SPOILER SWITCHLIGHTS ON OVERHEAD PFCS PANEL WITH SPOILERS EXTENDED AND HYDRAULIC PRESSURE ON. RAPID RETRACTION OF SPOILERS WITH NO LOAD CAN DAMAGE SPOILER SERVO.

(16) Turn on hydraulic systems B and C (Ref. 29-11-00). Verify following:

(a) The No. 4, 5, and 6 spoiler servos must not retract or extend (spoiler panel trailing edge must not move up or down from the hydraulic off rigged position).

(b) On PFCS panel, release (out) SPOILER L&R4, L5&6, and R5&6 switchlight. Spoiler panel trailing edge must not move down more than 0.06 inch. Depress (latch in) SPOILER switchlights L&R4, L5&6, and R5&6.

(c) If requirements of Steps 6H(16) (a) and 6H(16) (b) cannot be met, recheck spoiler rigging per Steps 6H(1) through 6H(15). If rigging checks out correctly, replace spoiler servo (Ref. 27-61-17).

(17) Operate speedbrake lever from 0 to MAX three times to stabilize control system.

(18) Position speedbrake lever full forward position. With spoilers full down (servo piston bottomed), verify 0.008 (±0.005) inch gap between servo input arm and servo down stop.

(19) Verify trailing edge upper contour of spoiler panels 4, 5, and 6 is 0.12 to 0.18 inch below the flap torque box upper contour if possible while maintaining required clearance between spoiler and vane. If vane is rigged higher than 0.12 inch below torque box upper contour, verify spoiler is rigged as close as possible to the 0.20 inch minimum between flap and vane (Ref. 27-51-00,501). If not, adjust as follows:

NOTE: Ignore spoiler three-inch metal trailing edge seal when checking spoiler contour.

(a) Shut off hydraulic power (Ref. 29-11-00).

(b) Remove eccentric pivot bolt cotter pin (Ref. Fig. 502 Sheet 2).

(c) Loosen castellated nut and disengage serrated washers (or on aircraft with SB27-245, serrations on anti-rotation eccentric bolt lock).

C C (d) Rotate eccentric bolt to bring spoiler into the lowest possible position.

C C C C C NOTE: The spoiler is set full down with the eccentric bolt and adjusted with the actuator rod end. This assures spoiler-to-vane clearance in the case the bolt lock washer fails.

(e) Engage serrated washers (or on aircraft with SB27-245, serrations on anti-rotation eccentric bolt lock).

(f) While holding ecentric bolt in position, torque nut 270 to 300 lb in.

(g) Install cotter pin.

C C (h) Adjust spoiler to the proper position per Step (20).

(20) If eccentric bolt does not bring spoiler into contour, adjust servo rod end bolt as follows:

(a) Loosen rod end jamnut until locking key is disengaged (Ref. Fig. 502, Sheet 2).

(b) Remove servo-to-spoiler attach bolt.

(c) Rotate rod end one half to a maximum of two turns to lengthen or shorten, as needed, to bring
CR spoiler into contour. Final rod end position must
CR be within the range of minus 1 to plus 5 threads
C showing through jamnut. Minimum thread engagement
C must be maintained. If necessary, the spoiler
C eccentric bolt may be adjusted to set spoiler with
C respect to the torque box.

(d) Reinstall servo-to-spoiler attach bolt, washer, and nut.

(e) Install cotter pin and lock-wire bolt.

NOTE: To prevent water from entering piston rod, apply sealant (GE RTV 154) to interface between feedback arm and piston rod, between jamnut and feedback arm, and between rod-end-thread and jamnut face. Sealant should be applied uniformly.

(f) Reengage locking key and torque jamnut 85 to 100 lb ft for spoiler 4, 45 to 55 lb ft for spoilers 5 and 6.

(21) Verify that hydraulic systems B and C are turned on.

(22) For spoiler measuring reference, mark flap torque box structure directly opposite of spoiler panels 4, 5, and 6 trailing edge reference. For aileron measuring reference, mark lower skin on inboard aileron inboard edge directly opposite index mark (red paint-filled dimple) on flap torque box.

NOTE: Spoiler trailing edge reference is the junction point of the spoiler trailing edge and spoiler trailing edge three-inch metal seal.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

(23) Position flaps to full down.

(24) Check for minimum and maximum spoiler deflection in the roll mode as follows:

(a) Rotate control wheel full left position.

(b) Verify spoiler panel 4 on left wing extends a minimum of 40 degrees and a maximum of 54 degrees and spoiler panels 5 and 6 on left wing extend a minimum of 38.5 degrees and a maximum of 54 degrees.

NOTE: Measure spoiler deflection from junction point of spoiler trailing edge and metal seal to reference mark on flap torque box.

- Linear dimension for spoiler deflection of 40 degrees for spoiler panel 4 is 15.5 inches.

- Linear dimension for spoiler deflection of 54 degrees for spoiler panel 4 is 20.5 inches.

- Linear dimension for spoiler deflection of 38.5 degrees for spoiler panel 5 is 14.6 inches and for spoiler panel 6 is 12.4 inches.

- Linear dimension for spoiler deflection of 54 degrees for spoiler panel 5 is 20.1 inches and for spoiler panel 6 is 17.1 inches.

NOTE: Measure spoiler deflection from spoiler trailing edge reference to reference mark on flap torque box.

(c) Return control wheel to neutral position.

(d) Rotate control wheel full right. Verify spoiler panel 4 on right wing extends a minimum of 40 degrees and a maximum of 54 degrees, and spoiler panels 5 and 6 on right wing extend a minimum of 38.5 degrees and a maximum of 54 degrees.

(25) Return control wheel to neutral position.

NOTE: Deflection of spoiler panels 5 and 6 in the roll mode is controlled (through the spoiler selector) by the inboard aileron-to-outboard aileron control system. To adjust spoiler 5 and 6 deflection, see Left (and Right) Inboard Aileron to Left (and Right) Outboard Aileron Servo Control System Rigging (Ref. 27-11-00, Adjustment/Test. Para. H and L).

(26) Retract flaps to full up to couple spoiler panels 5 and 6 to selector speedbrake inputs. As flaps retract, check for clearance between flap vane carriage fittings and lower surface of spoiler panel.

(27) Check spoiler deflection in the speedbrake mode as follows:

R (a) Move speedbrake lever full aft to MAX.

R (b) Verify spoiler 4 extends 54 to 63 degrees (20.5 to
R 23.6 inches).

R (c) Verify spoilers 5 and 6 extend 50 to 63 degrees
R (spoiler 5: 18.75 to 23.2 inches; spoiler 6:
R 15.8 to 19.7 inches).

(28) Check for proper contact between spoilers No. 4, 5 and 6, and associated flap vanes (Ref. 27-51-00).

NOTE: Following any rigging adjustment to the spoiler system, perform a DLC Null Functional Test to ensure DLC Null Angles are within limits (Ref. 27-61-00 Para. 4E).

(29) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(30) Close access panels opened in Step 6H (4)

6I. DLC Null Adjustment

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN LANDING GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(1) Apply hydraulic pressure to A and B systems (Ref. 29-11-00).

(2) Apply electrical power (Ref. 24-41-00).

CAUTION: WHEN EXTENDING OR RETRACTING WING FLAPS (OR WHEN OPERATING FLAP UP/DOWN SWITCH ON FLIGHT CONTROL AUXILIARY UNIT), AILERONS MUST BE HYDRAULICALLY ON AND IN NEUTRAL POSITION TO PREVENT ACTUATOR BURNOUT ON SPOILER MIXER AND SELECTOR UNITS.

(3) Extend wing flaps to 4 degrees or more (Ref. 27-51-00).

(4) Remove hydraulic pressure (Ref. 29-11-00).

(5) Remove electrical power (Ref. 24-41-00).

(6) Manually position both inboard ailerons to faired (±.12 inch) position and install aileron support tool (Fig. 505).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron is neutral with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(7) For number 4 spoiler panels, perform the following:

(a) Disconnect left hand mixer input rod (29) at attachment to spoiler override bungee (Fig. 503).

(b) Disconnect left hand mixer output rods (58 and 62) at attachment to mixer (Fig. 504 Sheet 4).

(c) Shorten mixer input rod (29) 1.5 turns at threaded end, lockwire, and connect to spoiler override bungee (Fig. 503).

(d) Lengthen mixer output rods (58 and 62) until they can be connected to mixer (with a free fit of rig pins R3 and R5), lockwire, and connect to mixer (Fig. 504 Sheet 4).

NOTE: Rig pin R5 which is inserted through mixer frame and speedbrake link (30) will no longer fit (Fig. 503).

(8) For number 2 and 3 spoiler panels, perform the following:

(a) Disconnect right hand mixer input rod (26) at attachment to spoiler override bungee (Fig. 503).

(b) Disconnect right hand mixer output rods (38 and 46) at attachment to mixer (Fig. 504 Sheet 3).

(c) Lengthen mixer input rod (26) 1.5 turns at threaded end, lockwire, and connect to spoiler override bungee (Fig. 503).

(d) Lengthen mixer output rods (38 and 46) until they can be connected to mixer (with a free fit of rig pins R4 and R5), lockwire, and connect to mixer (Fig. 504 Sheet 3).

NOTE: Rig pin R5 which is inserted through mixer frame and speedbrake link (30) will no longer fit (Fig. 503).

(9) Remove all rig pins.

(10) Remove aileron support tool if no further rigging will be accomplished.

(11) Perform DLC Null Functional Test (Ref. 27-61-00, Step 4E) to verify spoiler panel Null angles are within tolerance.

NOTE: If DLC maximum tolerances are still exceeded, repeat Steps 6I(7) and (8) but reverse the pushrod adjustments by 1/2 turn increments until DLC Null Angles fall within tolerance. Rig pin R5 which is inserted through mixer frame and special brake link (30) will not fit. Rig pins inserted through bellcranks 57, 61, 37 and 45 (Pushrods 58, 62, 38 and 46) must fit freely

6J. Completion Check

(1) Remove tags from hydraulic control panels.

(2) Verify all rig pins are removed from spoiler control system.

(3) Verify pushrod adjustable rod end lock-nuts are tightened and lock-wired.

(4) If cables are adjusted, verify turnbuckles are safetied.

(5) Verify all access doors and panels are closed.

(6) Following component replacement, perform Spoiler and Speedbrake Quick Rigging Check on affected spoiler panels (Ref. Para. 5).

SPEEDBRAKE CONTROL LEVER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Control Shaft Locating Fixture, G/ITEL 27-51-165, PN 1505655-101 LF or equivalent

Lock-wire, Fed Spec QQ-W-390, COND A, 0.020 inch diameter, or equivalent

Rig Pin, 5/16-inch diameter, 3-inches long (R3) (2 each)

2. Referenced Procedures

	24-41-00	External Power/Ground Service Systems - Maintenance Practices
	25-13-05	Center Console Trim Covers - Removal and Installation
	27-42-00	Horizontal Stabilizer Trim Control System - Adjustment and Test
R R	31-22-05	Speedbrake Control Lever Unsafe Takeoff Aural Warning Switch - Removal and Installation

3. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that circuit breakers THROT STAND (M5), T/O AURAL WRNG (H7), DLC SERVO A and B (H14 and H15) are opened and tagged.

(2) Remove center console trim panel on the left and right side (Ref. 25-13-05) (Ref. Fig. 401).

(3) Move flap handle, speedbrake lever, and engine throttle levers full forward.

(4) Remove screws securing throttle stand cover and remove cover by rotating and pulling it rearwards, taking care

not to damage lever seals. Pull sufficient throttle cover wire harness out of trough in throttle stand and rest cover on center console using pad to protect throttle cover (Ref. Fig. 401).

(5) Position pitch trim wheel to 4 degrees. Install rig pin (R3) in bracket and forward pitch trim cable drum beneath flight station floor [access through forward electronic service center (FESC)].

(6) Remove three nuts attaching Captains trim control to throttle stand. Move trim control outboard to disengage from mounting studs and interconnecting shaft.

(7) Identify wires for reinstallation. Remove five trim control wires from throttle stand terminal module. Remove trim control.

(8) Remove three nuts attaching First Officers trim control to throttle stand. Move trim control outboard to disengage from mounting studs and upward to disengage from vertical shaft.

(9) Identify wires for reinstallation. Remove two trim control wires from throttle stand terminal module. Remove trim control.

(10) Remove trim control interconnecting shaft from hollow throttle stand shaft.

(11) Remove bolt connecting speedbrake lever to vertical pushrod.

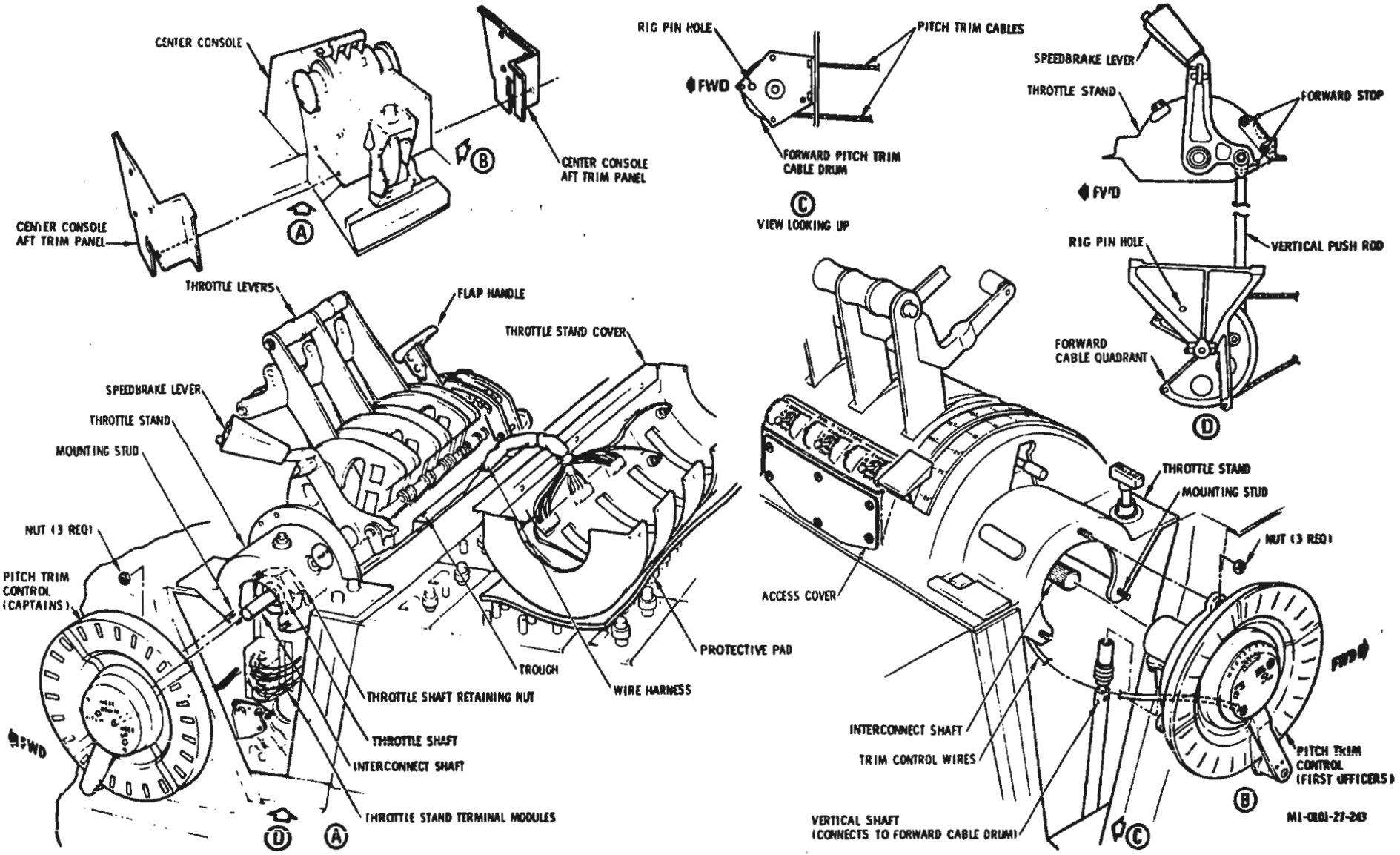
(12) Remove speedbrake lever grip and grip wires as follows:

(a) Remove bolt attaching wire cable clamp to speedbrake lever.

(b) Remove four screws that retain wire cable guard. Remove cable guard.

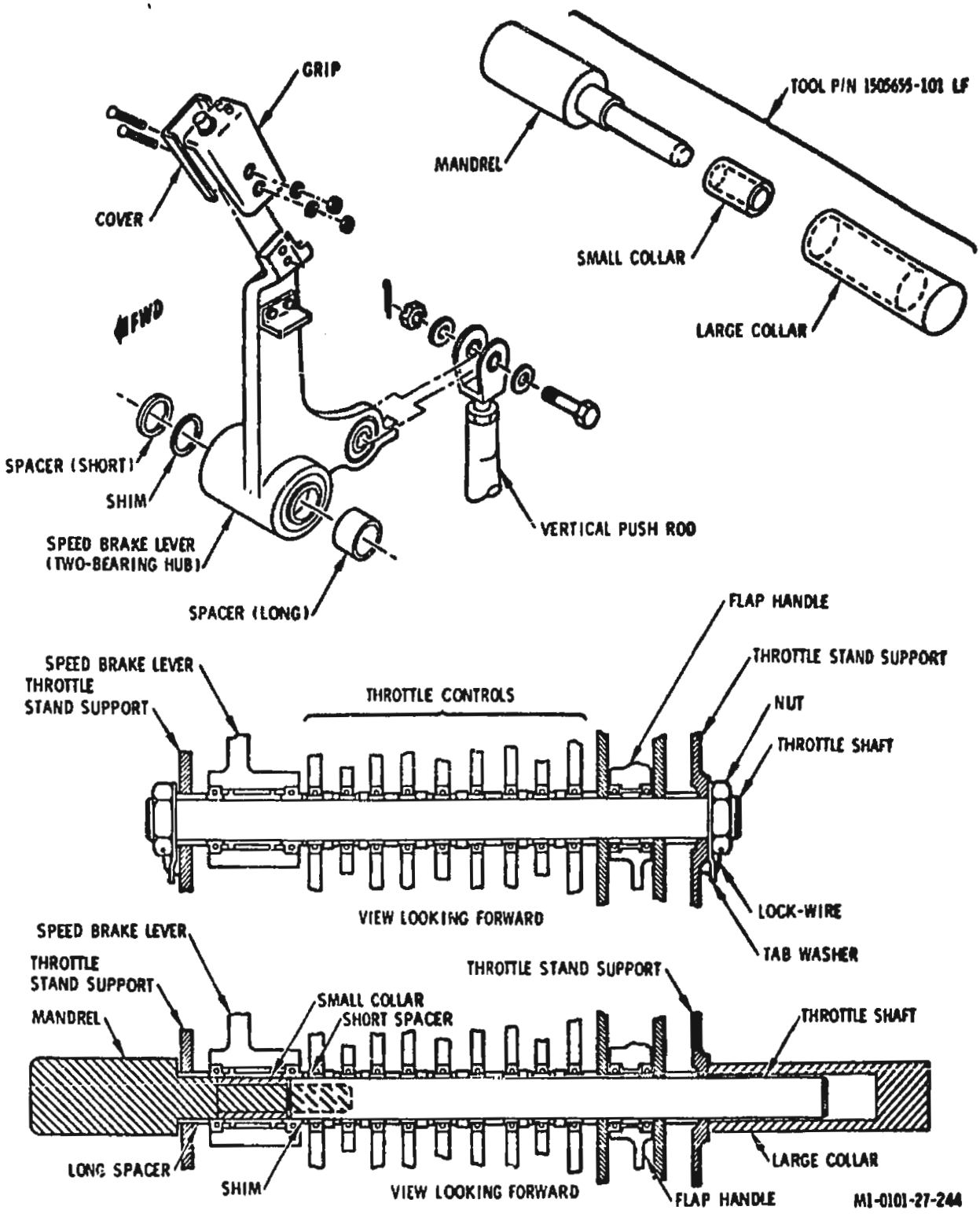
(c) Remove two screws retaining grip and cover to speedbrake lever. Remove grip and cover from speedbrake lever. Reinstall screws in grip and cover and position grip out of way.

(13) Remove lock-wire, nuts and tab washers from throttle stand shaft from both Captains and First Officers side of throttle stand (Ref. Fig. 401).



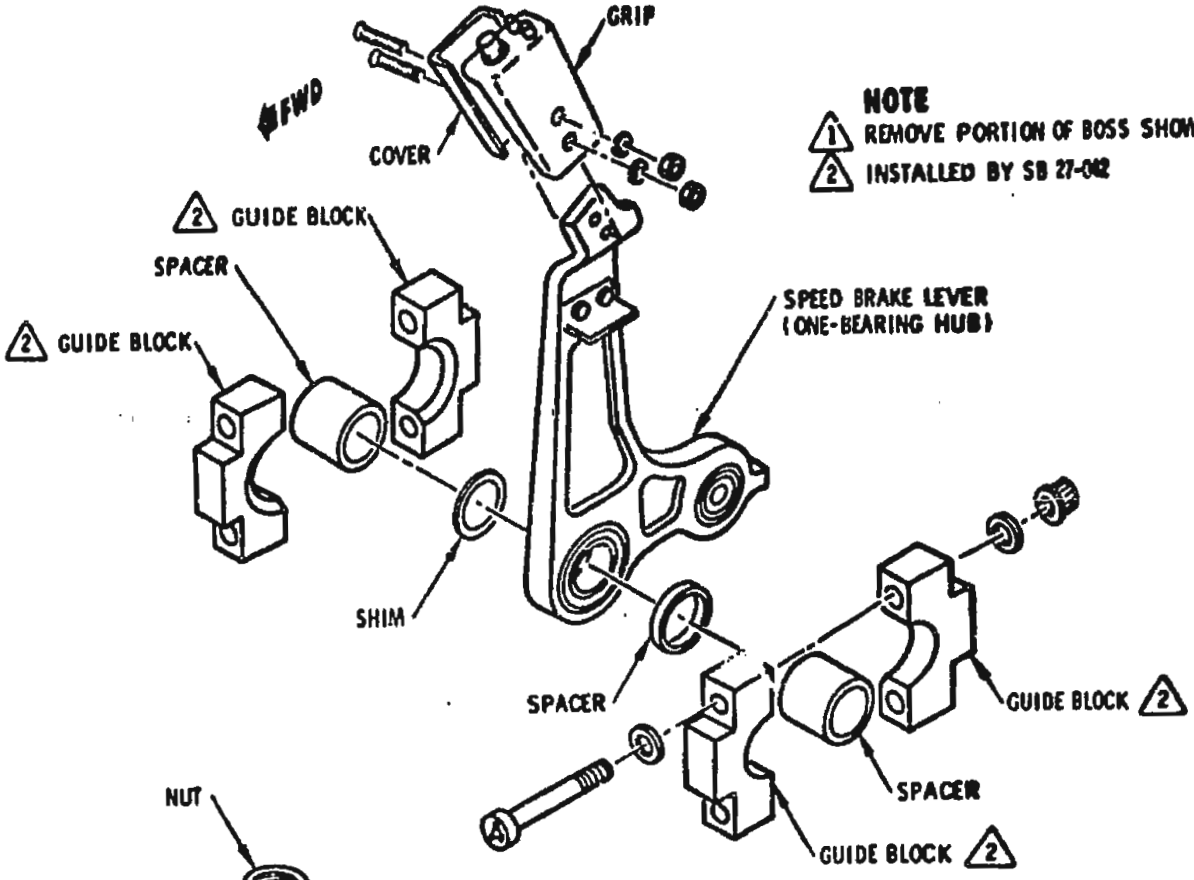
Speedbrake Control Lever - Removal and Installation
Figure 401 (Sheet 1)

R RR 0018 EFFECTIVITY: ALL

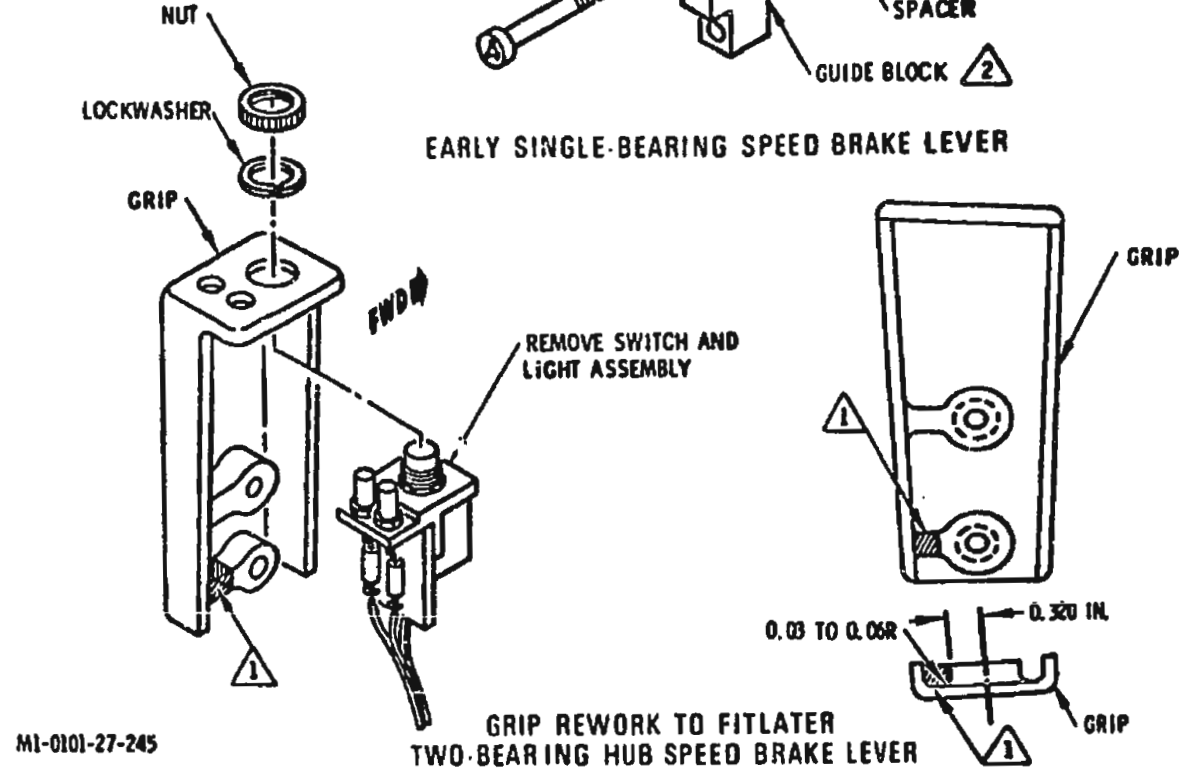


R Speedbrake Control Lever - Removal and Installation
R Figure 401 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



EARLY SINGLE-BEARING SPEED BRAKE LEVER



M1-0101-27-245

GRIP REWORK TO FITLATER
TWO-BEARING HUB SPEED BRAKE LEVER

R Speedbrake Control Lever - Removal and Installation
R Figure 401 (Sheet 3)

R EFFECTIVITY: ALL
R
0018

R NOTE: On aircraft 001-006 with SB27-042,
R remove guide blocks from each side of speedbrake
R lever hub (Ref. Fig. 401, Sheet 3).

(14) Drift out throttle stand shaft to free speedbrake lever as follows [use shaft control locating fixture (Ref. Fig. 401, Sheet 2)]:

(a) Place short collar on mandrel and insert small diameter of mandrel into end of shaft on Captains side of console.

(b) Hold large collar over shaft at other end so that it is in contact with throttle stand. Collar will react to light blows on mandrel and prevent shaft "lock-up".

(c) Carefully tap on mandrel to drift shaft out of speedbrake lever. Drift shaft until mandrel shoulder contacts throttle stand.

(d) While supporting speedbrake lever, withdraw mandrel and collar. Pull outboard spacer from throttle stand and remove speedbrake lever, spacer and shim. (Shim will be used on replacement lever.)

B. Installation

R NOTE: On aircraft 001-006,
R if aircraft has an early speedbrake lever with single
R hub bearing, replace lever with a forged lever
R containing a wide hub and two hub bearings. The wide
R hub speedbrake lever requires different spacers.

(1) While pushing in on throttle stand shaft, install replacement speedbrake lever parts. Install short spacer, shim, and then speedbrake lever. Install long spacer through throttle stand support (Ref. Fig. 401, Sheet 2).

NOTE: To assist in drifting throttle stand shaft into place, use mandrel and large collar and lightly tap mandrel.

(2) Install tab washers and nuts on both ends of throttle stand shaft. Verify that tab washer tangs are seated in notches in the throttle stand support. Tighten nuts but do not lock-wire at this time.

(3) With all levers full forward, temporarily install throttle stand cover taking care not to damage lever seals. Install cover attaching screws.

(4) Verify that speedbrake lever is in center of cover slot. If not, note dimension and direction speedbrake lever will have to be shifted.

(5) Remove throttle stand cover.

(6) If speedbrake lever is not in middle of cover slot, remove speedbrake lever and remove or add shims on inboard side of lever as required.

(7) With speedbrake lever mounting parts installed, and tab washer tangs seated in the throttle stand support notches, tighten throttle stand shaft nuts. Lock-wire nuts to tab washers.

(8) Install speedbrake lever grip and grip wires as follows:

R NOTE: On aircraft 001-006,
R if early machined speedbrake lever is being
R replaced with a forged speedbrake lever, rework
R speedbrake lever grip in accordance with Fig.
R 401 (Sheet 3) [Ref. SB27-094].

(a) Install grip and grip cover on lever. Install attaching screws, washers and nuts.

(b) Position wire cable in lever slot. Install wire cable guard with four retaining screws.

(c) Install wire cable clamp to inboard side of speedbrake lever.

(d) Cycle speedbrake lever through several full throw operations to verify that speedbrake lever operates freely without interference from the wire cable. Verify that wire cable does not rub, bind, or hang up on speedbrake lever.

(9) Connect vertical pushrod to speedbrake lever with bolt, washers and nut. Install cotter pin.

(10) Check rigging of vertical pushrod as follows (Ref. Fig. 401, Sheet 1):

(a) Position speedbrake lever full forward so speedbrake lever contacts forward stop.

(b) With speedbrake lever positioned full forward, rig pin (R3) should fit freely in the forward cable quadrant under flight station (access through FESC). If not, adjust vertical pushrod.

(c) Remove rig pin from cable quadrant.

(11) Verify that rig pin is installed in the pitch trim forward cable drum.

(12) Position First Officers pitch trim wheel pointer to 4 degrees, within area of blue dot. Couple trim control spline shaft to the vertical shaft and install trim control on mounting studs.

(13) Verify that First Officers pitch trim pointer still reads 4 degrees, within area of blue dot. Install three trim control attaching nuts.

(14) Connect First Officers trim control wires to terminal module.

(15) From Captains side of pedestal, install the trim control interconnecting shaft in the hollow throttle stand shaft and engage shaft in the First Officers trim control gearbox.

R CAUTION: ON AIRCRAFT 001-014 WITHOUT SB27-097, THE INTERCONNECT SHAFT MAY HAVE ONE END WITH A LONGER SPLINE. THE LONG SPLINE IS COUPLED TO THE CAPTAINS PITCH TRIM CONTROL. IF THE INTERCONNECT SHAFT IS REVERSED, THE SHAFT CAN DISENGAGE FROM CAPTAINS TRIM CONTROL. IF SHAFT CONTAINS A SHORT AND LONG SPLINE, VERIFY THAT SHORT SPLINE IS ENGAGED IN FIRST OFFICERS TRIM CONTROL.

SB 27-097 INSTALLS A RIVET AND TWO WASHERS ON THE LONG SPLINE TO ALLOW THE INTERCONNECT SHAFT TO BE INSTALLED EITHER WAY. LATER AIRCRAFT HAVE THE INTERCONNECT SHAFT WITH A SHORT SPLINE ON BOTH ENDS.

(16) Position Captains pitch trim wheel pointer to 4 degrees, within area of blue dot. Couple pitch trim control to interconnecting shaft and install trim control on mounting studs.

(17) Verify that Captains trim control pointer still reads 4 degrees, within area of blue dot. Install three trim control attaching nuts. Remove rig pin from forward pitch trim cable drum.

(18) Connect Captains trim control wires to terminal module.

(19) Verify that center console work area is clear of all tools and equipment.

(20) With all levers full forward, install throttle stand cover taking care not to damage lever seals. Verify that seal lips are in outward position. Install cover screws.

(21) Remove access cover on aft side of throttle stand cover (access cover located just below fuel and ignition switches). Through access opening, verify that throttle stand wire harness is stowed in trough attached to aft side of pedestal support (Ref. Fig. 401, Sheet 1).

(22) Operate all three throttle levers through full forward thrust range (DO NOT OPERATE REVERSE THRUST LEVERS). Verify that throttle lever mechanism does not foul wire harness. Position throttle levers to zero. Install access cover on throttle stand cover.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(23) Remove tags and close circuit breakers opened in Step A(1).

(24) Turn on electrical power (Ref. 24-41-00).

(25) Turn on all four hydraulic systems (Ref. 29-11-00).

(26) With flaps full-up, cycle speedbrake lever through several full speedbrake applications. Verify normal operation of speedbrake lever (normal operating force is 3 to 5 pounds). Verify that spoilers respond to speedbrake movement.

(27) Check the operation of the speedbrake emergency override switch as follows:

(a) On the top of the speedbrake lever, depress and release the override pushbutton to disable the DLC servo. Verify that the handle lights come on and that the force required to operate the speedbrake handle increases (35 to 46 pounds).

(b) Depress and release the speedbrake lever override pushbutton to enable the DLC servo. Verify that the handle lights go off and that the force required to move the speedbrake lever returns to normal (3 to 5 pounds).

(28) Cycle pitch trim control through several full pitch-up to pitch-down operations. Verify normal operation of pitch trim system. Verify that stabilizer follows pitch trim inputs (use surface position indicator). (Operate pitch trim from both the Captains and First Officers trim control.)

(29) Check the speedbrake lever unsafe takeoff aural warning switch operation (Ref. 31-22-05) and adjust as required.

(30) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(31) Turn off electrical power if no longer required (Ref. 24-41-00).

(32) Install center console trim covers.

DIRECT LIFT CONTROL (DLC) SERVO - REMOVAL AND INSTALLATION

1. General

The following is a list of DLC servo line replaceable units (LRU's):

DLC Servo Electrohycraulic Servo Valve - 27-61-07

DLC Servo Solenoid Shutoff Valve - 27-61-08

DLC Servo Pressure Switch - 27-61-36

2. Equipment and Materials

Container - one gallon

Hydraulic line plugs

Hydraulic fitting caps

Rig pins 2 each (R3), 5/16-inch diameter, 3 inches long (Part of B735 kit)

3. Referenced Procedures

20-29-01	Fluid Lines and Fittings Assembly - Maintenance Practices
22-17-01	FCES Computer - Removal and Installation
24-41-00	External Power/Ground Service Systems - Maintenance Practices
27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker FCES COMPUTERS DC and AC & L AOA(B4, B5). On Flight Engineer/Second Officers overhead panel CB2, zone 215, open and tag circuit breakers DLC SERVO A and B (H14, H15).

(2) Open access doors 147 AB for access to hydraulic service center.

NOTE: DLC servo replacement will not normally require any rigging adjustments if the servo input and output pushrod adjustments are not disturbed.

(3) Disconnect input pushrod from the DLC input arm by removing the attaching bolt. Tie pushrod out of way.

(4) Disconnect the output pushrods from the DLC output arm by removing the single attaching bolt. Tie pushrod out of way.

(5) Disconnect the two electrical connectors from the DLC servo.

(6) Disconnect the four hydraulic lines from the DLC servo. Install plugs and caps on hydraulic lines and fittings.

R WARNING: DLC SERVO WEIGHS APPROXIMATELY 55 POUNDS.

(7) Remove the six servo mounting bolts. Remove servo.

R B. Installation

(1) Verify circuit breakers listed in Step A(1) are open and tagged.

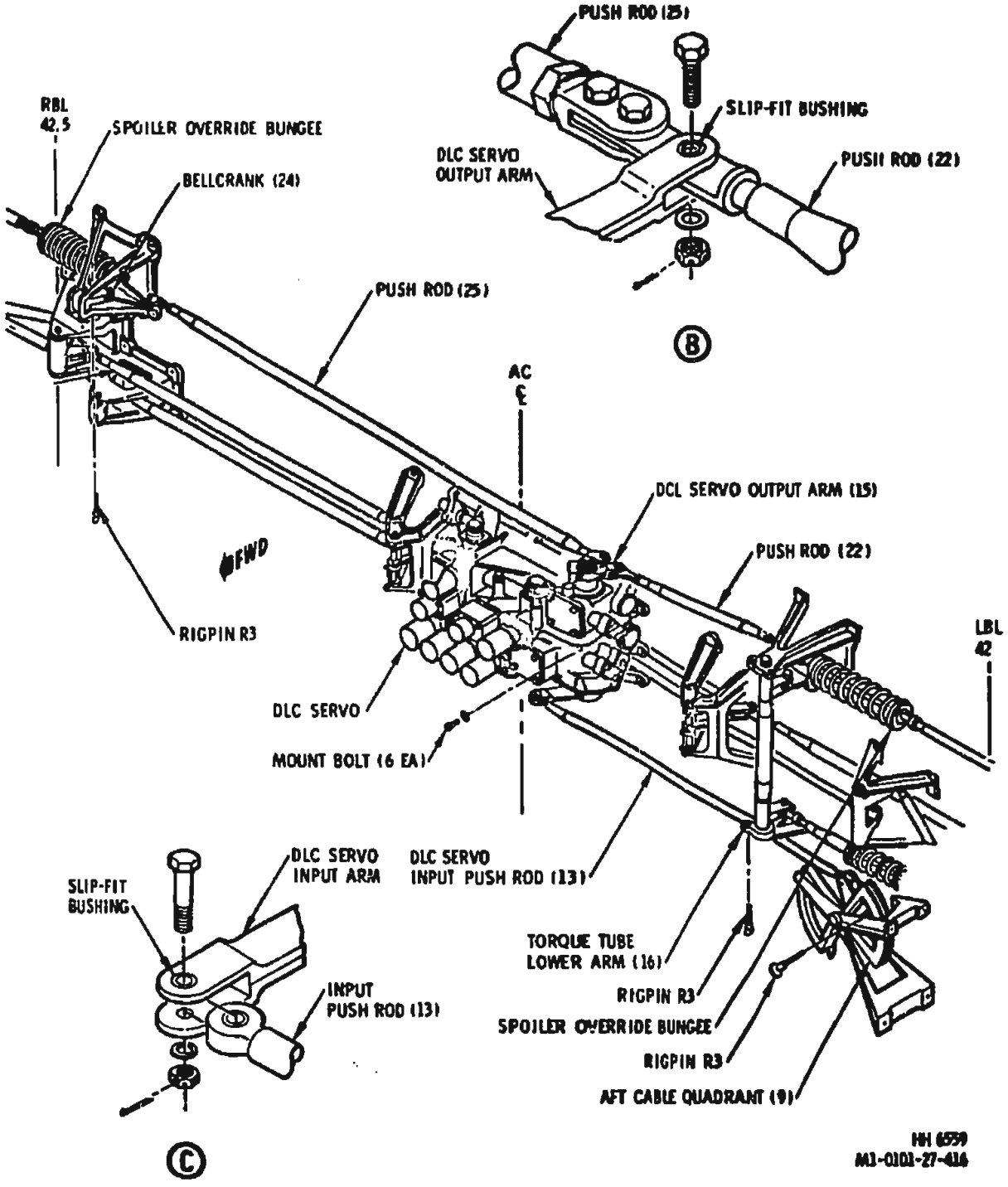
(2) Verify that the speedbrake control lever on pilots center console is full forward (0-degree spoilers).

(3) Raise DLC servo into position and install the six mounting bolts.

(4) Connect hydraulic lines to servo. Torque hydraulic fittings (Ref. 20-29-01).

(5) Verify that electrical connectors are not contaminated with oil. If they are, clean with approved solvent. Connect electrical connectors to servo.

(6) Verify that slip-fit bushing is installed in the DLC output arm (15). Install bolt, washer, and nut attaching the output pushrods to the DLC output arm. Install cotter pin.



R Direct Lift Control (DLC) Servo – Removal and Installation
R Figure 401

R NOTE: Each spoiler mixer incorporates a bias spring on the bottom of the mixer to load the mixer output arms in the retract direction. To ensure that all lost motion between the DLC servo and mixer is removed, the bias spring force must be overcome to position the DLC-to-mixer linkage so that the rig pins can be inserted freely.

When adjusting the pushrods between the DLC servo and mixer, it will require approximately a 40-pound force to position bellcrank (24) on right side, and torque tube lower arm (16) on left side to allow free insertion of rig pins in the bellcrank and arm.

In the following rigging steps, it is important that both rig pins are a free fit to ensure that all lost motion between the DLC and mixers is removed.

R (7) With the DLC servo output arm (15) against the DLC servo internal down stop, rig pin R3 must fit freely through the torque tube lower arm (16) in the left corner of hydraulic service center. If not, adjust pushrod (22).

R NOTE: With the speedbrake lever full forward, the DLC SERVO output arm will normally be against the DLC servo internal down stop (clockwise stop, viewed from above).

R (8) With the DLC servo output arm (15) against the DLC servo internal down stop, rig pin R3 must fit freely through the right bungee bellcrank (24) in the right corner of hydraulic service center. If not, adjust push rod (25).

R (9) Remove all rig pins.

R (10) Remove tags and close circuit breakers opened in Step 4A(1).

R (11) Remove placards from hydraulic panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(12) Turn on electrical power (Ref. 24-41-00).

R CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

(13) Turn on hydraulic systems A and B (Ref. 29-11-00).

(14) Bleed DLC servo by slowly cycling DLC input arm (bottom arm) through full spoiler applications at least five times or until DLC servo operates smoothly.

NOTE: After bleeding any component, bleed the associated hydraulic reservoir (Ref. 12-13-00).

(15) Check hydraulic connections at DLC servo for leakage.

(16) Verify that flight station speedbrake control lever is full forward (0-degree spoilers).

(17) In hydraulic service center, install rig pin (R3) through bracket and aft cable quadrant (9).

(18) Manually rotate DLC input arm (bottom of DLC) slowly towards spoiler up (clockwise, looking up). Determine threshold of DLC output arm movement (point where output arm on top of DLC starts to move). Slowly rotate DLC input arm toward spoiler down (counterclockwise, looking up) to move DLC input arm 0.06 to 0.10 inch back from threshold. Connecting bolt must now slip freely through DLC input arm and input pushrod. If not, adjust input pushrod (13).

NOTE: An alternate method is to adjust input pushrod to connect to DLC input arm with DLC output arm just at threshold, then lengthen input pushrod 1.5 turns.

(19) Verify that slip-fit bushing is installed in the input arm upper tang. Install input pushrod connecting bolt, washer, and nut. Install cotter pin.

(20) Remove rig pin from aft cable quadrant (9).

(21) Operate speedbrake lever through several full-throw cycles. Verify normal operation of the DLC servo and the spoilers. (Spoilers 1 through 4 operate with flaps extended; spoilers 2 through 6 operate with flaps full up.)

(22) Check for proper DLC input rigging as follows:

(a) Position speedbrake lever full forward (0-degree spoilers).

(b) Shut off and turn on DLC servo by depressing and releasing override pushbutton on the top of speedbrake lever two times. (Lights on speedbrake lever will come on when pushbutton positioned to shut off DLC servo.)

(c) Verify that DLC output arm does not move during Step (b). If DLC output arm moves, check rigging as outlined in Step (18).

(23) Perform DLC Servo Manual Mode Operational Test (Ref. 27-61-00, Adjustment and Test, Para. 4D).

(24) Perform DLC/AGSB Test portion of 22-17-01 (FCES Computer, Removal and Installation).

(25) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(26) Shut off electrical power if no longer required (Ref. 24-41-00).

(27) Close access door to hydraulic service center.

DIRECT LIFT CONTROL SERVO ELECTROHYDRAULIC SERVO VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Gasket (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

2. Referenced Procedure

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following circuit breakers:

DLC SERVO - A or B

FLIGHT STATION MISC - R AOA

On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - FCES - L AC a AOA.

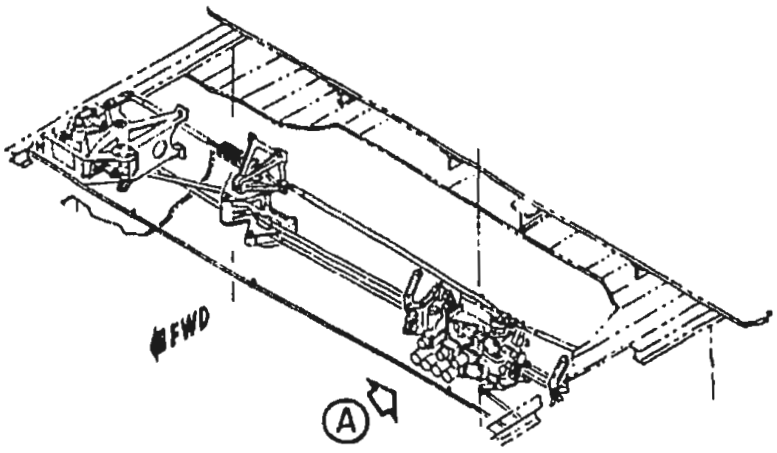
(2) Open hydraulic service center door 147AB.

(3) Remove mount bolts and remove servo valve (Ref. Fig. 401).

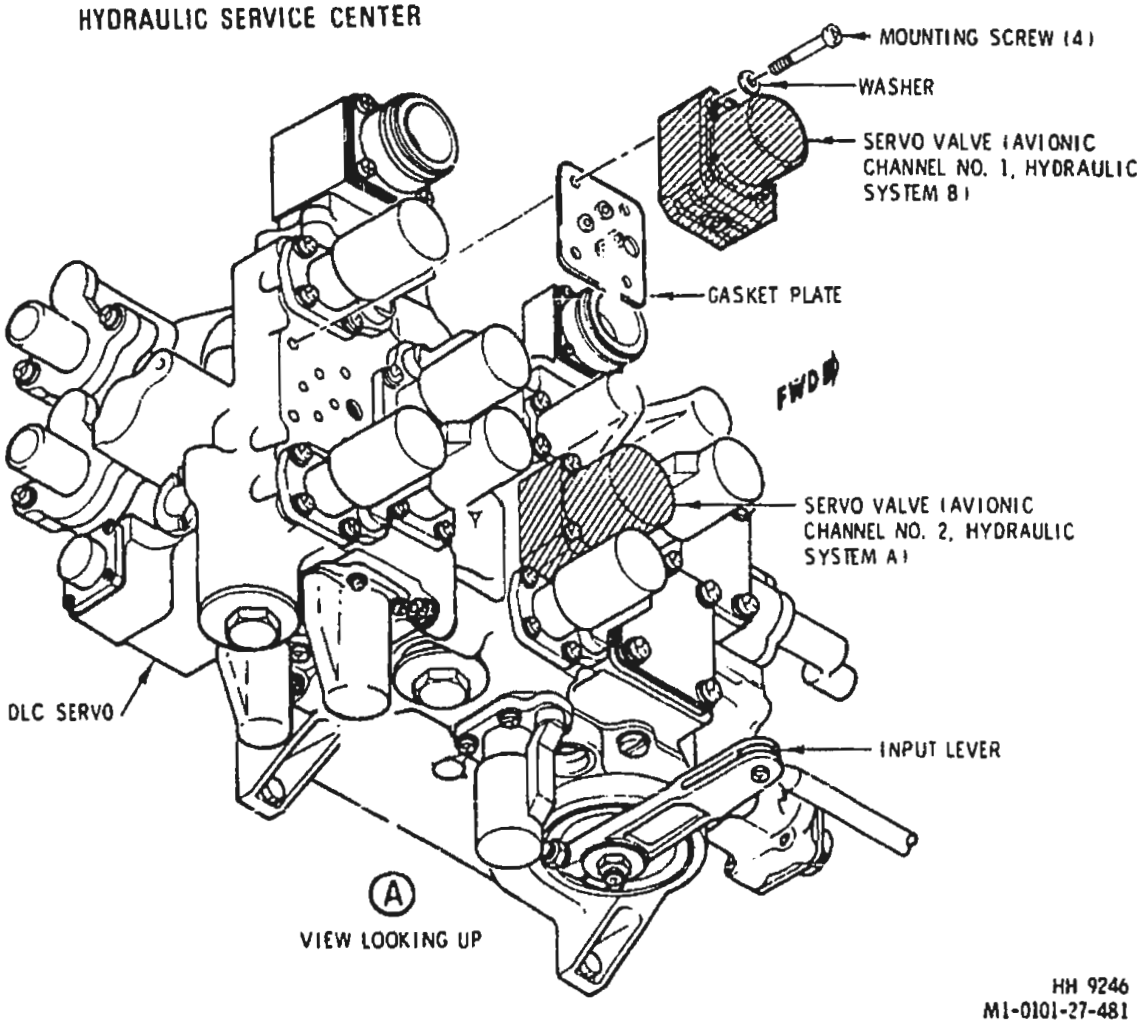
(4) Remove and discard plate gasket.

(5) Remove and discard preformed O-ring packing from servo valve electrical connection groove.

B. Installation



HYDRAULIC SERVICE CENTER



HH 9246
M1-0101-27-481

R Direct Lift Control Servo Electrohydraulic Servo Valve
R Removal and Installation
R Figure 401

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Install new preformed O-ring packing on valve electrical connection groove.

(3) Install new plate gasket and servo valve. Secure with mount bolts and lock-wire.

(4) Remove tags and close circuit breakers opened in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Remove tags installed at beginning of Paragraph 3.

(6) Turn on hydraulic system A or B as applicable (Ref. 29-11-00).

(7) Check switch for leaks.

(8) Turn off hydraulic system (Ref. 29-11-00).

(9) Close access door.

DIRECT LIFT CONTROL SERVO AND SPOILER CONTROL SERVO SOLENOID SHUTOFF VALVE - REMOVAL AND INSTALLATION

1. General

CR CR The solenoid shutoff valve can be replaced as an assembly and should not be considered field repairable.

2. Equipment and Materials

Gasket Plate (Ref. Fig. 401) (If replacing entire valve assembly)

O-ring (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

3. Referenced Procedures

22-17-01	FCES Computer - Removal and Installation
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Preparation

(1) Open and tag applicable circuit breaker as follows:

Direct Lift Control Servo:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, DLC SERVO - A or B.

On pilots overhead circuit breaker panel CB1, zone 210, AVIONICS FLIGHT CONTROL SYSTEM - FCES - L AC & AOA.

Spoiler Control Servo:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, SPOILER

SERVO; B, 1, 4, 6, L&R; SPOILER SERVO - B 1, 4, 6 L&R; A2L, or D2R; C3, 5, L&R.

(2) For access to direct lift control servo, open hydraulic service center door 147AB.

Spoiler control servo access is gained by moving flaps to 10-degree position as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on hydraulic system A or C (Ref. 29-11-00).

(b) Set flap control handle in the 10-degree position.

(c) Turn off hydraulic system A and C (Ref. 29-11-00).

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

B. Removal of Solenoid Coil Assembly

CR Section Deleted

C. Installation of Solenoid Coil

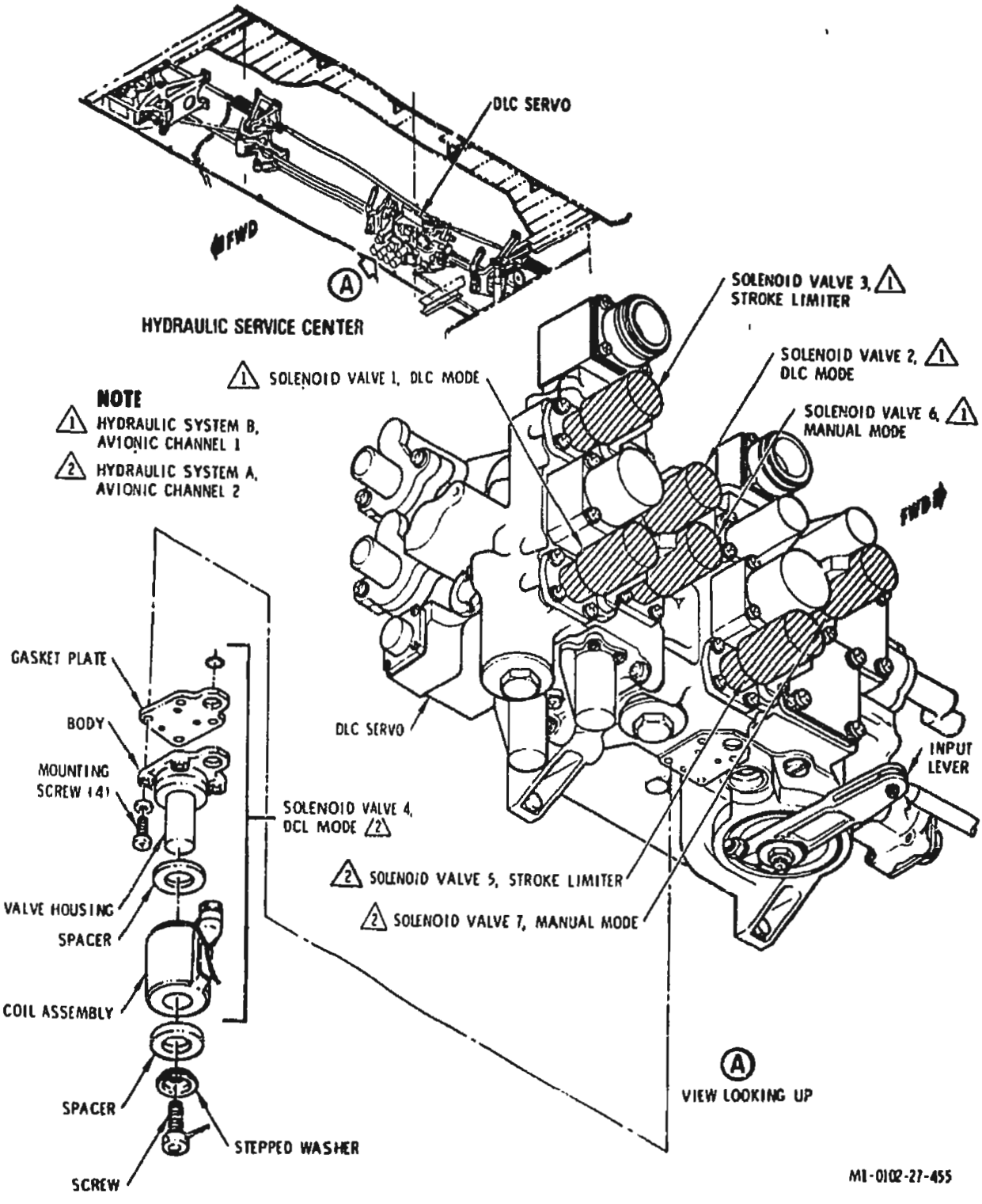
CR Section Deleted

D. Removal of Solenoid Shutoff Valve

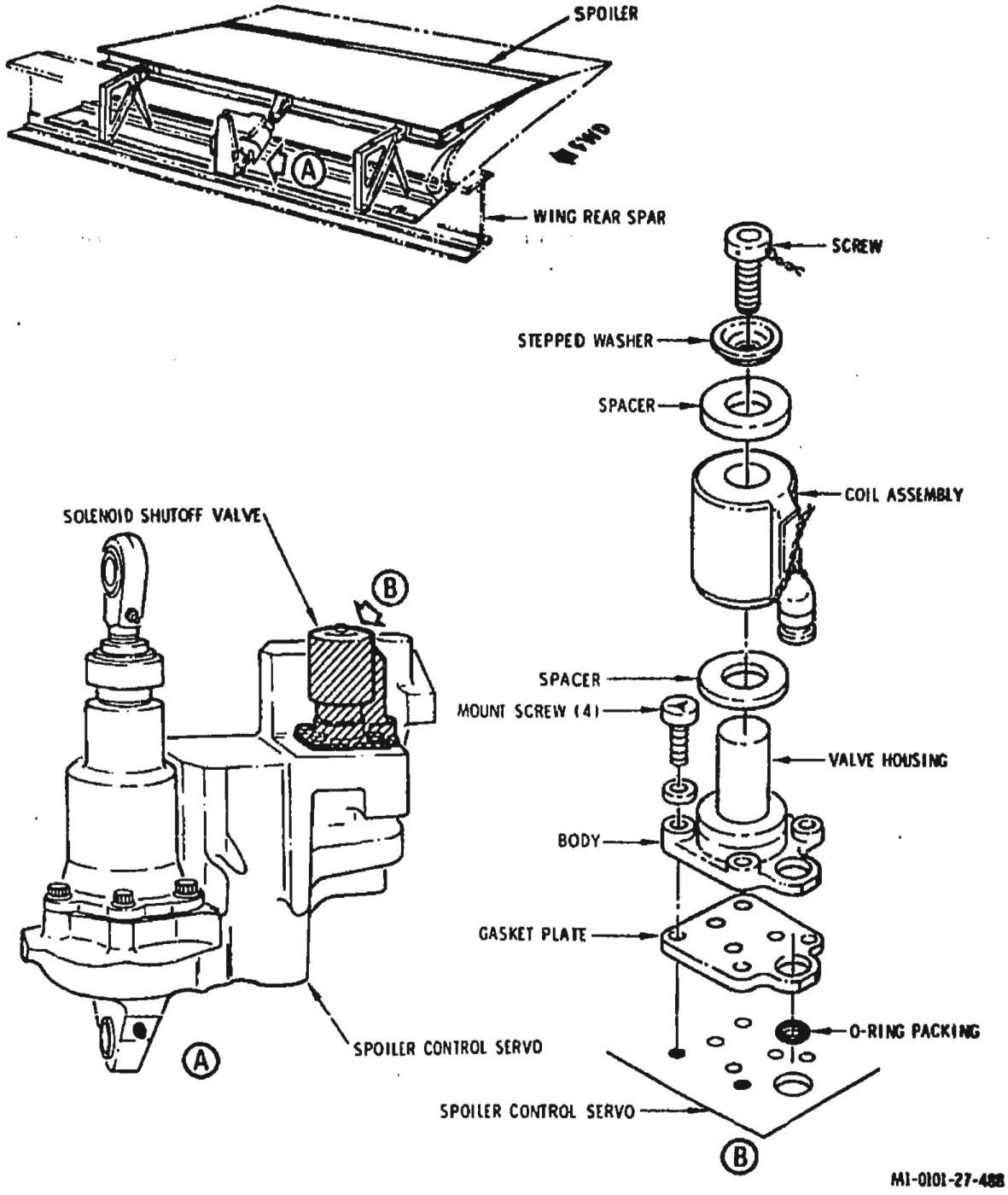
(1) Remove shutoff valve mount screws and remove valve (Ref. Fig. 401).

B. Installation of Solenoid Shutoff Valve

(1) Verify that circuit breaker opened in Step 4A(1) is open and tagged.



Direct Lift Control Servo and Spoiler Control Servo Solenoid Shutoff Valve - Removal and Installation
Figure 401 (Sheet 1)



Direct Lift Control Servo and Spoiler Control Servo Solenoid Shutoff Valve - Removal and Installation
Figure 401 (Sheet 2)

(2) Verify that O-ring is installed on valve electrical connector.

(3) Verify that a gasket plate is installed on valve. Install shutoff valve with mount screws and lock-wire.

NOTE: Tri-wing mount screws can be replaced by NAS 1351 socket-head cap screws.

(4) Check solenoid shutoff valve operation in accordance with Para. F.

F. Checkout of Solenoid Shutoff Valve

(1) Remove tag and close circuit breaker opened in Step 4A(1).

(2) Remove tags from hydraulic control panels.

(3) Turn on applicable hydraulic system (Ref. 29-11-00) (See Fig. 401, Sheet 1, to determine which hydraulic system is supplying the replaced DLC servo shutoff valve):

(a) System A or B for DLC Servo (Ref. Fig. 401).

(b) For spoiler servo 1, 4, and 6 both wings, system B; servo 3 and 5 both wings, system C; servo 2 left wing, system A; servo 2 right wing, system D.

NOTE: Hydraulic system A or B must be on to operate the DLC servo to position the spoiler servos.

(4) Check the spoiler servo shutoff valve as follows:

(a) Verify that the applicable SPOILER switchlight on the PFCS panel (on pilots overhead panel) is depressed (in).

(b) Operate the speedbrake lever and verify that spoiler with replaced shutoff valve responds to lever movement. Position speedbrake lever to zero degrees.

(c) Release (out) the applicable SPOILER switchlight on PFCS panel. The switchlight OFF light must come on.

(d) Operate the speedbrake lever and verify that spoiler with replaced shutoff valve does not

respond to lever movement. Position speedbrake lever to zero degrees.

(e) Depress (in) SPOILER switchlight.

(f) If shutoff valve was replaced, check shutoff valve for hydraulic leakage.

(5) Check the DLC servo shutoff valve as follows:

(a) If solenoid shutoff valve 1 through 5 is to be checked, accomplish paragraph 2C(1) (Preparation) and 2C(4) (DLC/AGSB Test) in 22-17-01, FCES computer - Removal and Installation.

(b) For shutoff valve 6 or 7, depress then release pushbutton switch on top of speedbrake handle. Verify that lights on speedbrake handle come on and that DLC servo does not respond to speedbrake handle movement, using normal force of 3 to 5 pounds on speedbrake handle. (In manual override, with no hydraulic power, the DLC can be positioned with a force of 35 to 46 pounds on speedbrake handle.)

(c) Depress then release pushbutton switch on top of speedbrake handle. Verify that lights on speedbrake handle go off and that DLC SERVO responds to speedbrake handle movement.

(d) If shutoff valve was replaced, check shutoff valve for hydraulic leakage.

(5) Position flaps to full up.

(6) Turn off hydraulic systems (Ref. 29-11-00).

(7) Close access door if opened for DLC access.

FILTER ELEMENT, DIRECT LIFT CONTROL SERVO REMOVAL AND INSTALLATION

1. Equipment and Materials

Drip pan, 1-gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

2. Referenced Procedure

29-11-00 Hydraulic Power - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Open hydraulic service center access door 147AB.

(2) In hydraulic service center, zone 147, place drip pan under direct lift control servo to catch hydraulic fluid.

(3) Remove filter cap from direct lift control servo (Ref. Fig. 401).

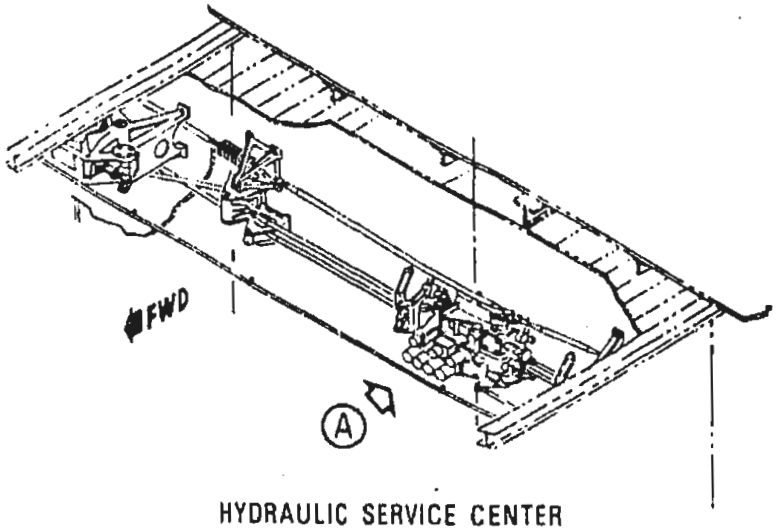
(4) Remove and discard backup ring, preformed packing, and backup ring from filter cap.

(5) Pull filter element from direct lift control servo. Remove and discard backup ring, preformed packing, and backup ring from filter element.

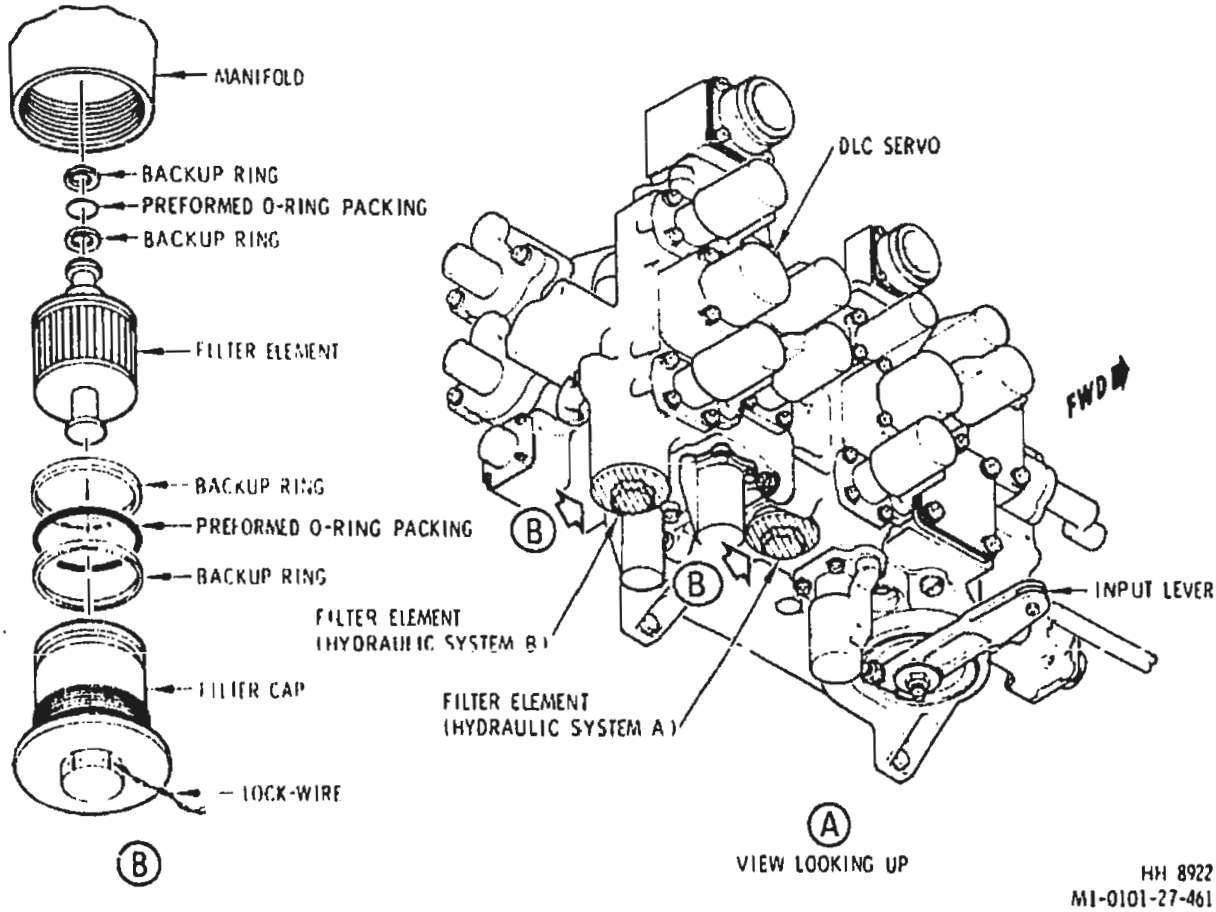
B. Installation

(1) Wet preformed packings and backup rings with hydraulic fluid before installation.

(2) Install backup ring, preformed packing, and backup ring on filter element.



HYDRAULIC SERVICE CENTER



HH 8922
MI-0101-27-461

R Filter Element, Direct Lift Control Servo
R Removal and Installation
R Figure 401

(3) Install filter element in direct lift control servo.

(4) Install backup ring, preformed packing, and backup ring in groove on filter cap.

CAUTION: DO NOT EXCEED 130 LB IN. WHEN TIGHTENING FILTER CAP.

(5) Install filter cap over filter element and torque 120 to 130 lb in. Attach lock-wire to filter cap and manifold.

R (6) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic system (Ref. 29-11-00) associated with filter element being installed (Ref. Fig. 401).

(8) Bleed direct lift control servo by cycling pilots speed brake control lever in flight station, zone 210, from full up to full down position three times. Visually determine that filter cap is not leaking.

(9) Turn off hydraulic power (Ref. 29-11-00).

(10) Close and secure access door opened in Step 3A(1).

SPOILER MIXER - REMOVAL AND INSTALLATION

1. General

The following is a list of mixer line replaceable units (LRU's):

Mixer dwell actuator - 27-61-25

2. Equipment and Materials

Rig pins - 5/16-inch diameter, 3 inches long (R3) (1 each) and 5/16 inch diameter, 5 inches long (R5) (4 each) (Part of B735 kit)

Aileron Support Tool, PN BF90, or equivalent

3. Referenced Procedures

	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: PROPER OPERATION OF THE SPOILER MIXER ASSEMBLY DEPENDS ON CORRECT ASSEMBLY AND ADJUSTMENT OF THE MIXER ASSEMBLY IN THE OVERHAUL SHOP. DO NOT TAMPER WITH OR MAKE ANY ADJUSTMENT ON THE MIXER ASSEMBLY UNLESS SPECIFICALLY DIRECTED BY MAINTENANCE MANUAL.

VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL ZONE 215, AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL, ZONE 147.

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 211, open and tag circuit breakers SPOILER DWELL DC and AC, (B7, B8).

(2) Verify that speedbrake lever is full forward (0 degrees).

(3) Open access doors 147 AB for access to hydraulic service center.

(4) Position inboard aileron, on same side as replacement mixer, to neutral (±0.12 inch) and install aileron support tool (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No.3 flap torque box.

R If location of inboard aileron neutral index
R mark is in doubt it may be checked or
R reestablished in accordance with 27-11-00,
R Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

(5) Disconnect actuator electrical connector from structure mounted receptacle just above mixer.

NOTE: Mixer replacement will not normally require any rigging adjustments if the interface pushrods adjustments are not disturbed.

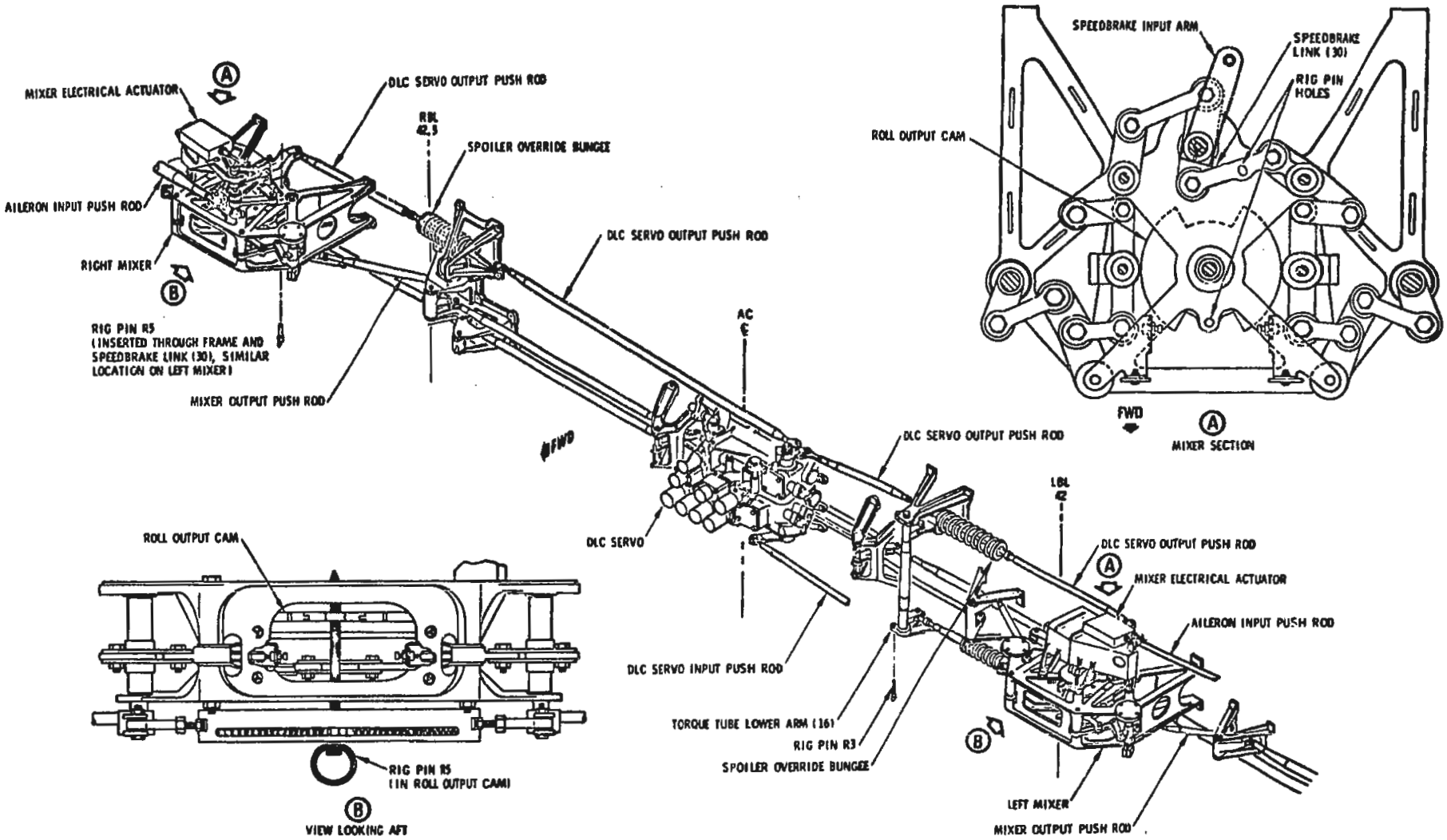
(6) Disconnect the aileron input pushrod from the mixer input arm by removing the attaching bolt.

NOTE: On the left mixer, the aileron input arm is on the top rear side; on the right mixer the arm is on the top forward side.

(7) Disconnect the Direct Lift Control (DLC) servo output pushrod from the mixer rear input arm by removing the attaching bolt.

(8) Disconnect the two mixer output pushrods from the mixer output arms (on bottom of mixer) by removing the attaching bolts.

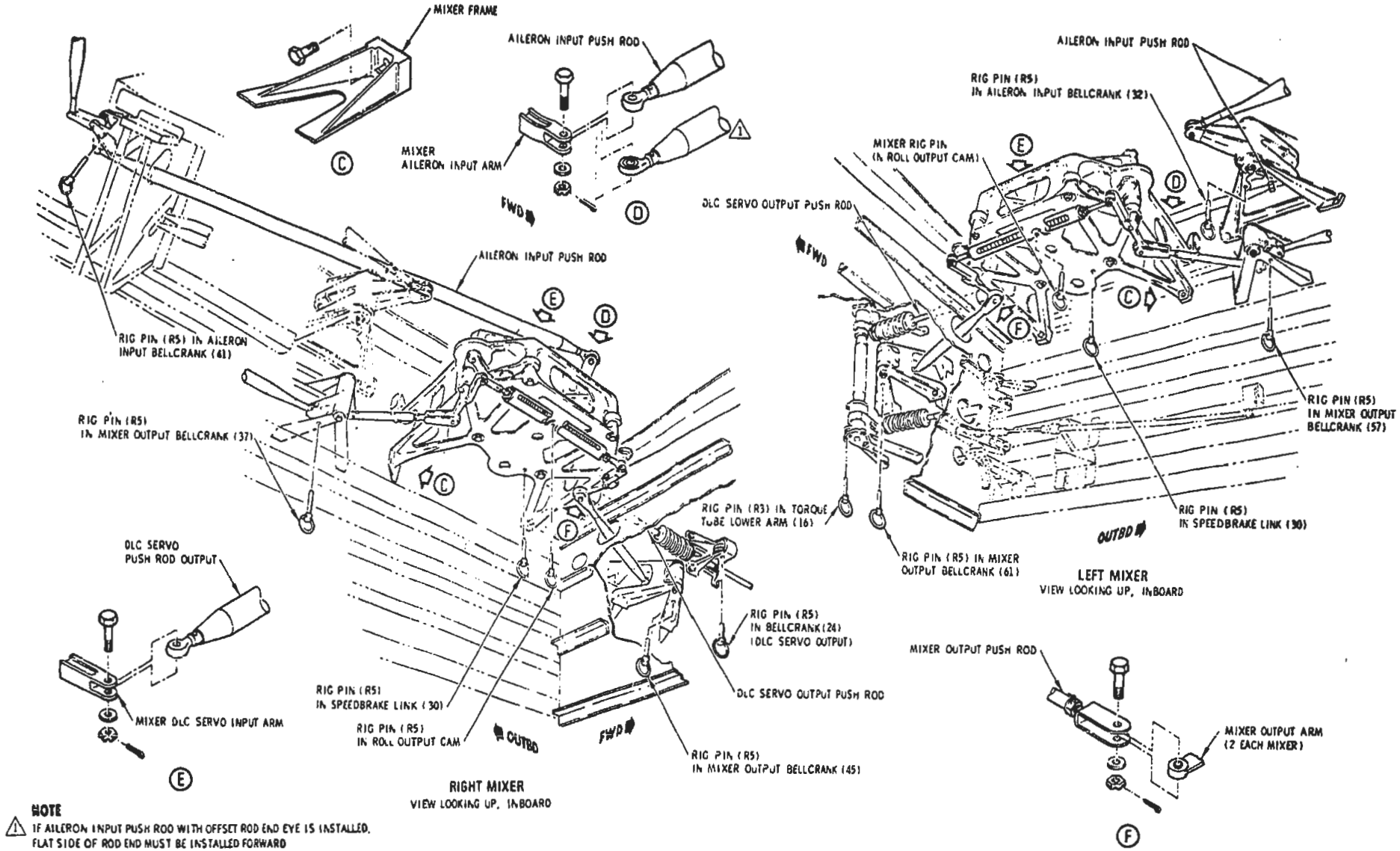
(9) Support mixer and remove the four mixer mounting bolts. Remove mixer.



R Mixer - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL

001B


MIXER FRAME
AILERON INPUT PUSH ROD
MIXER AILERON INPUT ARM
FWD
AILERON INPUT PUSH ROD
RIG PIN (R5) IN AILERON INPUT BELLCRANK (61)
RIG PIN (R5) IN MIXER OUTPUT BELLCRANK (37)
DLC SERVO PUSH ROD OUTPUT
MIXER DLC SERVO INPUT ARM
RIG PIN (R5) IN SPEEDBRAKE LINK (30)
RIG PIN (R5) IN ROLL OUTPUT CAM
OUTBD
FWD
RIG PIN (R5) IN MIXER OUTPUT BELLCRANK (45)
DLC SERVO OUTPUT PUSH ROD
RIG PIN (R5) IN BELLCRANK (24) (DLC SERVO OUTPUT)
RIGHT MIXER
VIEW LOOKING UP, INBOARD
AILERON INPUT PUSH ROD
RIG PIN (R5) IN AILERON INPUT BELLCRANK (32)
MIXER RIG PIN (IN ROLL OUTPUT CAM)
DLC SERVO OUTPUT PUSH ROD
FWD
RIG PIN (R3) IN TORQUE TUBE LOWER ARM (16)
RIG PIN (R5) IN MIXER OUTPUT BELLCRANK (61)
RIG PIN (R5) IN MIXER OUTPUT BELLCRANK (57)
RIG PIN (R5) IN SPEEDBRAKE LINK (30)
OUTBD
LEFT MIXER
VIEW LOOKING UP, INBOARD
MIXER OUTPUT PUSH ROD
MIXER OUTPUT ARM (2 EACH MIXER)

NOTE

⚠1 IF AILERON INPUT PUSH ROD WITH OFFSET ROD END EYE IS INSTALLED, FLAT SIDE OF ROD END MUST BE INSTALLED FORWARD

M1-0002-27-418

R Mixer - Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: ALL

001B

B. Installation

(1) Verify circuit breakers listed in Step A(1) are open and tagged.

(2) Verify that speedbrake lever is full forward (0 degrees).

(3) Verify that flaps are extended 4 degrees or more.

(4) Verify that all hydraulic power is turned off.

(5) Verify that inboard aileron on same side as replacement mixer is held in neutral by aileron support tool.

(6) Raise mixer into mounting position with electrical actuator positioned on top. Install four mixer mounting bolts.

(7) Connect actuator electrical connector and lockwire.

NOTE: It requires up to a 40-pound force on the speedbrake input arm of both mixers to position the mixer input arm to the rigged position (spoilers full down). (Load is produced by bias spring cartridge on mixer output arms on bottom of mixer.)

When adjusting the pushrods between the DLC servo and mixer, it will require as much as 40-pounds of force to position bellcrank (24) on right side, torque tube lower arm (16) on left side, and both mixer input arms to the rigged position.

In the following rigging steps, it is important that all rig pins are a free fit to ensure that the preload is maintained on the mixer input arms.

(8) Install rig pin (R5) through mixer frame and speedbrake link (30) at rear of mixer (Ref. Fig. 401, Sheet 1).

(9) For left mixer, insert rig pin (R3) in torque tube lower arm (16) just inboard of mixer and accessible from hydraulic service center.

(10) For right mixer, insert rig pin (R5) in bellcrank (24) just inboard of mixer and accessible from hydraulic service center.

(11) Manually rotate DLC servo output arm on top of DLC servo against the DLC internal downstop (clockwise, viewed from top).

(12) With DLC servo output arm against the DLC servo internal down stop, connect the DLC servo output pushrod to mixer input arm (lower rear arm on left mixer; rear arm on right mixer). Adjust DLC output pushrod to fit. Verify that rig pins through mixer frame and link and torque tube arm (16) (for left mixer) or bellcrank (24) (for right mixer) are a free fit. Install attaching bolt, washer, nut, and cotter pin.

(13) Install rig pin (R5) through mixer frame and roll output cam (Ref. Fig. 401, Sheet 2).

(14) Install rig pins (R5) in in the mixer output idler bellcranks (one on each side of mixer, with inboard idler bellcrank accessible in hydraulic service center). (Bellcrank (37) and (45) for right mixer; bellcrank (57) and (61) for left mixer.)

(15) Connect the mixer output pushrods to the mixer output arms (on bottom of mixer). Adjust pushrods to fit. Install attaching bolts, washer, nuts, and cotter pins.

(16) Install rig pin (R5) in the aileron input bellcrank just outboard of the mixer. (Bellcrank (41) for right mixer; bellcrank (32) for left mixer.)

(17) Connect the aileron input pushrod to the mixer input arm. If aileron input pushrod with offset rod end eye is installed, flat side of rod end must be installed forward. Adjust pushrod to fit. Install the attaching bolt, washer, nut, and cotter pin.

R
R
R

NOTE: On left mixer, aileron input arm is the top rear arm. On right mixer, aileron input arm is the top forward arm.

(18) Remove all rig pins.

(19) Remove tags and close circuit breakers opened in Step 4A(1).

(20) Turn on electrical power (Ref. 24-41-00).

(21) Verify that electrical actuator on top of mixer is in fully retracted position. [Actuator retract dimension is 7.03 (±0.10 inch) between attaching bolt centers.]

(22) Remove aileron support tool.

(23) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

(24) Turn on all four hydraulic systems (Ref. 29-11-00).

NOTE: Steps 4B(25) through 4B(30) determine if the spoilers are responding properly to speedbrake and roll inputs. Measurement of spoiler deflection is not required. Minimum spoiler deflections are presented for information only.

(25) Slowly rotate the flight station control wheels through several full roll applications. Verify that spoilers follow up-aileron movement (use surface position indicator). (Full roll input deploys spoilers 40 degrees minimum).

(26) Move flight station speedbrake control lever through several full spoiler applications. Verify that spoilers 1 through 4 on both wings follow speedbrake lever movement. (Full speedbrake input deploys spoilers 60 degrees.) Return speedbrake lever full forward to 0° spoilers.

(27) During Steps (24) and (25), visually determine that the mixer operates smoothly without binding. Check for

clearance between mixer pushrods and surrounding structure and equipment.

(28) Fully retract flaps.

(29) Slowly rotate control wheel through a full left and right roll application. Verify that spoilers do not respond to aileron inputs.

(30) Move speedbrake control lever from 0° to MAX and back to 0°. Verify that spoilers 2 through 6 follow speedbrake lever movement.

(31) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(32) Turn off electrical power if no longer required (Ref. 24-41-00).

(33) Close all access openings.

SPOILER MIXER - INSPECTION AND CHECK

1. General

With the flaps positioned four degree or more and the speedbrake lever positioned full aft, control wheel rotation full left or right may cause one of the two output linkages on both mixers to go overcenter. A tie-bar, two spacers, and two springs, are installed between the cam roller output arms to pull the mixer output linkages from the overcenter position when initiating a small control wheel input. This check is accomplished to verify that the spacers are installed and the tie-bar adjustments are correct. This check will also determine if there is excessive friction in any of the mixer output control path.

When the mixer output linkages go overcenter, a "bump" may be felt at the control wheel. This "bump" is normal and is a characteristic inherent in the mixer design. Note that the
R conditions to cause the "bump" are normally only experienced during ground test procedures.

2. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

3. Inspection/Check

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on all four hydraulic systems (Ref. 29-11-00).

(3) Position flap handle to 4 degrees or more.

(4) Visually verify that the electrical actuator on top of each mixer (in the main wheel wells) and the electrical actuator on the bottom of each selector (located in the wing trailing edge under spoiler No. 4) are in the retracted position.

NOTE: Actuator retract dimension between actuator attach bolt centers is approximately 7.0 inches (Ref. 27-61-25 for electrical actuator adjustment).

(5) Position speedbrake lever aft to 90% of Max (8 1/2 inches from full forward).

R (6) Apply full left roll input (trim at 0°).

NOTE: With speedbrake lever full aft and full roll inputs applied, the spoilers on the "down-aileron" wing will normally not retract below their speedbrake setting. However, due to tolerance buildup in the mixers and system
R friction, some spoilers on the "down-aileron" wing may retract slightly during the above condition. This is considered normal.

(7) Center control wheel.

(8) Return speedbrake lever to full forward (0°) spoilers.

(9) Verify that spoilers 2, 3 and 4 on the left wing fully retract. If spoilers 2, 3 and 4 remain extended, accomplish Step (15).

(10) Position speedbrake lever aft to 90% of Max (8 1/2 inches from full forward).

(11) Apply full right roll input (trim at 0°).

(12) Center control wheel.

(13) Return speedbrake lever to full forward (0°) spoilers

(14) Verify that spoilers 2, 3 and 4 on the right wing fully retract. If spoilers 2, 3 and 4 remain extended, accomplish Step (15).

(15) If spoilers 2, 3 or 4 remain extended during any of the above tests, accomplish following to determine if fault is due to excessive friction in the mixer output control system or is due to a faulty mixer.

(a) If spoiler No. 2 and 3 remain extended, check the right mixer output control system as follows:

- Disconnect the right mixer output pushrod, to the side remaining extended, at the mixer output lever.

- Apply a push and then a pull force to the mixer output pushrod in line with the pushrod centerline. The forces to operate the pushrod shall not exceed the values on the following chart.

(b) If spoiler No. 4 remains extended, check the left mixer output pushrods as follows:

- Disconnect the left mixer output pushrod, to the side remaining extended, at the mixer output lever.

- Apply a push and a pull force to the mixer output pushrod, in line with the pushrod centerline. The forces to operate the pushrod shall not exceed the values on the following chart.

	LEFT MIXER TO:		RIGHT MIXER TO:	
	LEFT SPOILERS	RIGHT SPOILERS	LEFT SPOILERS	RIGHT SPOILERS
Flaps extended 4° or more.				
To extend -	8 lbs.	10 lbs.	12 lbs.	11 lbs.
To retract from full up -	5 lbs.	7 lbs.	7 lbs.	6 lbs.
Flaps fully retracted.				
To extend -	22 lbs.	24 lbs.	12 lbs.	11 lbs.
To retract from full up -	4 lbs.	7 lbs.	7 lbs.	5 lbs.

(c) If the force required to operate any of the mixer output pushrods exceeds the chart values, inspect the affected control path for cause of excessive

friction and repair or replace components as required.

(d) If the forces required to operate the mixer output pushrods are within the chart limits, but spoilers remain extended with the control wheel centered and the speedbrake lever in 0°, replace the affected mixer (Ref. 27-61-12).

R (16) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

R (17) Turn off electrical power if no longer required (Ref. 24-41-00).

NO. 1 SPOILER OVERRIDE BUNGEE - REMOVAL AND INSTALLATION

1. General

If the override bungee jam sensing switch is inoperative, replace the bungee assembly. Bungee switch adjustment should only be done in the shop.

2. Equipment and Materials

Rig pins, 5/16 inch diameter by 3 inches long (R3), 2 each

3. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Bungee Removal

(1) Verify that speedbrake lever is fully forward.

(2) Open access door 147AB or 147BB to gain access to hydraulic service center.

(3) If jam sensing switch is installed on bungee, open and tag circuit breaker Spoiler Servo B (CB2-J16).

(4) If jam sensing switch is installed on bungee, disconnect switch electrical connector from structure mounted bracket (Ref. Fig. 401). Remove clamp attaching bungee switch wire harness to bracket.

(5) In hydraulic service center, install rig pin R3 in torque tube lower arm (1) (Ref. Fig. 401).

(6) Disconnect bungee from torque tube lower arm (1) by removing connecting bolt.

WARNING: VERIFY THAT THE LANDING GEAR DOWNLOCK SAFETY PIN AND INBOARD DOOR ACTUATOR LOCK ARE INSTALLED BEFORE WORKING IN MAIN WHEEL WELL AREA.

(7) In the left main wheel well, install rig pin R3 in torque tube lower arm (2).

(8) Disconnect bungee from torque tube lower arm (2) by removing connecting bolt.

R B. Bungee Installation

(1) Verify that rig pins are installed in the bungee input and output torque tube lower arms (1) and (2) (Ref. Fig. 401).

(2) Position bungee through opening in the hydraulic service center side-wall.

If bungee includes jam sensing switch, install bungee with switch on the inboard end facing up.

(3) Connect inboard end of bungee to torque tube lower arm (1) with bolt, washer, and nut.

(a) Install cotter pin.

(4) Adjust bungee rod-end fitting as necessary to permit the bungee outboard bolt to fit freely.

R R R NOTE: After a rod-end adjustment, verify that rod-end jamnuts are tight and that tab washers are properly engaged.

(a) Lock-wire, jamnut to tab washer.

(5) Connect outboard end of bungee to torque tube lower arm (2) with bolt, washer, and nut.

(a) Install cotter pin.

(6) If bungee includes jam sensing switch, connect switch electrical connector.

(7) Install clamp attaching bungee switch wire bundle to aft bulkhead structure.

(a) Verify that there is enough slack in wire bundle between clamp on switch mounting bracket and clamp on aft bulkhead structure to allow for bungee movement.

(8) Remove rig pins from torque tube lower arms (1) and (2).

(9) Check bungee assembly as outlined in Para. C.

C. Bungee Checkout

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic system C (Ref. 29-11-00).

R (3) Position flaps to 4 degrees or more to actuate No. 1 spoilers.

(4) Turn on hydraulic system B; turn off hydraulic system C (Ref. 29-11-00).

(5) Slowly cycle the speedbrake lever from full forward to full aft and back to full forward for several cycles. Verify following while cycling speedbrake lever:

(a) The No. 1 spoiler override bungee operates freely without binding and clears all structure and equipment.

(b) If the jam sensing switch is installed, verify that the switch wire bundle has enough slack and is not chafing against structure.

(c) The No. 1 left and right spoilers operate smoothly and follow speedbrake lever positioning.

NOTE: If bungee incorporates jam sensing switch, accomplish Step (6).

(6) Check jam sensing switch as follows:

(a) Position speedbrake lever to deploy the No. 1 left spoiler panel 10.0 (+0.5) degrees [6.0 (±0.3) inches extension at the spoiler panel trailing edge].

(b) Verify that No. 1 right spoiler panel is deployed 10.5 degrees (6.3 inches) or less. If right spoiler panel is more than 10.5 degrees, move the speedbrake lever forward slightly until the right spoiler panel is 10.0 (±0.5) degrees [6.0 (±0.3) inches].

(c) Mark the position of the aft edge of the speedbrake lever on the quadrant, using masking tape.

(d) Position speedbrake lever full forward.

(e) Install rig pin (R3) in the No. 1 spoiler bungee output torque tube lever arm (2) in left wheel well (Ref. Fig. 401).

CAUTION: DO NOT INSTALL A RIG PIN IN THE BUNGEE INPUT TORQUE TUBE ARM (1) IN HYDRAULIC SERVICE CENTER . TORQUE TUBE WILL BE DAMAGED.

DO NOT MOVE SPEEDBRAKE LEVER MORE THAN 10 DEGREES MARKED ON QUADRANT. RIG PIN IN TORQUE TUBE ARM (2) MAY BE DAMAGED.

(f) Slowly pull speedbrake lever back to the 10-degree mark on quadrant. Verify that ROLL SPEED BRAKE light on pilots annunciator panel comes on before speedbrake lever reaches the 10-degree mark. If not, position speedbrake lever full forward. Check rigging of DLC servo to spoiler No. 1 (Ref. 27-61-00, Adjustment/Test, Paragraph 6C). If rigging is satisfactory, replace the No. 1 spoiler bungee assembly.

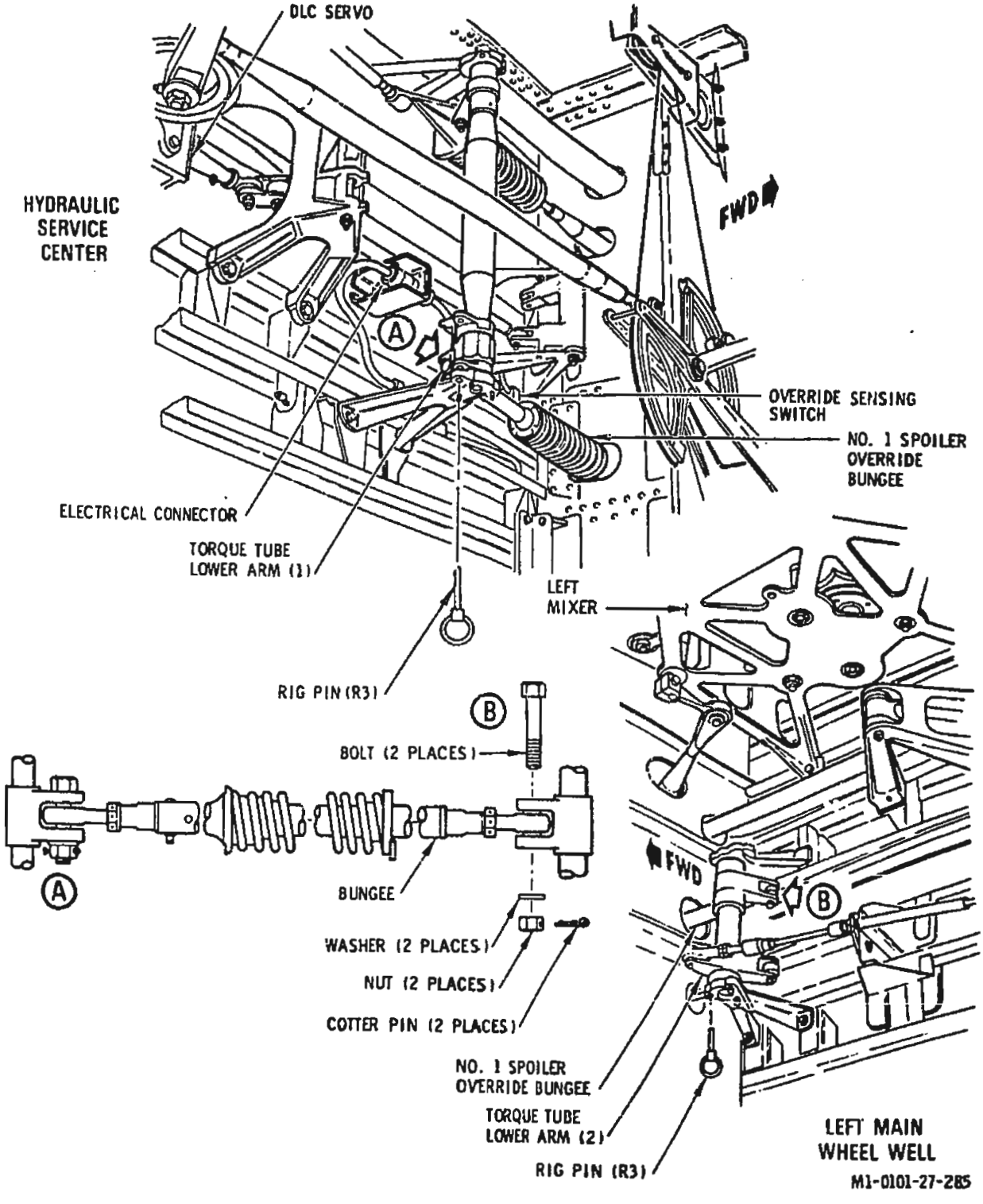
(g) Remove all rig pins.

(7) Close hydraulic service center access door.

(8) Position flaps to full up.

(9) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(10) Turn off electrical power if no longer required (Ref. 24-41-00).



No. 1 Spoiler Override Bungee - Removal and Installation
Figure 401

R SPOILER SCISSOR LINKAGE
R REMOVAL AND INSTALLATION

R 1. General

R This procedure is for the removal and installation of the
R spoiler system scissor assembly located at OWS 97. This scissor
R is connected by pushrods to the No. 4 spoiler servo and the
R selector.

R Removal and installation procedure for the aileron/spoiler
R scissor linkage located at OWS 45 is provided in 27-11-29.

R 2. Equipment and Materials

R Rigpin, 5/16-inch diameter by 5-inch long (R5)

R Rigpin, 5/16-inch diameter by 6-inch long (R6) (3 required)

R Rigpin, Stepped, 5/16-inch and 3/16-inch diameter by 6-inch long
R (R6A)

R Aileron Support Tool, BF90, or equivalent

R 3. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	27-11-00	Aileron Control System - Adjustment and Test
R	29-11-00	Hydraulic Power - Maintenance Practices

R 3. Removal/Installation

R WARNING: VERIFY HYDRAULIC POWER IS OFF AND HYDRAULIC PANELS AND
R FLIGHT CONTROLS ARE TAGGED AGAINST OPERATION.

R (1) Tag Flight Engineer/Second Officers hydraulic system
R panel, zone 215 and hydraulic service panel, zone 147.
R Tag control wheel and speedbrake handle against
R operation.

R (2) Open access panel 561BB (left wing) or 661BB (right
R wing) (Ref. 6-40-00).

R (3) Remove bolt that connects No. 4 Spoiler Servo pushrod
R to scissor.

R (4) Remove bolt that connects Selector pushrod to scissor.

R (5) Loosen cable turnbuckles until cables are slack.

R (6) Tag cables for identification. Remove bolts that
R connect cables to scissor bellcranks.

R (7) Remove bolts attaching scissor linkage to aircraft.
R Remove scissor linkage assembly.

R B. Installation

R (1) On replacement scissor assembly, loosen both nuts on
R each pivot bolt assembly and retorque as follows:

R (a) Torque nut on larger diameter outer bolt to 70 to
R 80 lb-in.

R NOTE: Larger diameter bolt must be torqued first
R to prevent spoiler control system friction
R problems.

R (b) Torque nut on inner bolt to 20 to 25 lb-in.

R (c) Install lockwire between inner and outer pivot
R bolt nuts.

R (2) Verify flaps are fully down.

R NOTE: If flaps are not fully down, turn on hydraulic
R power (Ref. 29-11-00), reposition flaps and turn
R off hydraulic power.

R (3) Open following applicable access panels (Ref. 6-40-00):

R (a) Left wing: 541GB, 561AB, 561BB

R (b) Right wing: 641GB, 661AB, 661BB

R (4) Verify spoiler panels 4, 5 and 6 are fully down (servo
R piston bottomed).

R (5) Verify speedbrake control handle on pilots center
R console is full forward (0-degree position) and
R speedbrake handle and control wheel are tagged against
R operation.

R (6) Verify hydraulic power is off and control panels are
R tagged against operation.

R (7) Manually position both inboard ailerons to faired
R (±0.12 inch) and install aileron support tools (Ref.
R 27-11-00, Adjustment and Test, Fig. 513).

R NOTE: Inboard aileron is neutral when lower inboard
R surface of aileron is aligned with a red
R paint-filled dimple on No. 3 flap torque box.

R On aircraft without SB27-162,
R inboard aileron is neutral with aileron faired.

R On aircraft with SB27-162,
R inboard aileron neutral is with aileron 1.5
R degrees up from fiared.

R (8) Position scissor linkage assembly in aircraft and
R install with eight bolts and washers.

R (9) Install both rigpins (R6) in bellcrank assembly located
R at IWS 503, just inboard of inboard aileron. All four
R bellcrank arms must be locked in position.

R (10) Install rigpin (R5) in scissor linkage assembly.

R (11) Attach cables to scissor bellcranks with nuts, bolts
R and washers. Install cotter pins.

R (12) Adjust cable turnbuckles to meet the following
R requirements:

R (a) Rigpin R5 must fit freely through scissor linkage
R bellcrank.

R (b) Both rigpins R6 must fit freely through bellcrank
R assembly located at IWS 503.

R (c) Cable tension must conform to chart located in
R Figure 401.

R (13) Install safetys on turnbuckles.

R (14) With rigpin in scissor linkage assembly, attach spoiler
R servo pushrod to scissor with nut, bolt and washers.
R Install cotter pin. Verify spoiler servo input arm is
R 0.008 (±0,005) inch from servo downstop (clockwise stop
R viewed from top). If not adjust pushrod.

R (14) On aircraft 001-026,
R attach selector pushrod to scissor with nut, bolt and
R washers. Install cotter pin. With rigpin in scissor
R linkage bellcrank, rigpin R6 must fit through selector

frame, speedbrake input arm and aileron input arm. If not, adjust speedbrake input pushrod.

NOTE: The inboard aileron may have to be manually moved up or down to align aileron input arm. Aileron input arm rigging is accomplished in 27-11-00.

If selector dash number is 121 or higher (1506801-121), use the stepped rigpin R6A (5/16- and 3/16-inch diameter).

(14) On aircraft 027-999, attache selector pushrod to scissor with nut, bolt and washers. Install cotter pin. With rigpin installed in scissor linkage bellcrank, rigpin R6A (stepped rigpin, 5/16- and 3/16-inch diameter) must fit through selector frame, speedbrake input arm and aileron input arm. If not, adjust speedbrake input pushrod.

NOTE: The inboard aileron may have to be manually moved up or down to align aileron input arm. Aileron input arm rigging is accomplished in 27-11-00.

(15) Remove all rigpins and verify all pushrod and cable assembly attach bolts have been safetied.

(16) Remove aileron support tools from both inboard ailerons.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(17) Turn on all four hydraulic systems (Ref. 29-11-00).

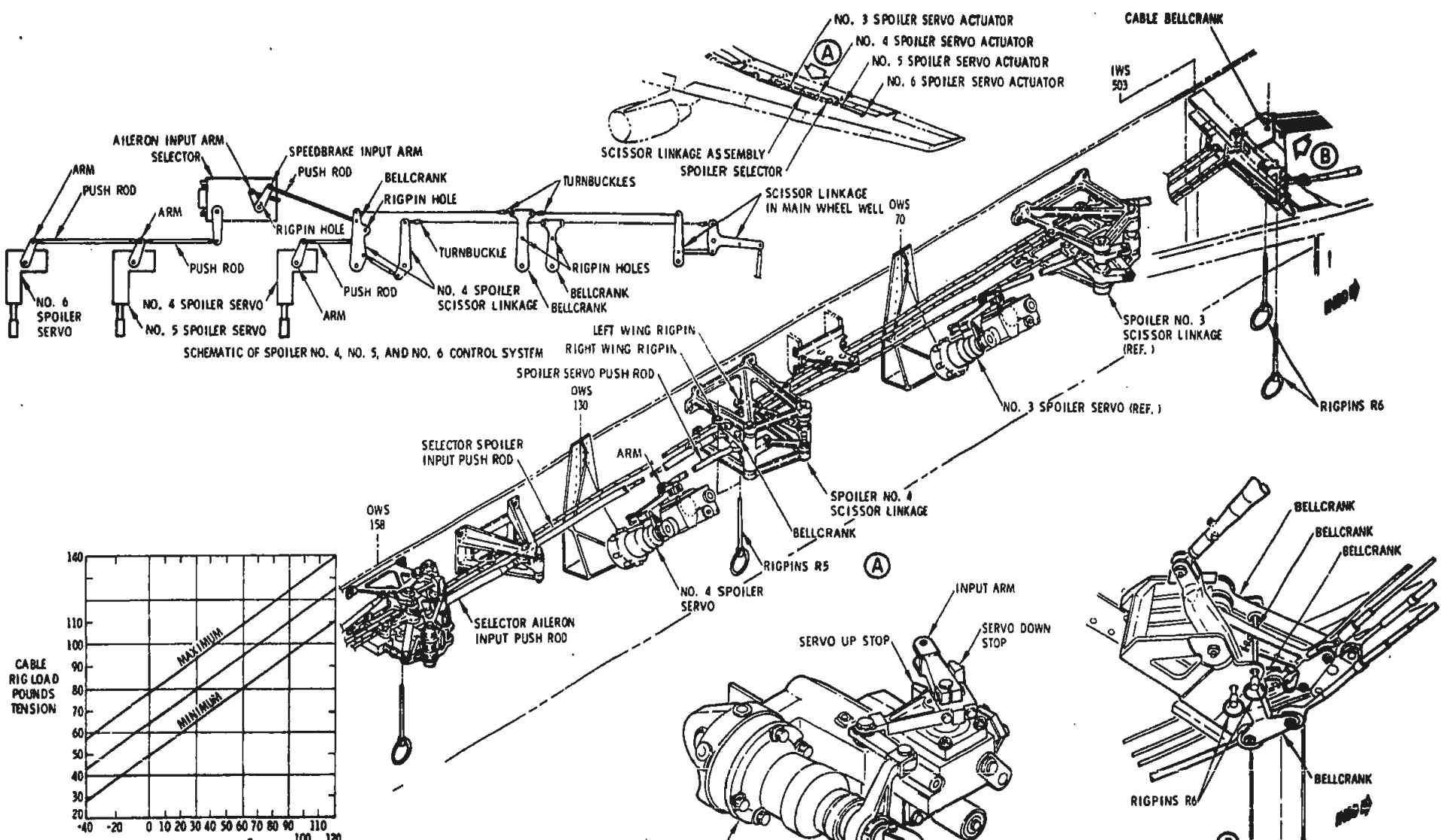
(18) Retract flaps to full up position.

(19) Slowly operate speedbrake control handle through full speedbrake application. Visually verify normal operation of spoilers 4, 5 and 6.

R NOTE: Step 3B(19) determines if the spoilers are
R responding properly to speedbrake input.
R Measurement of spoiler deflection is not
R required.

(20) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(21) Close access panels that were opened for this procedure.



R Spoiler Scissor Linkage Assembly - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

SPOILER SERVO CONTROL - REMOVAL AND INSTALLATION

1. General

CR CAUTION: PRESSURE SWITCH MUST BE INSTALLED ON SERVO THAT IS
CR INSTALLED IN THE NO. 1 POSITION (Ref. 27-61-38, Fig.
CR 401).

The No. 1 and No. 2 servos are identical and can be used on either wing except No. 1 servo includes a pressure switch.

(The No. 2 servo incorporates a cover plate on the switch mounting pad . The pressure switch can be left in the No. 2 position without being connected to ships wiring.)

The No. 3 and No. 4 servos are identical and can be used on either wing.

The No. 5 and No. 6 servos are identical and can be used on either wing.

Removal and installation procedures are the same for left and right spoiler servos.

The following is a list of spoiler servo line replaceable units (LRUs):

Solenoid shutoff valve, 27-61-08

No. 1 spoiler pressure switch, 27-61-38

Spoiler servo filter, 27-61-42

2. Equipment and Materials

Rig pins, (R3), 5/16-inch diameter, 3 inches long, and (R6), 5/16-inch diameter, 6 inches long, or (R6A), stepped, 5/16-inch and 3/16-inch diameter, 6 inches long (Part of Rig Pin Kit B-735)

Aileron Support Tool, BF90, or equivalent

Grease, Aircraft and Instrument, MIL-G-23827A (AEROSHELL 7), or equivalent

Hydraulic line fitting protective cover, or a pressure plate, if hydraulic pressure will be applied to manifold with spoiler servo removed

Spoiler Servo hydraulic fitting protective cover

Sealant, PR 1435 (conforming to Lockheed Material Spec. LCM 40-2180, Type 6), (TWA STK NBR 50-0833), or equivalent

Wrench - Crowfoot, G/ITEL 27-61-68, or equivalent

Washer, PN5710-112-2, or equivalent

Cotter Pin, MS24665-151, or equivalent

Cotter Pin, MS24665-441, or equivalent

Lockwire, Fed Spec. QQ-W-390, 0.040 inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-13-01	Hydraulic Bootstrap Reservoir - Servicing
12-23-20	Flight Controls Lubrication
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
27-11-00	Aileron Control System - Maintenance Practices
27-51-00	Flap Control System - Adjustment and Test
27-61-08	Direct Lift Control Servo and Spoiler Control Servo Solenoid Shutoff Valve - Removal and Installation
27-61-38	Number 1 Spoiler Servo Pressure Switch - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) Open and tag following circuit breakers:

(a) On pilots overhead circuit breakers panel CB1, zone 210, for spoiler servo No. 1 only - SPOILER DWELL DC (B7)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

For spoiler servo No. 2: left wing - SPOILER SERVO A 2L (J15)

For spoiler servo No. 2: right wing - SPOILER SERVO D 2R (J18)

For spoiler servos No. 1, 4, or 6: either wing - SPOILER SERVO B 1, 4, 6, L & R (J16)

For spoiler servos No. 3 or 5: either wing - SPOILER SERVO C 3, 5 L & R (J17)

(2) Open applicable access panels in wing lower surface (Ref. 6-40-00):

For spoiler servo No. 1: 541CB left wing, 641CB right wing

For spoiler servo No. 2: 541FB left wing, 641FB right wing

For spoiler servo No. 3: 561AB left wing, 661AB right wing

For spoiler No. 4: 561BB left wing, 661BB right wing

For spoiler servo No. 5 or 6: 561CB left wing, 661CB right wing

(3) Verify speedbrake lever in flight station is full forward (0-degrees).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

(4) Pressurize hydraulic system C (Ref. 29-11-00).

(5) Position flap control handle in flight station to 10 degrees or more to provide access to spoiler servo.

(6) When flaps extend to selected position, turn off hydraulic power.

WARNING: ENSURE ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL, ZONE 147.

(7) Disconnect hydraulic manifold fitting by removing attaching screws. Install protective cover on hydraulic manifold fitting and on servo pad (Ref. Fig. 401).

NOTE: If hydraulic pressure will be turned on with spoiler servo removed, install plate seal and pressure plate on hydraulic manifold fitting.

(8) Disconnect pushrod (controlex cable on spoiler servo No. 1) from spoiler servo input arm by removing connecting bolt.

(9) Disconnect electrical connector from spoiler servo.

(10) On aircraft 001-017, remove screws and nuts holding bushing retaining clamp halves together. Remove retaining clamp.

(11) Support spoiler and remove servo-to-spoiler connecting bolt. Disengage servo piston rod from spoiler.

(12) Remove servo-to-wing fitting eccentric pivot bolt and remove servo. Spoiler servo weighs approximately 20 pounds.

NOTE: When removing eccentric pivot bolt, the largest diameter of the bolt (containing concentric grooves) can hang up on the square opening of

anti-rotation plate (Ref. Fig. 401, Sheet 2). While pushing out eccentric pivot bolt, rotate servo slightly on its longitudinal axis, or move servo sideways slightly to align pivot bolt with square opening.

B. Installation

(1) Verify flaps are fully extended.

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND HYDRAULIC SERVICE CENTER HYDRAULIC SERVING PANEL.

(2) Verify applicable circuit breakers opened in Step 4A(1) are open and tagged.

(3) On aircraft 001-017, on the servo wing fitting, verify straight sleeve bushing is flush (+ 0.020 inch maximum protrusion) with outside face of fitting. Position bushing as required.

R NOTE: No.1 and No. 2 spoiler servos are identical except No. 1 spoiler includes a pressure switch. Verify proper servo is being installed (Ref. Para. 1, General).

(4) Position spoiler servo in mounting position: input arm on bottom for spoiler servo No. 1, input arm on top for spoiler servos 2 through 6.

NOTE: Before installing eccentric pivot bolt, verify anti-rotation bearing is threaded on eccentric pivot bolt so bearing is flush (+0.07, -0.03 inch) with end of eccentric pivot bolt (Ref. Fig. 401, Sheet 2).

(5) Butter-lube eccentric pivot bolt with grease, MIL-G-23827A. Install bolt and attaching hardware (Ref. Fig. 401 Sheet 2). Tighten nut; do not safety.

NOTE: If installation of eccentric pivot bolt is difficult due to inability to align pivot bolt with wing fitting holes, remove bolt-on serrated locking washer from wing fitting to allow visual alignment of pivot bolt. Reinstall bolt-on locking washer after installing pivot bolt.

(6) On aircraft 001-017, verify 0.25-inch minimum gap between wing fitting and actuator anti-rotation bearing for installation of

bushing retaining clamp (Ref. Fig. 401, Sheet 2). If not, remove eccentric pivot bolt, adjust anti-rotation bearing outward and reinstall eccentric pivot bolt. Install bushing retaining clamp on eccentric pivot bolt with screws and nuts. Install retaining clamp so clamp grips journal of eccentric bolt and bears against lug of wing fitting; torque nuts 11 to 15 pound inches.

(7) Butter-lube spoiler attaching bolt with grease, MIL-G-23827A.

NOTE: A spacer is bonded to both internal faces of spoiler clevis fitting. The spacers are installed to prevent servo rod-end rotation. If a spacer comes loose, rebond to clevis fitting. [The spacers are installed so flat face of spacer is against and bonded to clevis fitting, and thin section of spacer is located in lower half of clevis (Ref. Fig. 401).]

(8) Install bolt, washers, and nut. Align antirotation tang on bolt with shoulder on spoiler fitting. Do not tighten nut.

(9) Remove protective covers from hydraulic line manifold fitting and spoiler servo pad. Verify plate gasket seal is installed on servo pad. Inspect mating surfaces for burrs, nicks, and cleanness. Verify manifold fitting and servo pad are approximately parallel from top to bottom. If not, loosen B nuts on other end of hydraulic line assembly and connect manifold fitting to servo per following Step 4B (10).

(10) Connect hydraulic line manifold fitting by installing attach screws. Torque attach screws 70 to 80 lb in. and lock-wire. If hydraulic line assembly B nuts were loosened to align manifold to servo, torque B nuts (Ref. 20-29-01).

NOTE: If hydraulic line assembly was installed by tightening B nuts before connecting manifold to spoiler servo, manifold may be misaligned (not parallel with servo pad). Connecting a misaligned manifold to servo can cause eventual failure of brazed joint where hydraulic line joins manifold.

(11) Connect spoiler servo control input pushrod (controlex cable on No. 1 spoiler servo) to input arm by installing attaching bolt, washers, and nut. Install cotter pin (MS24665-151).

(12) Verify electrical connector is not contaminated with oil. If necessary, clean with approved solvent.

(13) Install electrical connector and lock-wire.

(14) Lubricate servo bearings (Ref. 12-23-20).

(15) Check adjustment of spoiler servo input pushrod or controlex cable as follows (Ref. Fig. 401, Sheet 3):

(a) Verify speedbrake lever in flight station is in full forward position (0-degrees).

(b) For spoiler servo No. 1, install rig pin (R3) in bottom of controlex drive torque tube in left wheel well. With servo actuator fully retracted (piston bottomed), servo input arm must be 0.008 (±0.005) inch from servo external down stop (clockwise stop viewed from bottom). If not, adjust locknuts that clamp controlex cable to bracket just upstream of servo. Remove rig pin.

NOTE: For spoiler servos No. 2 through 6, manually position aileron affecting associated spoiler to neutral position (±0.125 inch) and install aileron support tool (Ref. 27-11-00). For spoiler servos 2 and 3 on either wing, position right inboard aileron to neutral. For spoiler servo 4 on either wing, position left inboard aileron to neutral. For spoiler servos 5 and 6 on left wing, position left inboard and outboard ailerons to neutral. For spoiler servos 5 and 6 on right wing, position left inboard and both right ailerons to neutral.

Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

If location of inboard aileron neutral index mark is in doubt it may be checked or reestablished in accordance with 27-11-00, Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

On aircraft 001-018, 021, 022, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

On aircraft 019, 020, 023-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint filled index notch on fixed trailing edge; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(c) For spoiler servo No. 2, install rig pin (R6) in cable bellcrank upstream (outboard) of servo. With servo actuator fully retracted (piston bottomed), servo input arm must be 0.008 (±0.005) inch from servo external down stop (clockwise stop viewed from top). If not, adjust pushrod between cable bellcrank and input arm. Remove rig pin.

(d) For spoiler servos No. 3 and 4, install rig pin (R6) in scissor linkage inboard of associated servo. With servo actuator fully retracted (piston bottomed), servo input arm must be 0.008 (±0.005) inch from servo external down stop (clockwise stop viewed from top). If not, adjust associated pushrod between scissor linkage and servo input arm. Remove rig pin.

(e) For spoiler servo No. 5 and 6, insert rig pin (R6), or on aircraft with selector dash number 121 or higher (1506801-121), insert stepped rig pin (R6A) through spoiler selector frame, aileron input arm, and speed brake input arm. With servo actuator fully retracted (piston bottomed) servo input arm must be 0.008 (±0.005) inch from servo external down stop (clockwise stop viewed from top). If not, adjust pushrod between selector output arm and servo input arm (for No. 5 servo). For spoiler servo No. 6 adjust pushrod between No. 5 and 6 servo input arms. Remove rig pin.

NOTE: If pushrod between selector and No. 5 servo has been adjusted, check No. 6 servo pushrod adjustment.

Rigpin used in selector is 5/16-inch diameter, 6 inches long. On aircraft with selector dash number 121 or higher (1506801-121), use stepped rig pin R6A (5/16-inch and 3/16-inch diameter).

(16) Verify speedbrake lever in flight station is full forward (0-degree position).

(17) Verify proper contact/clearance between affected spoiler (rub strips) and vanes (27-51-00).

(18) With servo actuator fully retracted (piston bottomed), verify spoiler trailing edge upper contour is 0.12 to 0.18 inch below flap torque box upper contour if possible while maintaining required clearance (0.20 inch minimum) between spoilers 3 through 6 and the associated vanes. If spoilers 3 through 6 must be rigged higher than 0.12 inch below flap torque box, rig as close to the 0.20 inch minimum between spoiler and vane as possible. Adjust servo length as follows:

NOTE: On spoilers 1 and 2, if 0.12 to 0.18 inch dimension cannot be held on both ends of spoiler panel, rig low end only to 0.12 to 0.18 dimension.

(a) On aircraft without SB27-245, loosen eccentric pivot bolt nut and disengage serrated washer. (Verify serrated lock washer limb is not broken off by verifying serrated washer cannot rotate relative to pivot bolt.)

(a) On aircraft with SB27-245, loosen eccentric pivot bolt nut and disengage anti-rotation eccentric bolt lock.

(b) Rotate eccentric bolt to bring spoiler into contour.

(c) On aircraft without SB27-245, engage mating surfaces of serrated washer.

(c) On aircraft with SB27-245, engage mating surfaces of serrated lock washer to anti-rotation serrated bolt lock.

R (d) Holding eccentric bolt in place, torque nut 270 to
R 700 lb. in. on spoilers 1 through 4 and 150 to 400
R lb. in. on spoilers 5 and 6. Install cotter pin
R (MS24665-441).

R NOTE: Use Crowfoot Wrench (G/ITEL 27-61-68) when
R torquing eccentric pivot bolt nut on
R spoilers 5 and 6. If eccentric pivot bolt
R nut slot and cotter pin bolt hole do not
R align within torque values add
R (PN5710-112-2) washer directly under
R eccentric pivot bolt nut, two washers
maximum.

(19) Verify there is 0.005 inch minimum clearance between antirotation lug and antirotation bearing (Ref. Fig. 401, Sheet 2). If clearance is below minimum the antirotation lug may be reworked (Ref. SB27-208).

R NOTE: Insufficient clearance between antirotation lug
R and antirotation bearings may prevent spoilers
R from fully retracting. Rework will improve
spoiler reliability.

(20) If eccentric bolt does not bring spoiler into contour, adjust servo rod end as follows:

(a) Loosen rod end jamnut until locking key is disengaged. While loosening jamnut, hold piston rod against rotation (use wrench flats on feedback link next to rod end).

(b) Remove servo-to-spoiler attach bolt.

(c) Adjust rod end one half to a maximum of two turns to lengthen or shorten as needed to bring spoiler into contour. Final rod end position must have no more than five threads showing or one thread inside jamnut.

(d) Install spoiler-to-servo attach bolt. Install cotter pin and lock-wire bolt.

NOTE: To prevent water from entering piston rod, apply sealant (PR 1435) to interface between feedback arm and piston rod, between jamnut and feedback arm, and between rod-end thread and jamnut face. Sealant should be applied uniformly.

(e) Reinstall key. While holding piston rod against
R rotation, torque jamnut 85 to 100 lb-ft on

R spoilers 1 through 4, 45 to 55 lb-ft on spoilers 5 and 6. Lock-wire jamnut.

NOTE: If installed, remove aileron support tools.

(21) Remove hydraulic panel placards.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(22) Remove tags and close circuit breakers opened in Step 4A(2).

(23) Turn on electrical power (Ref. 24-41-00).

CAUTION: VERIFY ALL RIG PINS AND AILERON SUPPORT TOOLS ARE REMOVED FROM AILERON CONTROL SYSTEM BEFORE PRESSURIZING HYDRAULIC SYSTEMS.

(24) Pressurize hydraulic power (Ref. 29-11-00): system A for spoiler servo No. 2 left wing; system B for spoiler servos No. 1, 4, and 6 both wings; system C for spoiler servos No. 3 and 5 both wings; system D for spoiler servo No. 2 right wing. Hydraulic system A or B must be on to supply DLC servo.

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS IN SPOILER SERVO AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW HYDRAULIC SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

(25) To enable spoiler servo No. 1 or couple spoiler servos 2 through 6 to speedbrake handle, position flaps as follows:

(a) Spoiler servo No. 1: position flaps 4 degrees or more to enable servo.

(b) Spoiler servos No. 2, 3, and 4: flaps may be in any position.

(c) Spoiler servos No. 5 and 6: position flaps full up (zero degrees) to couple 5 and 6 (through selector) to speed brake system.

NOTE: For flap operation, use hydraulic system C.

CAUTION: DO NOT OPERATE SPOILERS UNLESS HYDRAULIC PRESSURE HAS BEEN ON FOR AT LEAST FIVE MINUTES TO ENSURE PROPER FILLING OF ALL SERVO CAVITIES AND PREVENT SERVO OSCILLATION.

(26) Bleed replaced servo by cycling speed brake lever in flight station through five full applications. Bleed until spoiler operates smoothly with no roughness.

NOTE: After bleeding servo, bleed associated hydraulic reservoir (Ref. 12-13-01).

(a) Check servo hydraulic connections for leakage.

(b) Check servo installation during full throw cycles for proper clearance between servo and surrounding equipment and structure.

(27) Position speedbrake lever to 0 degrees. With spoiler held full down with hydraulic power, verify spoiler trailing edge upper contour is 0.12 to 0.18 inch below flap torque box upper contour (except where it is rigged higher to achieve correct spoiler to vane rigging) [Ref. Step 4B(18)].

NOTE: Full hydraulic down (piston bottomed) position of spoiler can be verified by releasing (out) the associated spoiler switchlight on the PFCS panel. Spoiler trailing edge should not move down more than 0.060 inch. If spoiler moves down more than 0.060 inch, recheck spoiler servo input pushrod rigging [Step 4B(15)]. Depress (in) SPOILER switchlight after check.

(28) With spoilers full down, fully retract flaps. Check for positive clearance between flap vane carriage and lower surface of spoiler panel while retracting flaps. After check, fully extend flaps.

(29) Position speed brake lever in flight station to several intermediate positions and to MAX position. Visually determine replaced spoiler servo responds to speedbrake lever positions.

(30) Position speedbrake lever to 0 degrees. Spoilers must fully retract.

R CAUTION: DO NOT RELEASE (OUT) ANY SPOILER SWITCHLIGHT ON
R OVERHEAD PFCS PANEL WITH SPOILERS EXTENDED AND
R HYDRAULIC POWER ON. RAPID RETRACTION OF UNLOADED
R SPOILER CAN DAMAGE SPOILER SERVO.

(31) On pilots overhead PFCS panel, release (out) the SPOILER switchlight that corresponds to replaced servo. Switchlight OFF legend will come on.

(32) Position speed brake lever to MAX position. Spoilers deactivated by released switchlight must not deploy. This checks solenoid shutoff valve on servo.

(33) Position speed brake lever to 0.

(34) On the PFCS panel, depress (latch in) spoiler switchlight released in Step 4B(31). OFF legend will go off.

R (35) For spoiler servo No. 1 add the following check:

(a) Position flaps to 4 degrees or more.

(b) Turn off hydraulic system B (spoiler servo No. 1 supply). ROLL SPEED BRAKES light on pilots caution and warning panel will come on. This checks spoiler servo No. 1 pressure switch.

(c) Pressurize hydraulic system B. ROLL SPEED BRAKES light will go off.

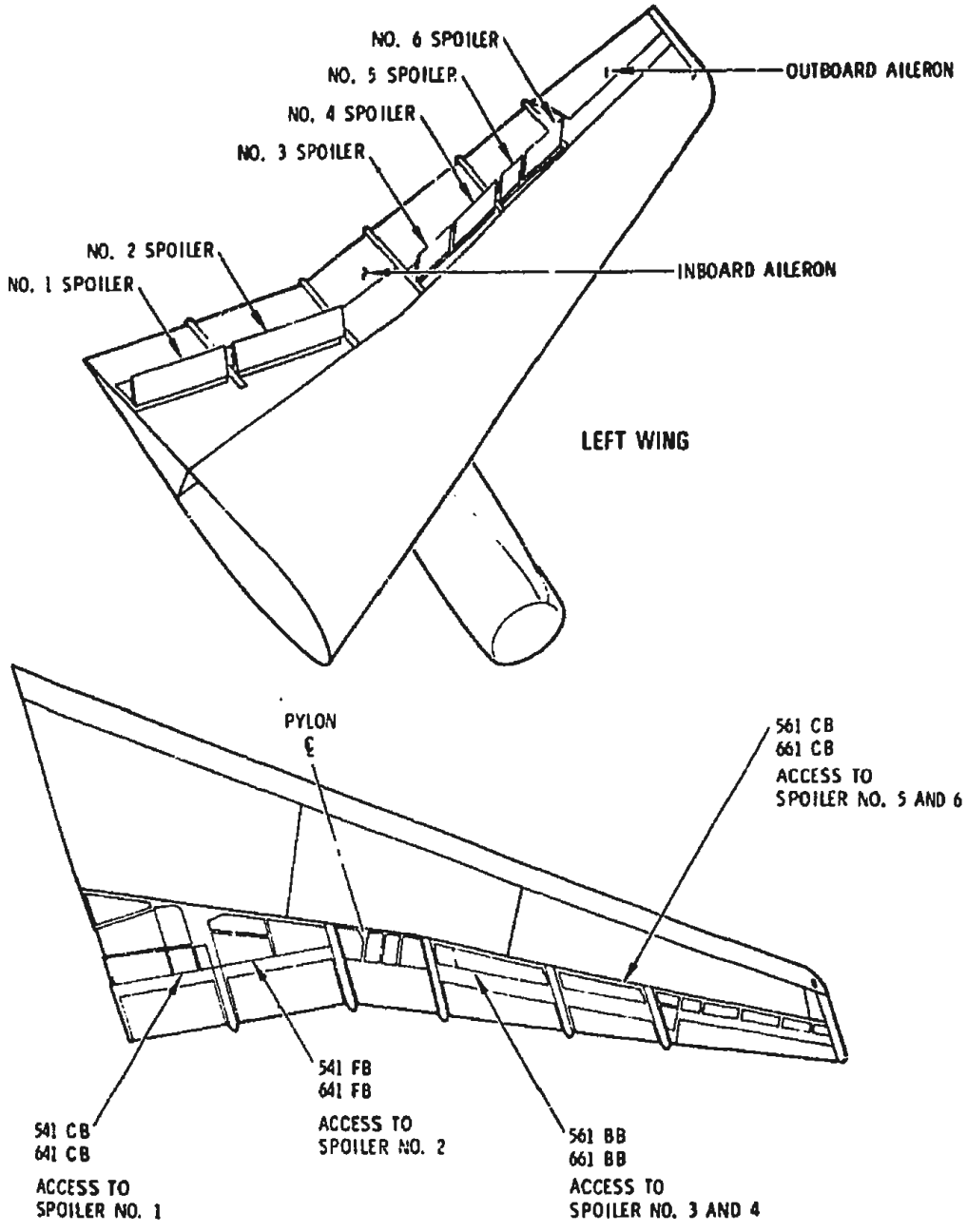
(36) Position flaps to 0 degrees.

(37) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(38) Turn off electrical power if no longer required (Ref. 24-41-00).

NOTE: If slat lock switch on SLAT MONITOR panel was released at beginning of procedure, depress (in) slat lock switch.

(39) Close access panels opened in Step 4A(2) (Ref. 6-40-00).



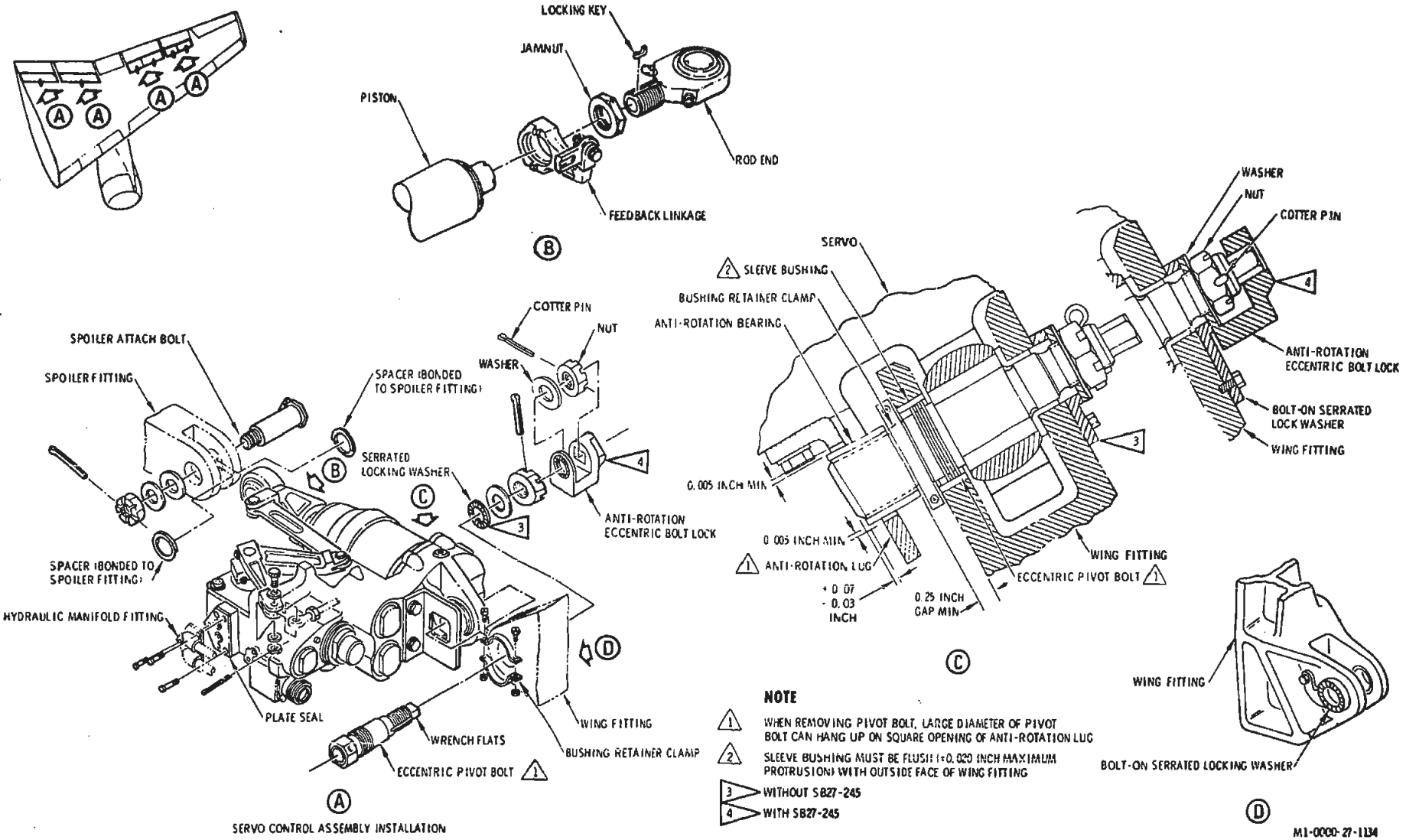
NOTE

LEFT WING SHOWN
RIGHT WING SIMILAR

UNDERSIDE OF LEFT WING

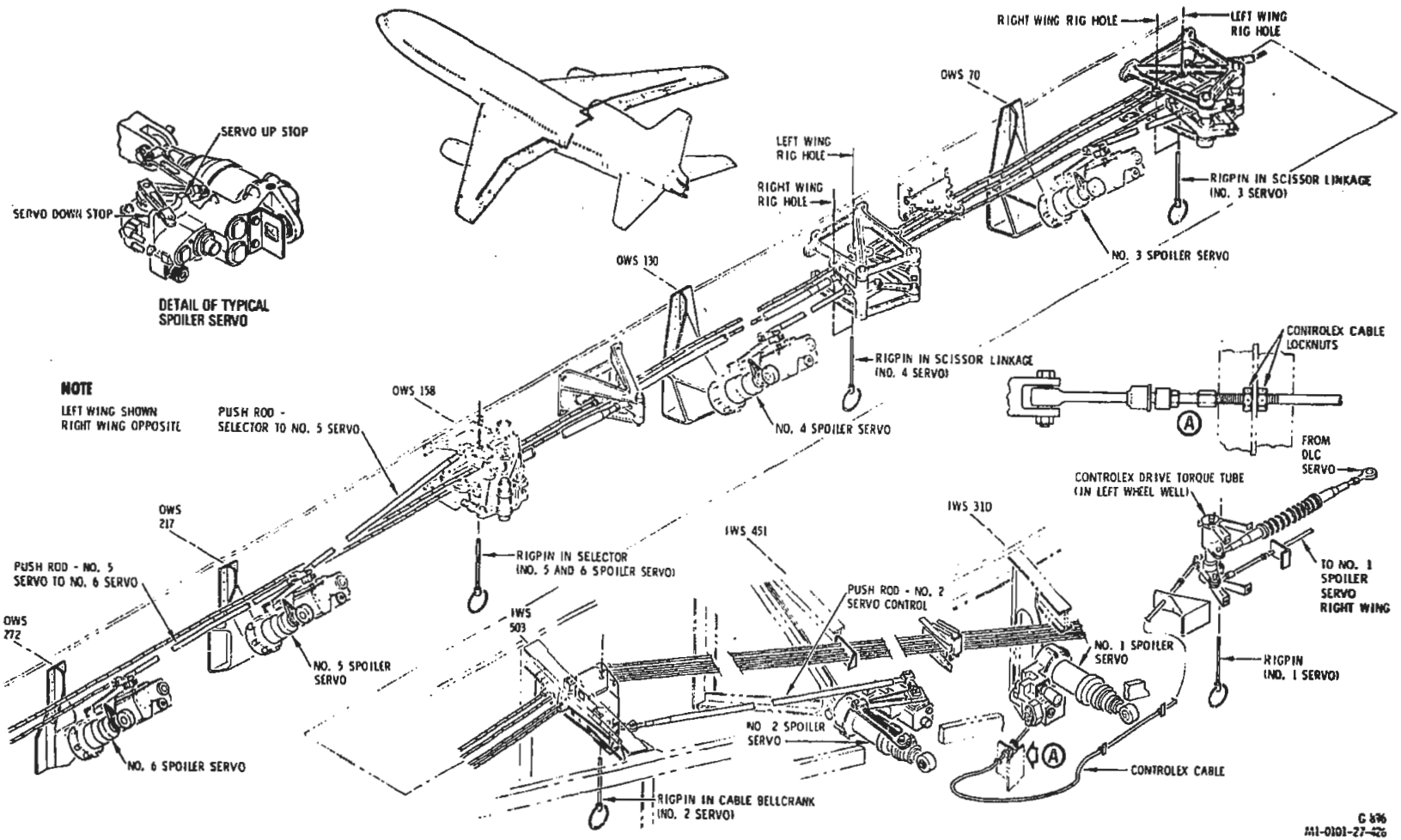
HH 6524
M1-0101-27-423

Spoiler Servo - Removal and Installation
Figure 401 (Sheet 1)



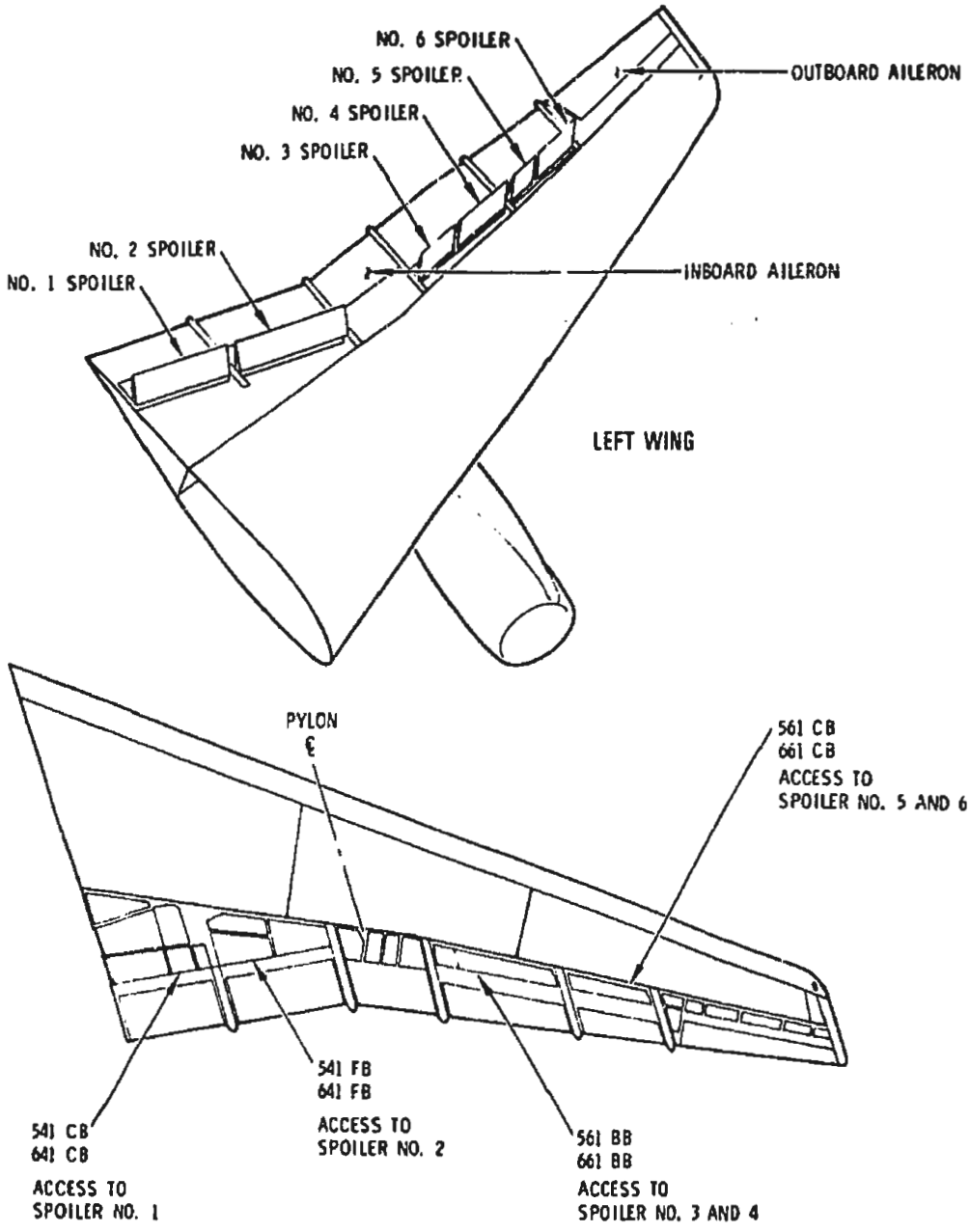
Spoiler Servo - Removal and Installation
Figure 401 (Sheet 2)

R EFFECTIVITY: 001-017, 024
R
001B



Spoiler Servo - Removal and Installation
Figure 401 (Sheet 3)

R EFFECTIVITY: 001-017, 024
R
001B



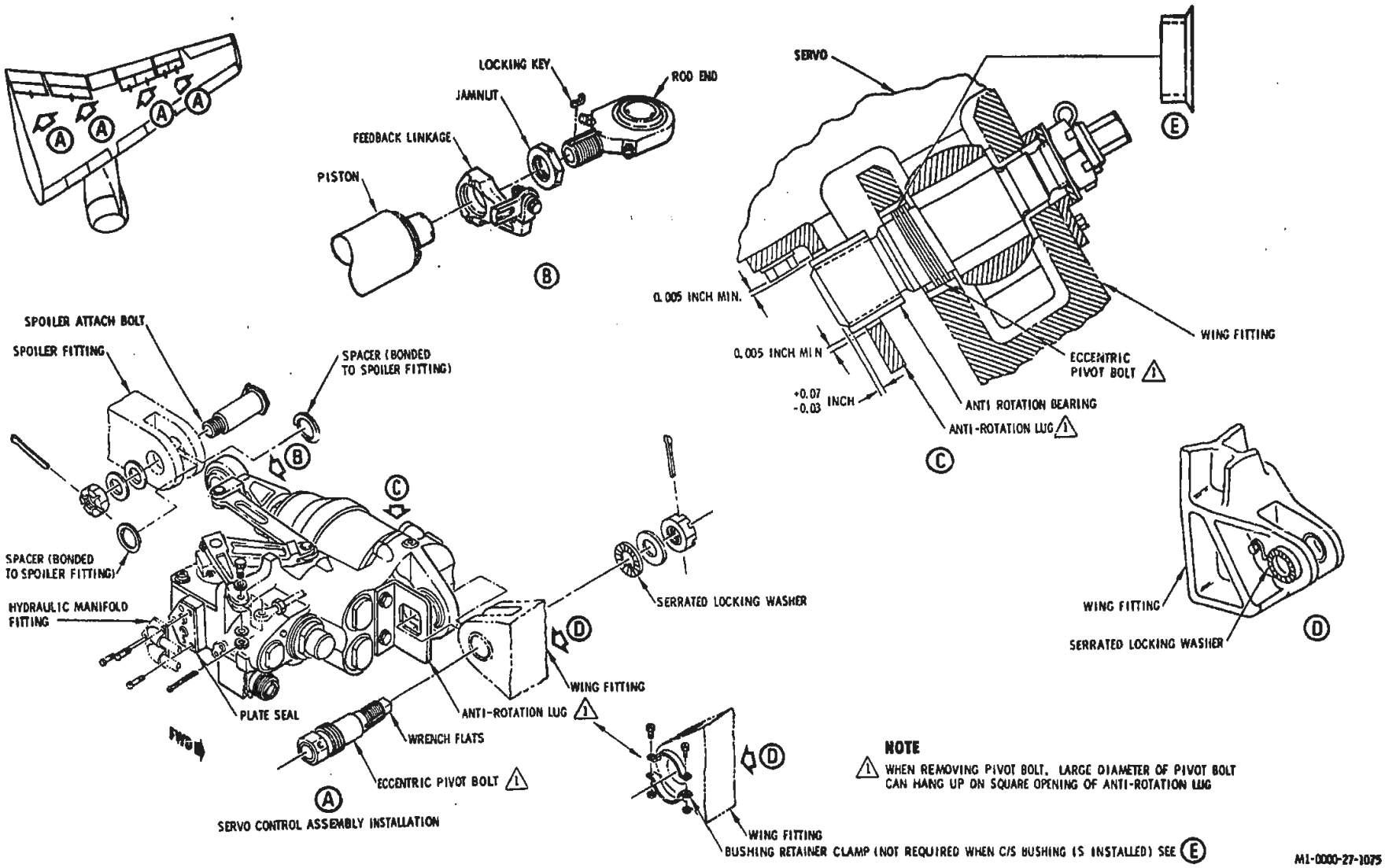
NOTE

LEFT WING SHOWN
RIGHT WING SIMILAR

UNDERSIDE OF LEFT WING

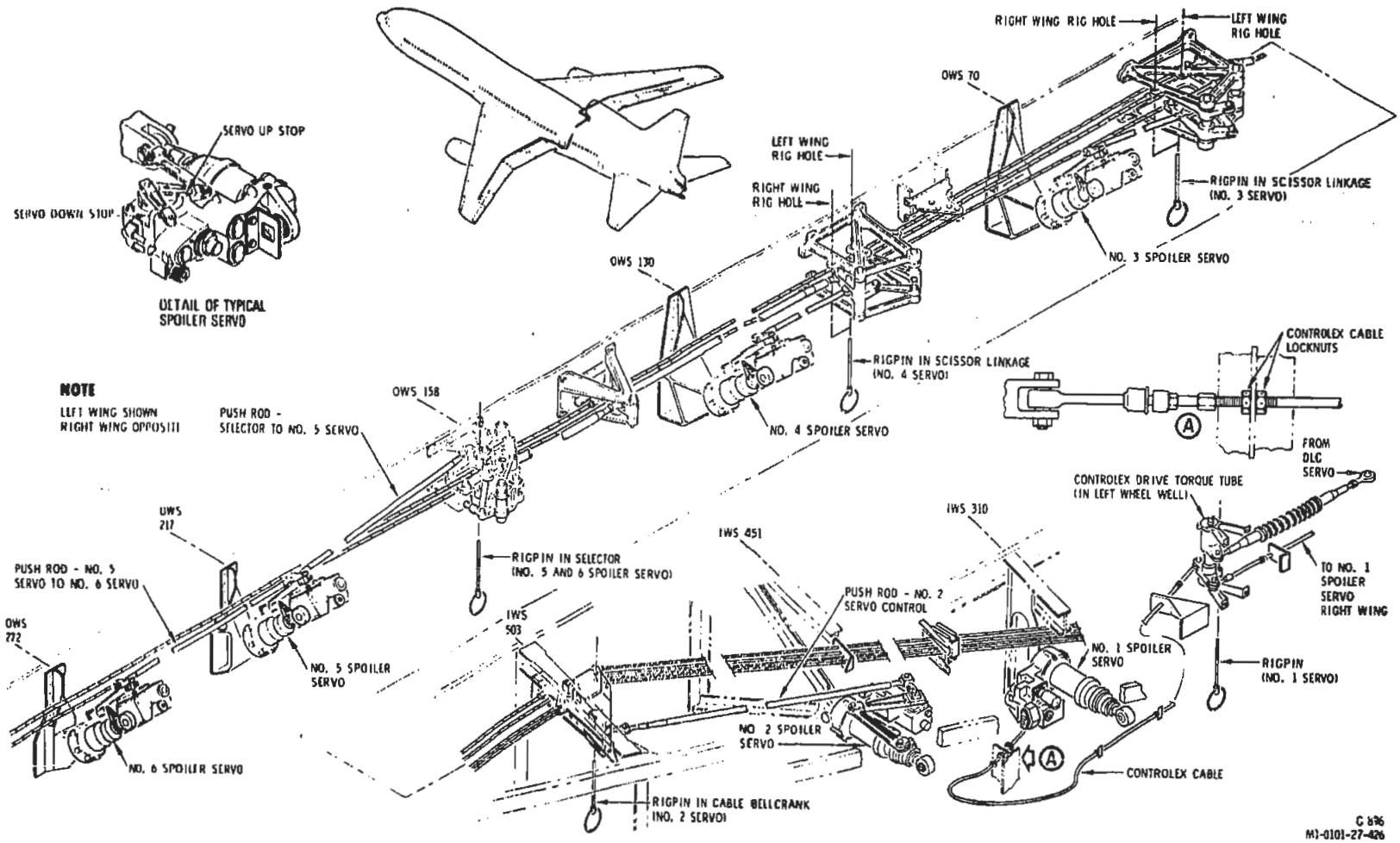
HH 6524
M1-0101-27-423

Spoiler Servo - Removal and Installation
Figure 401 (Sheet 1)



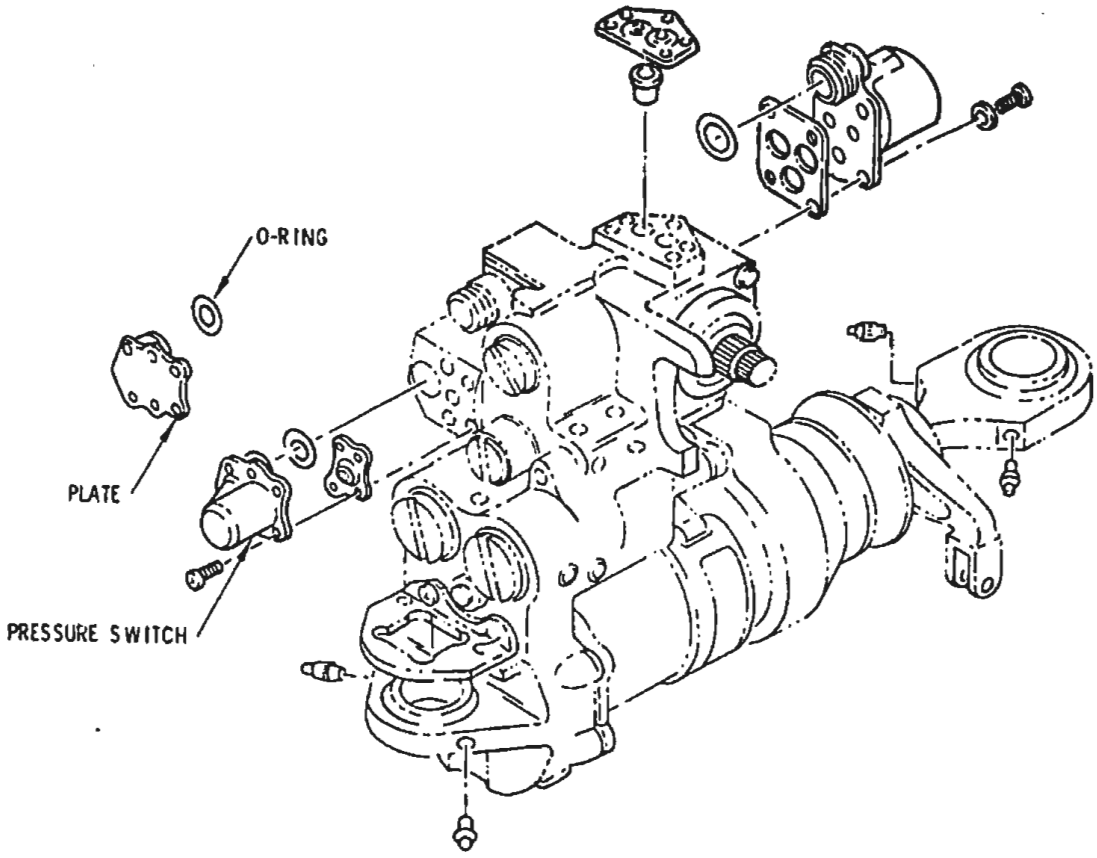
C
C Spoiler Servo - Removal and Installation
Figure 401 (Sheet 2)

R EFFECTIVITY: 018-023, 025-999
R
001B



Spoiler Servo - Removal and Installation
Figure 401 (Sheet 3)

R EFFECTIVITY: 018-023, 025-999
R
001B



MI-0000-27-758

C Control Assembly, Inboard Spoiler Servo
C Figure 401 (Sheet 4)

R EFFECTIVITY: ALL
R
001B

OUTBOARD SPOILERS CONTROL SELECTOR - REMOVAL AND INSTALLATION

1. General

Removal and installation procedures for the left and right outboard spoilers control selectors are the same except for access panel references.

2. Equipment and Materials

Rig pins, 5/16-inch diameter by 3 inches long (R3), 5 inches long (R5) and 6 inches long (R6), 1/4-inch diameter by 6 inches long (R6B), 5/16-inch and 3/16-inch diameter (stepped rig pin, R6A) (All above rig pins are part of rig pin kit, PN B735)

Aileron Support Tool, PN BF90, or equivalent

Grease, Aircraft and Instrument, MIL-G-23827A (AEROSHELL 7), or equivalent

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	24-41-00	External Power/Ground Service System - Maintenance Practices
R	27-11-00	Aileron Control System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	27-61-17	Spoiler Servo Control - Removal and Installation
	27-61-00	Spoiler and Speedbrake Control System - Fault Isolation
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

(1) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

(2) Turn on hydraulic systems A and B (Ref. 29-11-00).

(3) On pilots overhead circuit breaker panel CB1, Zone 210, open and tag circuit breakers SPOILER DWELL DC and AC (CB1-B7 and B8).

(4) Move flap control handle to full flap position to provide access to selector.

(5) Turn off hydraulic power (Ref. 29-11-00). Tag Flight Engineer/Second Officers Hydraulic system panel, zone
R 215, and Hydraulic Service Panel, zone 147.

(6) Remove access panel 561 BB or 661 BB from wing trailing
R edge lower surface (Ref. 6-40-00).

(7) Remove number four spoiler servo-to-spoiler attach bolt (Ref. 27-61-17). Support servo by tying servo to structure to avoid strain on hydraulic lines.

(8) Prop spoiler number four open to provide access to selector.

R (9) Disconnect electrical connector from actuator on control selector.

(10) On speed brake input arm (upper arm) remove bolt through retainer. Rotate retainer to expose speed

brake input push rod-to-arm connecting bolt. Disconnect speed brake input push rod from selector lower arm by removing connecting bolt.

(11) Disconnect No. 5 spoiler servo actuator push rod from selector output arm (center arm) by removing connecting bolt.

(12) Disconnect aileron input push rod from aileron input arm (upper arm) by removing retainer and connecting bolt closest to arm and then loosening second connecting bolt.

(13) Remove selector mounting bolts. Remove selector.

B. Installation

(1) Verify circuit breakers opened in Step 4A(3) are open and tagged.

(2) Verify all hydraulic power is turned off.

(3) Raise selector into position and install mounting bolts and washers.

NOTE: The left and right selectors are identical. The left selector is installed with electrical actuator on outboard side; the right selector is installed with electrical actuator on inboard side.

(4) Install and rig aileron input pushrod (81) (smallest diameter pushrod) as follows (Ref. Fig. 402):

(a) When installing right selector, manually position right inboard, right outboard and left inboard ailerons to neutral (±0.125 inch) and install aileron support tool on all three ailerons (Ref. 27-11-00, Fig. 513).

When installing left selector; manually position left inboard and left outboard ailerons to neutral (±0.125 inch) and install aileron support tool on both ailerons (Ref. 27-11-00, Fig. 513).

NOTE: Inboard aileron is in neutral when lower inboard surface of aileron is aligned with a red paint-filled dimple on No. 3 flap torque box.

R If location of inboard aileron neutral
R index mark is in doubt it may be checked or

R reestablished in accordance with 27-11-00,
R Maintenance Practices.

On aircraft without SB27-162, inboard aileron neutral is with aileron faired.

On aircraft with SB27-162, inboard aileron neutral is with aileron 1.5 degrees up from faired.

On aircraft 001-018, 021, 022, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with lower surface of adjacent fixed trailing edge structure at a point 10 inches forward of trailing edge.

On aircraft 019, 020, 023-999, outboard aileron is in neutral position when lower inboard surface of aileron is aligned with a red paint-filled index notch on fixed trailing edge end rib; notch is 10 inches forward of trailing edge and 1.54 inches up from lower edge. Aileron neutral is 3 degrees up from faired with fixed trailing edge.

(b) On aircraft 001-026, install (5/16-inch diameter) rig pin (R6) through selector frame, speedbrake input arm (80), and aileron input arm (79). Adjust aileron input pushrod (81) to fit, then, for left selector, lengthen pushrod (81) two full turns; for right selector, shorten pushrod two full turns. Verify pushrod (81) is oriented so bolt heads will be up for left selector, and bolt heads down for right selector. After lengthening or shortening pushrod two turns, and connecting pushrod to selector, verify rig pin R63 (1/4-inch diameter) can be inserted in selector.

CAUTION: AILERON INPUT PUSHROD (81) MUST BE INSTALLED WITH BOLT HEADS UP ON LEFT SELECTOR AND WITH BOLT HEADS DOWN ON RIGHT SELECTOR.

Install and tighten both bolts that attach aileron input pushrod to aileron input arm on selector. On pushrod for right selector install bolt retainer over bolt heads.

NOTE: Lengthening or shortening aileron input pushrod, after adjusting pushrod to 5/16-inch rig pin, ensures spoilers 5 and 6 deflect a minimum of 38.5 degrees.

If selector dash number is 121 or higher (1506801-121), install stepped rig pin R6A (which includes 5/16-and 3/16-inch steps) in selector and adjust aileron input pushrod to fit. After adjusting pushrod to fit stepped rig pin position, do not lengthen or shorten pushrod prior to installing attaching bolts.

(b) On aircraft 027-999, install rig pin R6A (stepped rig pin with 5/16 and 3/16 inch diameter) through selector frame, speedbrake input arm (80), and aileron input arm (79). Adjust aileron input pushrod (81) to fit between bellcrank (20) and aileron input arm (80) on selector.

CAUTION: AILERON INPUT PUSHROD (81) MUST BE INSTALLED WITH BOLT HEADS UP ON LEFT SELECTOR AND WITH BOLT HEADS DOWN ON RIGHT SELECTOR.

Install and tighten both bolts that attach aileron input pushrod to aileron input arm on selector. On pushrod for right selector install bolt retainer over bolt heads.

(c) Remove 1/4-inch rig pin from selector if installed.

(5) Install and rig speedbrake input pushrod (96) as follows (Ref. Fig. 402):

(a) Verify speedbrake control lever on pilots center console is full forward (0-degree position).

(b) Install rig pin (R5) in No. 4 spoiler scissor linkage bellcrank (93) (just inboard of No. 4 spoiler servo).

(c) Verify applicable rig pin [R6 or R6A (per Step (4)(b)] is installed in selector.

NOTE: On aircraft using R6 rig pin (5/16 inch), manually reposition inboard aileron the slight amount necessary for free insertion of rig pin R6 in selector.

(d) Adjust speedbrake input pushrod (96) to fit between scissor linkage bellcrank (93) and speedbrake input arm (80) (lower arm of selector).

CAUTION: IF SPEEDBRAKE INPUT PUSHROD ROD-ENDS ARE ATTACHED WITH HI-LOCK PINS AND COLLARS, INSURE PUSHROD IS INSTALLED SO HI-LOCK COLLARS ON SELECTOR END OF PUSHROD ARE ON TOP.

(e) On aircraft 001-014 with SB27-090 and 015-999, install the connecting bolt (bolt head on bottom) washer and nut. Install cotter pin.

(e) On aircraft 001-014 without SB27-090, Insure pushrod is installed with Hi-lock collars on selector end of pushrod positioned on top of pushrod. Install connecting bolt (bolt head on bottom) washer and nut. Rotate bolt retainer into position and install retainer bolt, washer, and nut.

NOTE: If the pushrod is installed with a Hi-lock collar on bottom, collar will ride dwell actuator selector frame clevis.

(f) Remove rig pin from scissor linkage bellcrank.

(6) Install and rig selector output pushrod (99) as follows (Ref. Fig. 402):

(a) Verify spoilers 5 and 6 are fully retracted (pistons bottomed).

(b) With rig pin installed in selector per Step (5)(b), temporarily connect selector output arm. The No. 5 spoiler servo input arm (97) must be 0.008 (±0.005) inch from servo downstop (clockwise stop, viewed from top). If not, adjust pushrod (99).

NOTE: Selector output arm roller must be contacting output cam.

If pushrod (99) is adjusted, check rig of pushrod (100) between spoiler servo 5 and 6. [With rig pin in selector, and pushrod (99) and (100) connected, No. 6 spoiler servo input arm (98) must be 0.008 (±0.005) inch from servo downstop. If not, adjust length of pushrod (100).]

(c) Connect selector output pushrod to selector output arm with a bolt, washer, and nut. Install cotter pin.

(7) Remove rig pin from selector.

(8) Verify all rig pins are removed from aileron and spoiler control systems.

(9) Remove inboard aileron support tool.

(10) Connect electrical actuator electrical connector to structure-mounted receptable and lock-wire.

(11) Reinstall number four spoiler servo-to-spoiler attach bolt as follows:

(a) Butter-lube spoiler attach bolt with grease, MIL-G-23827A.

NOTE: A spacer is bonded to both internal faces of spoiler clevis fitting. The spacers are installed to prevent servo rod-end rotation. If a spacer comes loose, rebond to clevis fitting. [Spacers are installed so flat face of spacer is against and bonded to clevis fitting, and thin section of spacer is located in lower half of clevis (Ref. 27-61-17, Fig. 401)].

(b) Remove props and supports from spoiler panel and from servo.

(c) Install bolt, washers, and nut. Align antirotation tang on bolt with shoulder on spoiler fitting.

(d) Torque nut and install cotter pin.

(12) Remove tags and close circuit breakers opened in Step 4A(2).

(13) Remove tags from hydraulic control panels.

(14) Accomplish Selector Checkout, Paragraph 4C.

C. Selector Checkout

R This test determines if the spoilers are responding properly
R to speedbrake and roll inputs. Measurement of Spoiler
R deflection is not required. However, minimum spoiler
R deflections are presented for information only.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic systems B and C (Ref. 29-11-00).

(3) Position flap control handle to full up (0-degree).

NOTE: If spoilers and selector fail to work as required insure selector was installed correctly. If problem persists refer to 27-61-00 fault isolation.

(4) When flaps have reached selected positions, slowly rotate flight station control wheel through several full roll applications. Spoilers No. 5 and 6 must not operate. Center control wheel.

(5) Position speed brake control lever in flight station to MAX position. Spoilers No. 5 and 6 must fully deploy. (Full deployment of spoilers will extend spoilers a minimum of 55 degrees.)

(6) Slowly move speed brake control lever from MAX to 0 degree and return for several full throw applications. Visually determine selector mechanism operates smoothly (no binding).

(7) Place speed brake control lever at 0 degree. Spoilers must retract completely.

(8) Position flaps to 10 degrees. Electrical actuator on selector must retract. Visually determine actuator operation is smooth (no binding).

(9) Position speed brake control lever to MAX. Spoilers No. 5 and 6 must not operate.

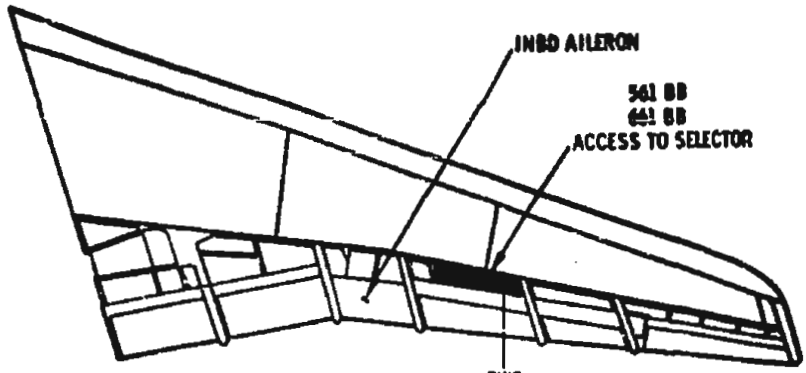
(10) Position speed brake control lever to 0 degree.

(11) Slowly cycle flight station control wheels through several full roll applications. Spoilers No. 5 and 6 must follow up-aileron movement. (Full aileron input
R must extend spoilers a minimum of 38 degrees).
R Visually determine selector mechanism operates smoothly (no binding).

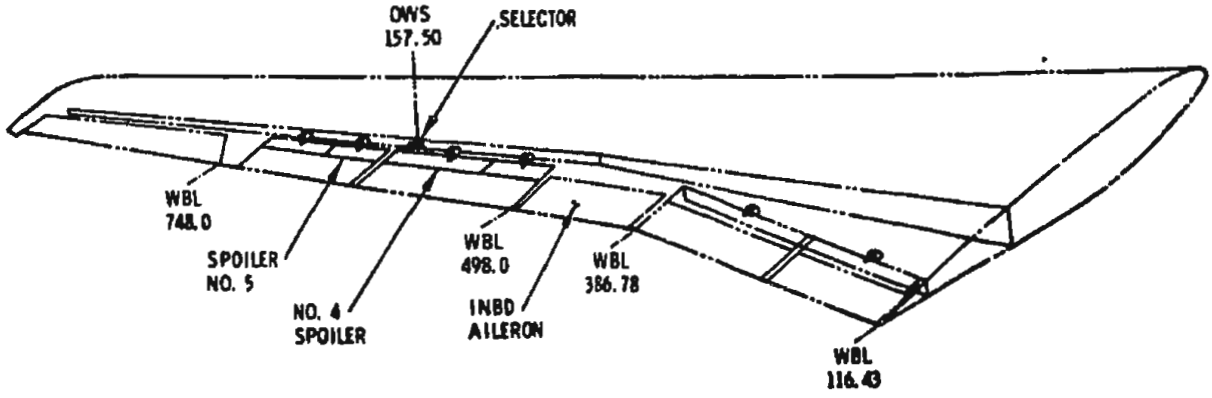
(12) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(13) Turn off electrical power if no longer required (Ref. 24-41-00).

(14) Close access panel.



LEFT WING
VIEW LOOKING UP



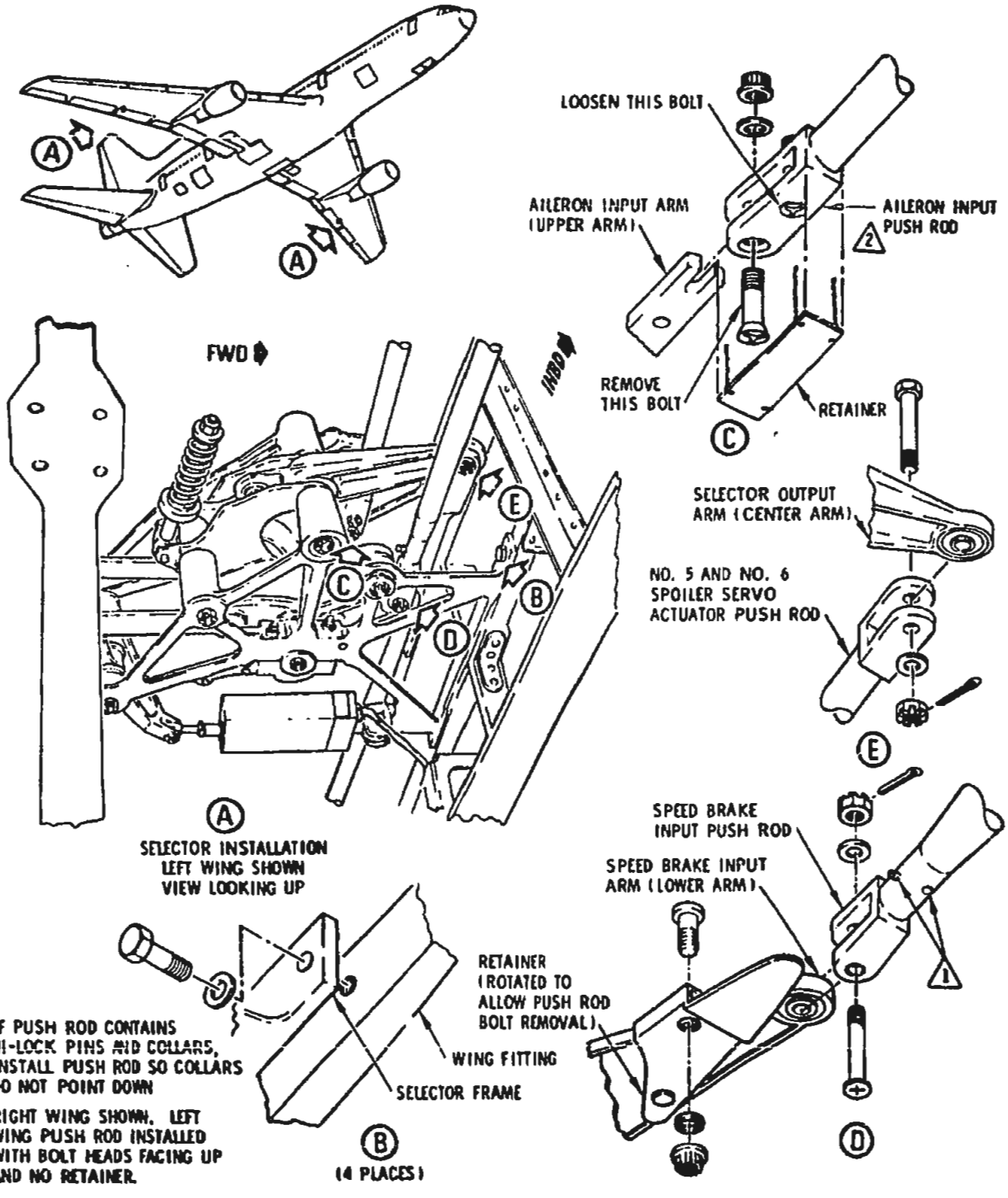
LEFT WING
VIEW LOOKING DOWN

NOTE

LEFT WING SHOWN
RIGHT WING SIMILAR

M1-0100-27-427

Outboard Spoilers Control Selector - Removal and Installation
Figure 401 (Sheet 1)

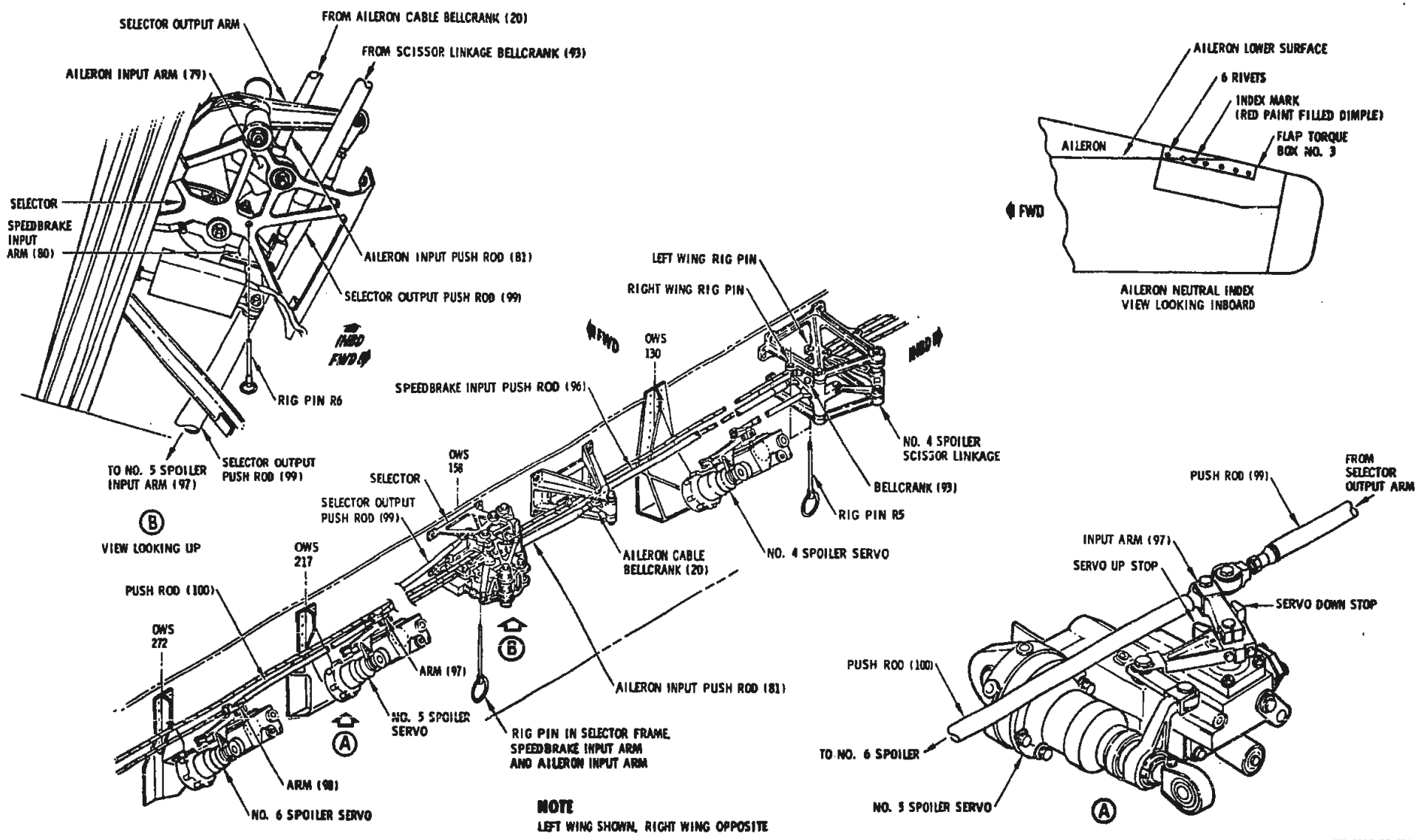


NOTE

1. IF PUSH ROD CONTAINS HI-LOCK PINS AND COLLARS, INSTALL PUSH ROD SO COLLARS DO NOT POINT DOWN
2. RIGHT WING SHOWN. LEFT WING PUSH ROD INSTALLED WITH BOLT HEADS FACING UP AND NO RETAINER.

M1-0004-27-426

Outboard Spoilers Control Selector - Removal and Installation
Figure 401 (Sheet 2)



Outboard Spoilers Control Selector Rigging
Figure 402

SPOILER SELECTOR AND MIXER DWELL ELECTRICAL ACTUATOR REMOVAL AND INSTALLATION

1. Equipment and Materials

Aileron Support Tool, BF90, or equivalent

Lock-wire, Fed Spec QQ-W-423, Form 1, Cond A, 0.032-inch diameter, or equivalent

Rigpin, 5/16-inch diameter by 3 inches long (R3)

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Selector Dwell Actuator - Removal/Installation

A. Removal (Ref. Fig. 401)

WARNING: VERIFY THAT ALL HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00).

(1) On the pilots overhead circuit breaker panel CB1, open and tag circuit breaker SPOILER DWELL - AC (B8).

(2) Remove access panel to gain access to spoiler selector: left wing, 561 BB; right wing, 661 BB (Ref. 6-40-00).

CR NOTE: With flaps full-up and the access panel under
CR the selector installed, the selector actuator is
CR not accessible.

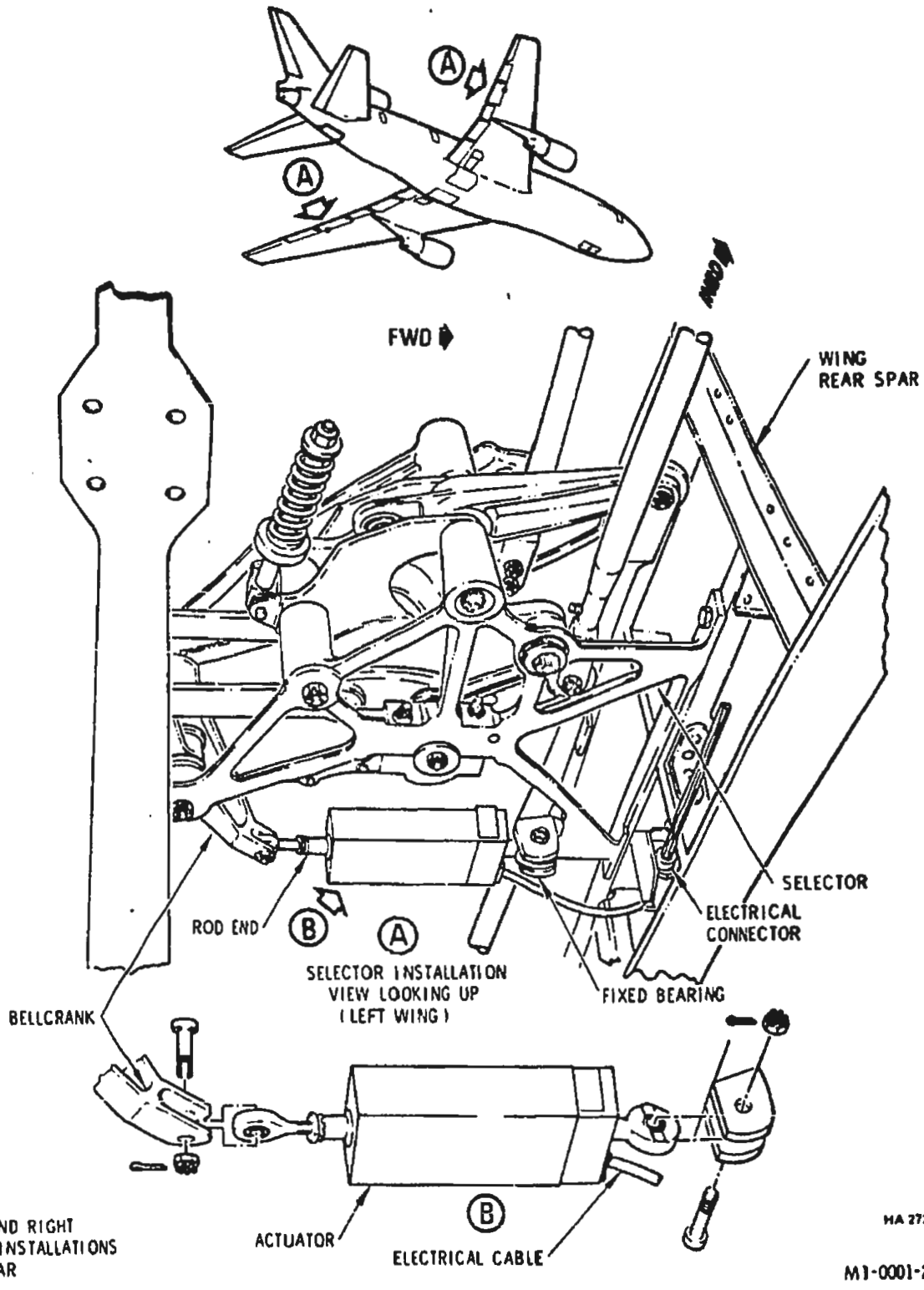
(3) Disconnect dwell actuator electrical connector at rear spar.

(4) Remove actuator rod-end bolt.

(5) Remove actuator fixed bearing attach bolt. Remove actuator.

B. Installation (Ref. Fig. 401)

(1) Verify that spoilers are in 0° (full down) position.



R Selector Dwell Actuator - Removal and Installation
R Figure 401

(2) Verify that flaps are in 0° (full up) position.

(3) Verify that both inboard ailerons are faired (±8°). Block aileron in place, or use aileron support tool, BF90 (Ref. 27-11-00, Fig. 513).

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(4) Install actuator with fixed bearing pointing forward. Electrical cable on forward side of actuator must be outboard on left wing, inboard on right wing. Verify that slip-fit bushing is installed in selector attach fitting. Install fixed bearing attaching bolt and nut.
C Install cotter pin. Actuators with vented housing must
C have the vent on the bottom.

(5) Connect actuator electrical connector to receptacle on rear spar.

(6) On aircraft with access panel under selector removed, verify actuator is fully extended as follows:

(a) On pilots overhead circuit breaker panel CB1, verify that circuit breakers SPOILER DWELL - DC and AC (B7, B8) are closed.

(b) Turn on electrical power (Ref. 24-00-00).

(c) With flaps at 0° (full up), selector dwell actuator should fully extend.

C NOTE: Actuator length when fully extended is 9.56
C (±0.10) inches between actuator attaching
C bolt centers.

(d) Turn off electrical power.

(6) On aircraft with access panel under selector installed, verify actuator is fully extended as follows:

NOTE: The FCAU allows the actuator to extend with the flaps extended allowing access to the actuator with the access panel under the selector installed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURING ANY HYDRAULIC SYSTEM

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Verify control column lock is in place.

(b) Remove tags from hydraulic control panels.

(c) Turn on electrical power (Ref. 24-00-00) and verify circuit breakers CB1-B7 and B8 are closed.

(d) Turn on hydraulic systems A and C (Ref. 29-00-00).

(e) Extend flaps to allow access to actuator.

(f) On flight control auxiliary unit (FCAU) in FESC depress and hold MANUAL pushbutton and then hold FLAPS switch on FCAU in the UP position.

(g) After 15 seconds, while still holding the switch and pushbutton on FCAU, open circuit breakers CB1-B7 and B8.

(h) Release Manual pushbutton and FLAPS switch on FCAU.

(i) Verify dimension between actuator attaching bolt centers is 9.56 (±0.10) inches.

(j) Retract flaps to the 0° (full up) position.

(k) Close circuit breakers CB1-B7 and B8.

(l) Turn off hydraulic power (Ref. 29-11-00) and tag hydraulic control panels against operation.

(m) Turn off electrical power.

(7) Position bellcrank, to which actuator rod end connects, in the aft direction until stop is contacted.

(8) With bellcrank maintained against the stop, adjust actuator length so that the bolt can be installed through the bellcrank and the rod-end with no preload. (Rod-end may be shortened up to 1/2 turn to align with bellcrank clevis.)Tighten rod-end jamnut and lock-wire.

(9) Verify slip-fit bushing is installed in bellcrank. Connect actuator rod end to bellcrank with connecting bolt and nut. Install cotter pin.

(10) Remove aileron blocks or support tool.

(11) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(12) Turn on electrical power (Ref. 24-00-00).

(13) Turn on hydraulic system B and C (Ref. 29-11-00).

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMEDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

(14) Verify that flaps are in 0° (full up) position.

(15) Verify that spoilers are in 0° (full down) position.

NOTE: During the operational steps that follow, visually determine that selector and dwell actuator operate smoothly without binding.

(16) Rotate roll control wheel through several left and right roll applications. Spoilers 5 and 6 must not operate. Center control wheel.

(17) Position speedbrake lever from 0° to MAX. Spoilers 5 and 6 must operate (positioning speedbrake lever to MAX will deploy spoilers 60 degrees). Use surface position indicator to verify spoiler movement.

(18) Position speedbrake lever to 0°. Spoilers must fully retract.

(19) Position flap lever to 4°. When flaps pass 2.5°, selector actuator will fully retract.

(20) Position speedbrake lever to MAX. Spoilers 5 and 6 must not operate.

(21) Position speedbrake lever to 0°.

(22) Rotate roll control wheel through several left and right roll applications. Spoilers 5 and 6 must follow up-aileron movement. Full aileron input (20°) will extend spoilers 40°. Center control wheel.

(23) Position flaps to 0° (full up). Verify that selector actuator fully extends.

(24) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(25) Turn off electrical power if no longer required (Ref. 24-00-00).

(26) Install access panel.

4. Mixer Dwell Actuator - Removal/Installation

A. Removal (Ref. Fig. 402)

WARNING: VERIFY THAT ALL HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00).

(1) Position aileron (on same side as replacement mixer) in the faired position. Block aileron in place or use aileron support tool, BF90 (Ref. 27-11-00, Fig. 513).

(2) Onpilots overhead circuit breaker panel CB1, open and tag circuit breaker SPOILER DWELL - AC (B8).

NOTE: The left mixer is located in the left main wheel well, the right mixer is located in the right main wheel well. The dwell actuator is mounted on top of the mixer.

(3) Enter main wheel well and use stand or ladder to gain access to dwell actuator.

(4) Disconnect actuator electrical connector at ceiling beam.

(5) Remove actuator rod-end bolt.

(6) Removeactuator fixed bearing attach bolt. Remove actuator.

B. Installation (Ref. Fig. 402)

(1) Verify that inboard aileron (on same side as replacement mixer) is faired. Block aileron in place or use aileron support tool, BF90 (Ref. 27-11-00, Fig. 513).

(2) Verify that flaps are extended 4° or more.

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(3) Install actuator with fixed bearing pointing outboard. Electrical cable must be aft of actuator fixed bearing on left mixer, and forward on right mixer. Verify that slip-fit bushing is installed in mixer attach fitting. Install fixed bearing attach bolt, washer, and nut.
C Install cotter pin. Actuators with vented housing must
C have the vent on the bottom.

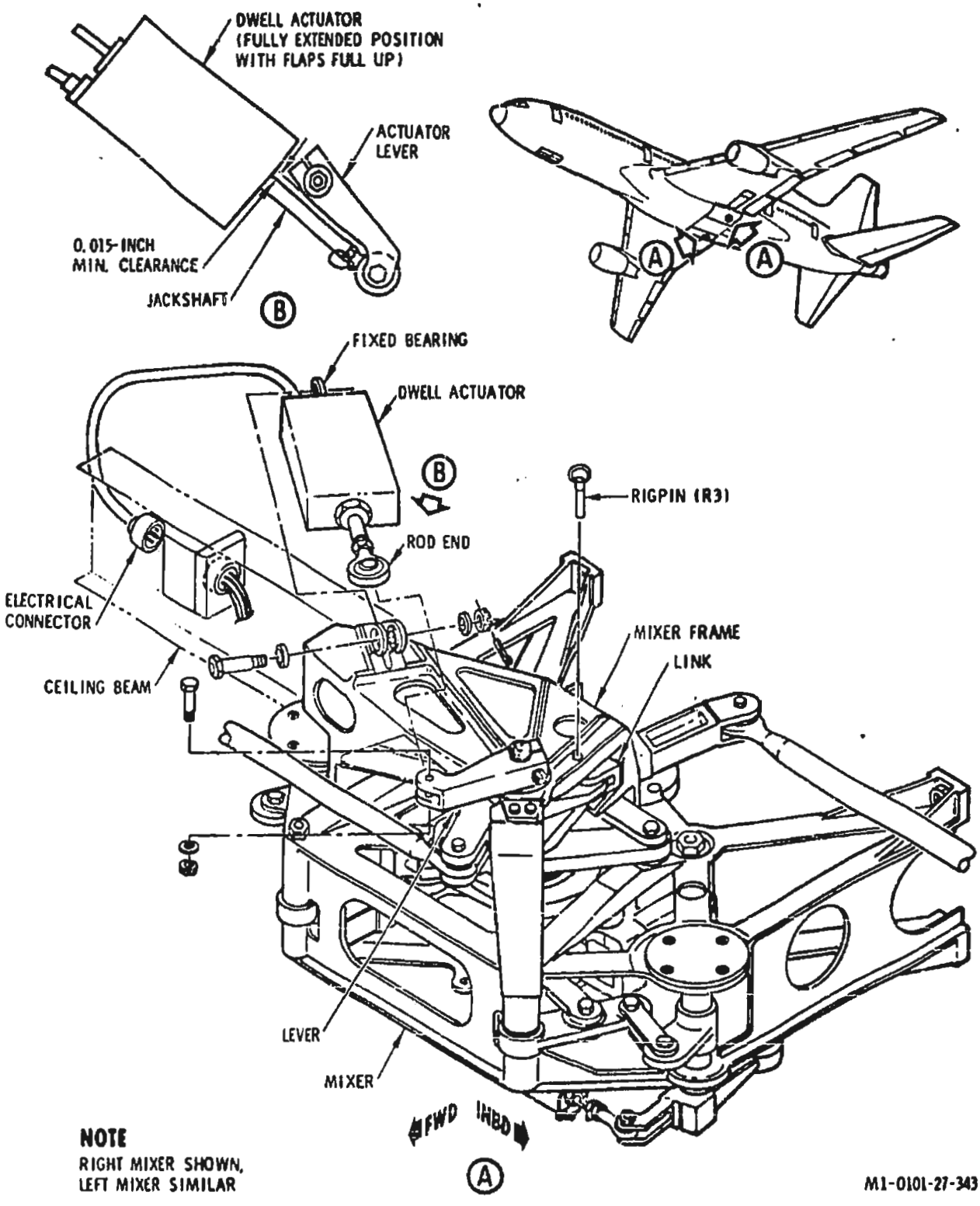
(4) Connect actuator electrical connector to receptacle on ceiling beam.

(5) Before connecting actuator rod-end to bellcrank, verify that actuator is fully retracted as follows:

(a) On pilots overhead circuit breaker CB1, verify that circuit breakers SPOILER DWELL - DC and AC (B7, B8) are closed.

(b) Turn on electrical power (Ref. 24-00-00).

(c) With flaps extended 4° or more, actuator will fully retract.



Mixer Dwell Actuator - Removal and Installation
Figure 402

NOTE: Actuator retract dimension between actuator attaching bolt centers is 7.03 (±0.10) inches.

(d) Turn off electrical power.

(6) Install rig pin (R3) through mixer frame and dwell actuator shift link.

(7) Adjust actuator rod-end to allow installation of bolt through actuator rod-end and lever. Tighten jamnut and lock-wire.

CAUTION: EARLIER ACTUATORS USED A TAB LOCK WASHER TO SAFETY THE JAMNUT. ON THESE ACTUATORS, VERIFY THAT TAB LOCK WASHER IS FACING AWAY FROM ACTUATOR LEVER CLEVIS TO PROVIDE CLEARANCE IN ACTUATOR EXTEND POSITION.

(8) Install actuator rod-end attaching bolt, washer, and nut. Install cotter pin.

(9) Remove rig pin.

(10) Remove aileron blocks or support tool.

(11) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

(12) Turn on electrical power (Ref. 24-00-00).

(13) Turn on hydraulic system B and C for left mixer; system A, C, and D for right mixer (Ref. 29-11-00).

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMEDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

NOTE: During the operational steps that follow, visually determine that the mixer dwell actuator operates smoothly without binding.

(14) With flaps extended 4° or more, cycle roll control wheel through several left and right roll inputs. Verify the following:

(a) For left mixer: spoilers 4, 5, and 6 on both wings must follow up-aileron movement. (Full aileron input of 20° will extend spoilers 40°.) Center control wheel.

(b) For right mixer: spoilers 2 and 3 on both wings must follow up-aileron movement. (Full aileron input of 20° will extend spoilers 40°.)Center control wheel.

(15) Position flaps to 0° (full up). Mixer dwell actuator must extend.

(16) With actuator extended, check for minimum clearance of 0.015 inch between actuator jackshaft and the actuatorlever hub (Ref. Fig. 402, View B). If minimum clearance not available, shorten actuator rod-end within limits of rig pin requirements of Steps (5) through (8).

(17) Cycle roll control wheel through several left and right roll inputs. Verify that all spoilers on both wings do not respond to aileron inputs. Center control wheel.

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-00-00).

INBOARD SPOILERS, PANELS 1 AND 2 - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Cotter Pin, MS 24665-153

R Cotter Pin, MS 24665-304

R Cotter Pin, MS 24665-372

Sling, General Purpose, PN B715, or equivalent

R Lockwire, QQ-W-390, .040 inch or equivalent

Grease, Aircraft and Instrument, MIL-G-23827A (AEROSHELL 7), or equivalent

2. Referenced Procedures

	12-23-00	Flight Controls Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-51-00	Flap Control System - Adjustment and Test
R	27-61-17	Spoiler Servo Control - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal (Ref. Fig. 401)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic system B for No. 1 left and right spoilers, system A for No. 2 left spoiler, or system D for No. 2 right spoiler (Ref. 29-11-00).

R CAUTION: DO NOT USE AC PUMPS TO OPERATE SPOILERS ON THE GROUND. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS IN SPOILER SERVO AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW HYDRAULIC SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES.

NOTE: Hydraulic System A or C must be on to operate flaps.

(3) Position speed brake lever in flight station to 0° (spoilers full down).

R CAUTION: TO PREVENT DAMAGE TO SPOILER SELECTOR DWELL ACTUATOR WHEN OPERATING THE FLAPS THROUGH THE 4° POSITION, VERIFY THAT AILERONS ARE WITHIN 10° OF FAIRED AND THAT SPEEDBRAKE LEVER IS WITHIN 2 INCHES OF 0°.

(4) Position flap lever in flight station to fully extend flaps (Ref. 27-51-00).

(5) With flaps fully extended and spoilers full down, turn off hydraulic power (Ref. 29-11-00).

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(6) Attach general purpose sling mounting plates to two holes in spoiler trailing edge.

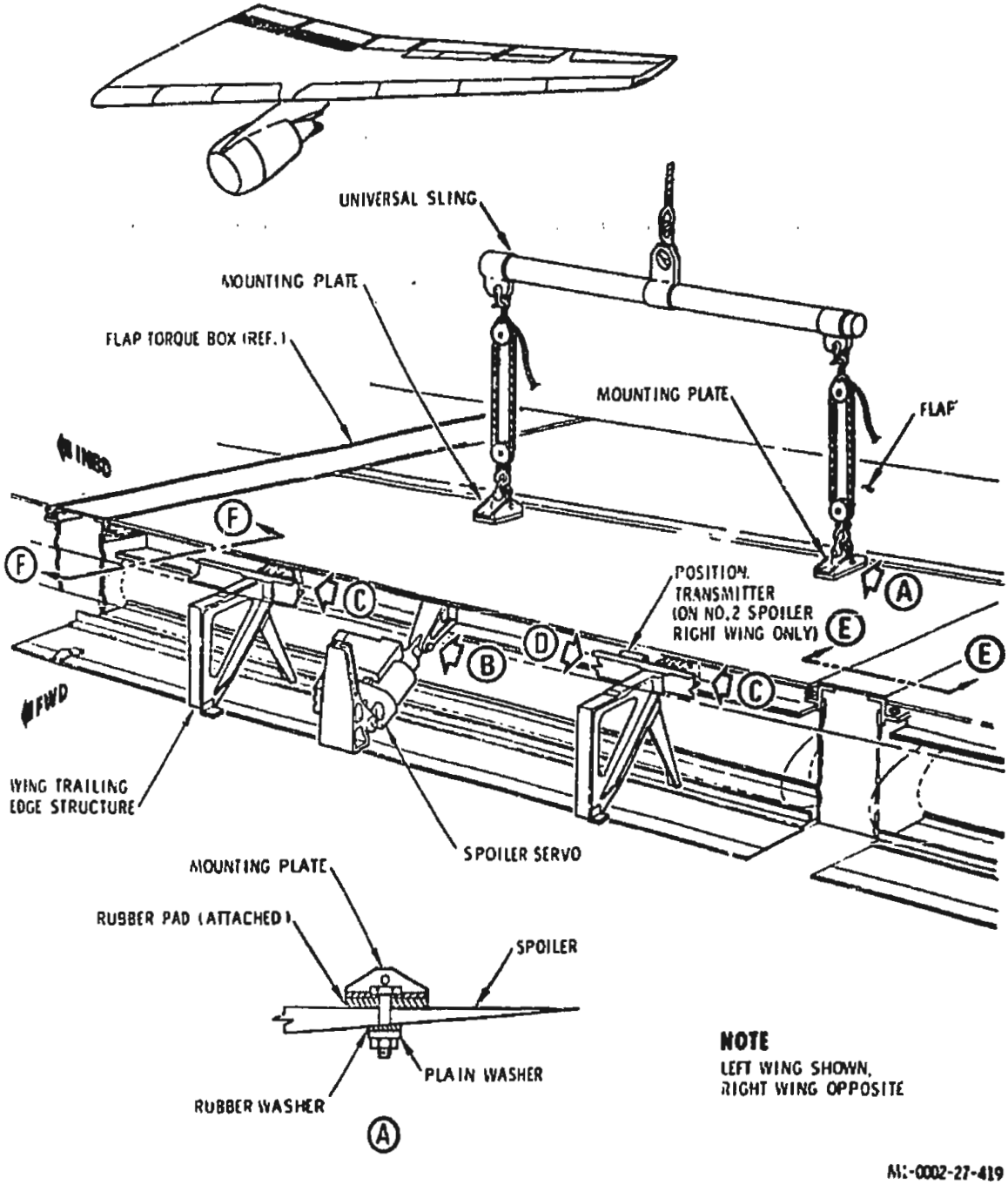
(7) Connect sling to mounting plates.

(8) Take up on hoist to eliminate most of the slack in sling ropes.

R CAUTION: DO NOT APPLY LIFTING LOAD TO SLING. SPOILER STRUCTURE CAN BE DAMAGED.

(9) Disconnect spoiler servoactuator from spoiler by removing connecting bolt.

(10) Manually position spoiler full up and carefully take up on hoist to hold spoiler up.

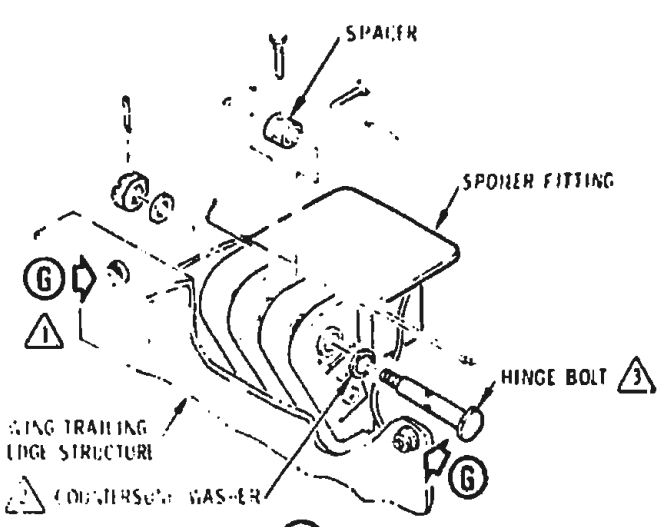


MI-0002-27-419

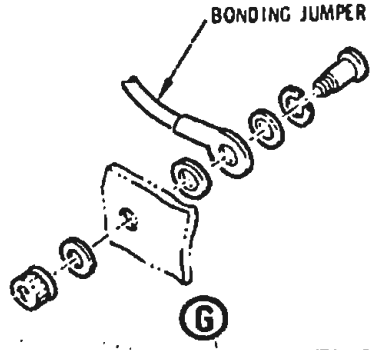
R Inboard Spoilers (Panels 1 and 2) - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL

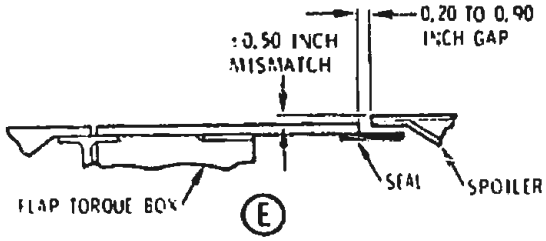
001B



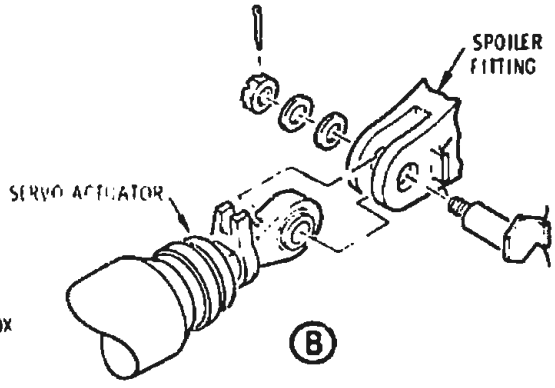
SPOILER HINGE DETAILS

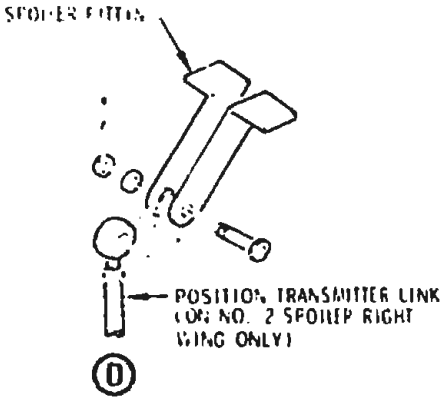


BONDING JUMPER ATTACH DETAILS



MISMATCH AND GAP BETWEEN SPOILER AND FLAP TORQUE BOX (MEASURE MISMATCH AT FORWARD END OF SPOILER ONLY)





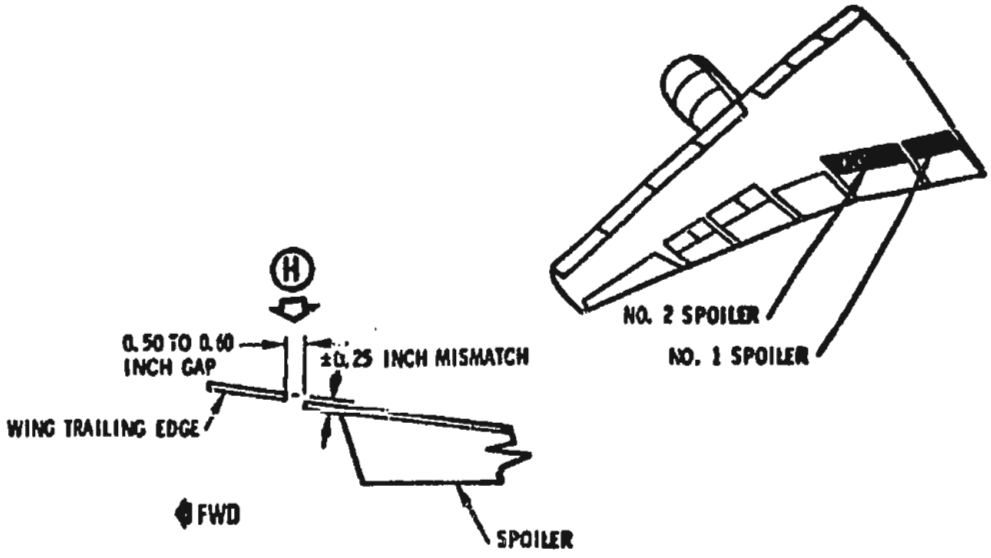
NOTE

1. TWO BONDING JUMPERS ON INBOARD HINGE OF SPOILER 1 AND 2
2. COUNTERSINK MUST FACE BOLTHEAD
3. COAT WITH MIL-G-23827A GREASE

M1-0005-27-420

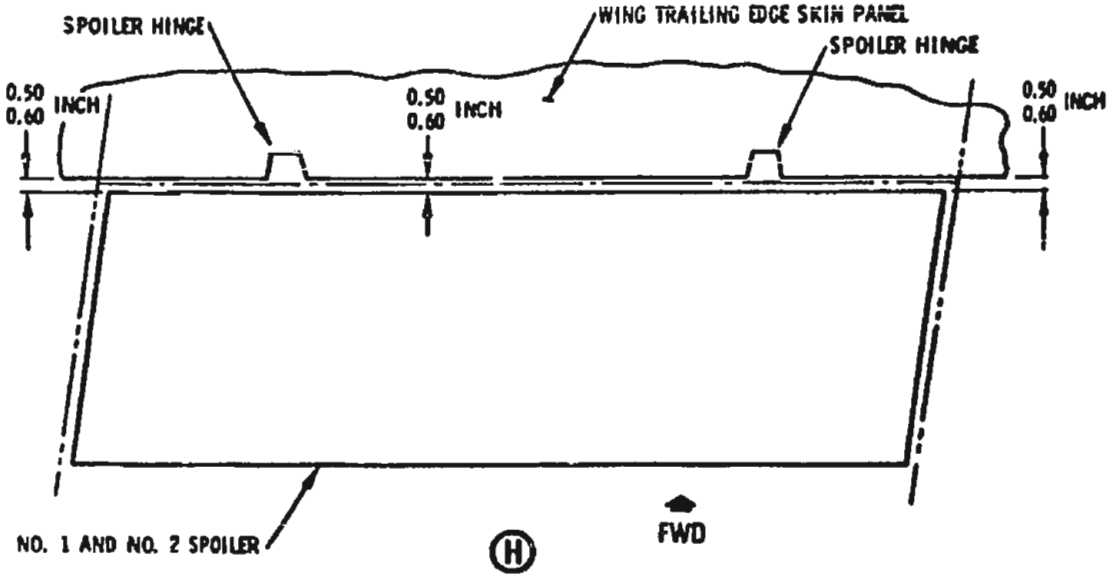
R Inboard Spoilers (Panels 1 and 2) - Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: ALL



F

MISMATCH AND GAP BETWEEN
NO. 1 AND NO. 2 SPOILER AND WING TE



H

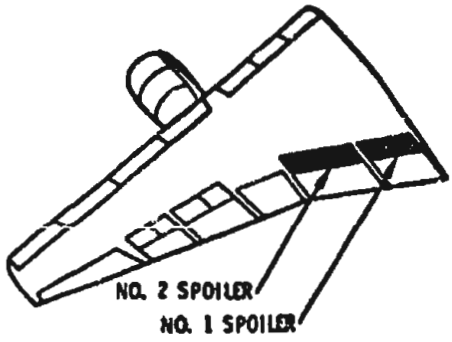
LOOKING DOWN
DIMENSIONS TYPICAL FOR BOTH LEFT AND RIGHT WINGS

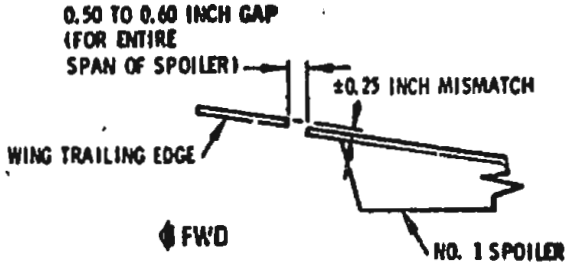
M1-32801-27-098

R Inboard Spoilers (Panels 1 and 2) - Removal and Installation
R Figure 401 (Sheet 3)

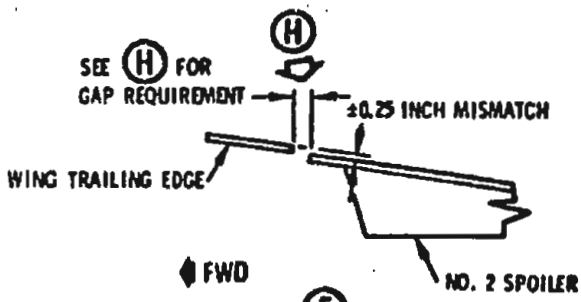
EFFECTIVITY: 001-026 WITHOUT SB57-073

001B

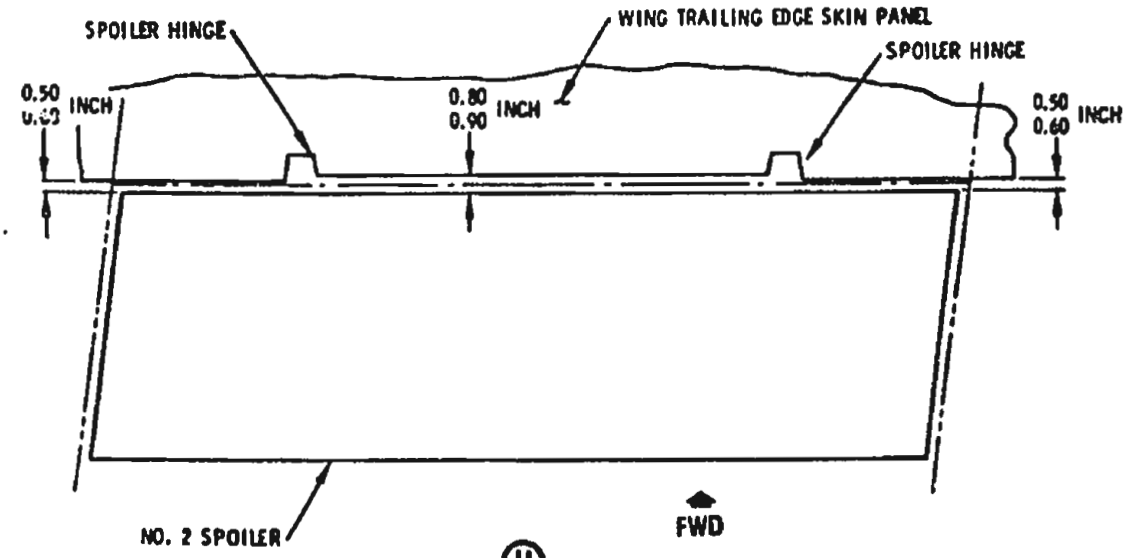




Ⓕ
MISMATCH AND GAP BETWEEN
NO. 1 SPOILER AND WING TE



Ⓕ
MISMATCH AND GAP BETWEEN
NO. 2 SPOILER AND WING TE



Ⓗ
LOOKING DOWN
DIMENSIONS TYPICAL FOR BOTH LEFT AND RIGHT WINGS

M1-0101-27-099

R Inboard Spoilers (Panels 1 and 2) - Removal and Installation
R Figure 401 (Sheet 3)

EFFECTIVITY: 001-026 WITH SB57-073 AND 027-999

NOTE: If sling is not being used, block spoiler in full up position to provide access to hinge bolts.

(11) Disconnect bonding jumpers across hinges.

(12) On the No. 2 right spoiler, disconnect position transmitter link by removing attaching bolt.

(13) Remove two clevis pins from center spacer of both hinge bolts.

R CAUTION: SPOILER NO. 1 WEIGHS 65 POUNDS, SPOILER NO. 2 WEIGHS 80 POUNDS.

(14) Support spoiler and remove spoiler hinge bolts. Remove spoiler.

B. Installation (Ref. Fig. 401)

R (1) Verify flaps are fully extended and all hydraulic power is turned off.

(2) Install mounting plates to replacement spoiler and connect to universal sling.

(3) Lift spoiler into position.

(4) Lubricate hinge bolts with MIL-G-23827A grease.

(5) Install hinge bolts, spacers, washers, and nuts.
R Verify countersunk washer is under bolt head and
R countersink faces bolt head.

R CAUTION: INSTALL HINGE BOLTS SO FLAT ON BOLT HEAD MATES
R WITH ANTI-ROTATION ANGLE ON HINGE.

(6) Tighten nut to obtain gap of 0.002 to 0.005 inch
R between nut and washer. Install cotter pins (P/N MS
R 24665-304).

(7) Install two flathead pins through each spacer and hinge
R bolt. Install cotter pins (P/N MS 24665-153).

R (8) Install bonding jumpers by installing attaching screws,
R washers, lockwashers, and nuts.

R (9) On No. 2 right spoiler, connect position transmitter
R link to spoiler by installing attaching bolt, washer,
R nut, and cotter pin (P/N MS 24665-153).

(10) If a hoist was used, lower spoiler to full down position, remove mounting plates, and remove hoist.

R (11) Butter-lube servo attach bolt with MIL-G-23827A grease.
R Attach servo piston rod to spoiler by installing
R attaching bolt, washers, and nut. Install cotter pin
R (P/N MS 24665-372). Lock-wire bolt using .040 inch
R inconel wire.

R CAUTION: ALIGN BOLT HEAD TANG WITH ANTI-ROTATION SHOULDER ON HINGE.

(12) Lubricate spoiler hinge and actuator fittings (Ref. 12-23-00).

(13) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(14) Turn on electrical power (Ref. 24-41-00).

(15) Turn on hydraulic system B for No. 1 left and right spoilers, system A for No. 2 left spoiler, or system A and D for No. 2 right spoiler (Ref. 29-11-00).

NOTE: Hydraulic System A or B must be on to supply DLC servo.

(16) Move speed brake control lever from 0° to MAX for
R several full throw applications. Verify spoiler
R operates smoothly without binding.

R (17) If the No. 2 right spoiler was replaced, verify right
R outboard spoiler pointer on surface position indicator
R follows spoiler movement. With spoilers full down
R verify spoiler pointer is aligned with other spoiler
R pointers.

(18) With spoilers full down (piston bottomed), verify spoiler trailing edge (at lowest end of spoiler) is 0.12 to 0.18 inch below flap torque box upper skin contour. If not, adjust spoiler servo length (Ref. 27-61-17, Removal and Installation).

CR CR CR NOTE: When properly adjusted, opposite end of spoiler (inboard end) may be raised 1.0 inch maximum from the torque box.

(19) Check gap between spoiler and wing trailing edge and between spoiler and flap torque box is within tolerance (Ref. Fig. 401, Sheet 3).

(20) Check mismatch (step) between spoiler and wing trailing edge and between spoiler and flap torque box is within tolerance (Ref. Fig. 401, Sheet 2 and 3).

NOTE: Mismatch between spoiler and wing trailing edge can be affected by contour irregularities in the wing trailing edge. To properly check mismatch, use flat (wide) surface of a flexible steel 24 to 36 inch scale (a piece of 0.015 to 0.020 spring steel 0.50 inch wide can be used). Lay steel scale flat across spoiler to wing gap to eliminate contour irregularities and measure mismatch.

(21) Check for proper contact between spoilers No. 1 and 2 rub strips and associated vanes (Ref. 27-51-00 Adjustment/Test, Para. 5G).

(22) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(23) Turn off electrical power if no longer required (Ref. 24-41-00).

R INBOARD SPOILERS PANELS 1 AND 2 - INSPECTION AND CHECK

R 1. Referenced Procedures

R 24-41-00 External Power/Ground Service System - Maintenance Practices

R 27-51-00 Flap Control System - Adjustment and Test

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 2. Inspection/Check

R A. Spoiler Freeplay

R (1) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (2) Turn on hydraulic power system A, and system C (Ref. 29-11-00).

R (3) Position flap lever in flight station to fully extend flaps (Ref. 27-51-00).

R (4) Verify speed brake lever in flight station to 0° (spoilers full down).

R (5) Turn off all hydraulic power (Ref. 29-11-00).

R (6) Grasp the spoiler at the trailing edge, midway of the total panel length.

R (7) Using a 6-inch scale, and with spoiler panel still at 0°, sight a reference (0-inch mark) from the spoiler trailing edge surface to the scale.

R (8) Manually, raise the spoiler, lifting it at the trailing
R edge as high as possible, following the normal path of
R travel.

R CAUTION: ONCE SPOILER FREEPLAY TRAVEL ENDS, DO NOT
R CONTINUE TO RAISE SPOILER PANEL.

R (9) Measure the distance the spoiler trailing edge moved,
R in comparison to the referenced 0-inch mark.

R (10) Compare the resulting distance with the following:

R Panel 1: .620 inch maximum

R Panel 2: 0.620 inch maximum

R NOTE: If any spoiler panel exceeds the maximum
R freeplay travel, inspect spoiler servo attach
R points and spoiler panel hinge points for
R excessive wear.

R (11) Turn on hydraulic power systems A and C (Ref.
R 29-11-00).

R (12) Raise flaps to 0° (full up) (Ref. 27-51-00).

R (13) Turn off hydraulic power systems A and C (Ref.
R 29-11-00).

R (14) Turn off electrical power (Ref. 24-41-00).

OUTBOARD SPOILERS, PANELS 3, 4, 5, AND 6 REMOVAL AND INSTALLATION

1. Equipment and Materials

Grease, MIL-G-23827A (AEROSHELL 7), or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

R Cotter Pin, P/N MS24665-153

R Cotter Pin, P/N MS24665-304

R Cotter Pin, P/N MS24665-372

2. Referenced Procedures

	12-23-00	Flight Controls Lubrication
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-51-00	Flap Control System - Adjustment and Test
R	27-61-17	Spoiler Servo Control - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic systems B and C (Ref. 29-11-00).

R CAUTION: DO NOT USE AC PUMPS TO OPERATE SPOILERS ON THE GROUND. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS IN SPOILER SERVO AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW HYDRAULIC SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES.

(3) Position speed brake lever in flight station to 0° (full down).

R CAUTION: TO PREVENT DAMAGE TO SPOILER SELECTOR DWELL ACTUATOR WHEN OPERATING THE FLAPS THROUGH THE 4° POSITION, VERIFY THAT AILERONS ARE WITHIN 10° OF FAIRED AND THAT SPEEDBRAKE LEVER IS WITHIN 2 INCHES OF 0°.

(4) Position flap control lever in flight station to full down position.

(5) When flaps are fully extended and spoilers full down,
R turn off hydraulic power (Ref. 29-11-00).

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(6) Turn off electrical power (Ref. 24-41-00).

(7) Disconnect spoiler servo piston rod from spoiler by removing connecting bolt. Support spoiler panel while disengaging piston rod from spoiler.

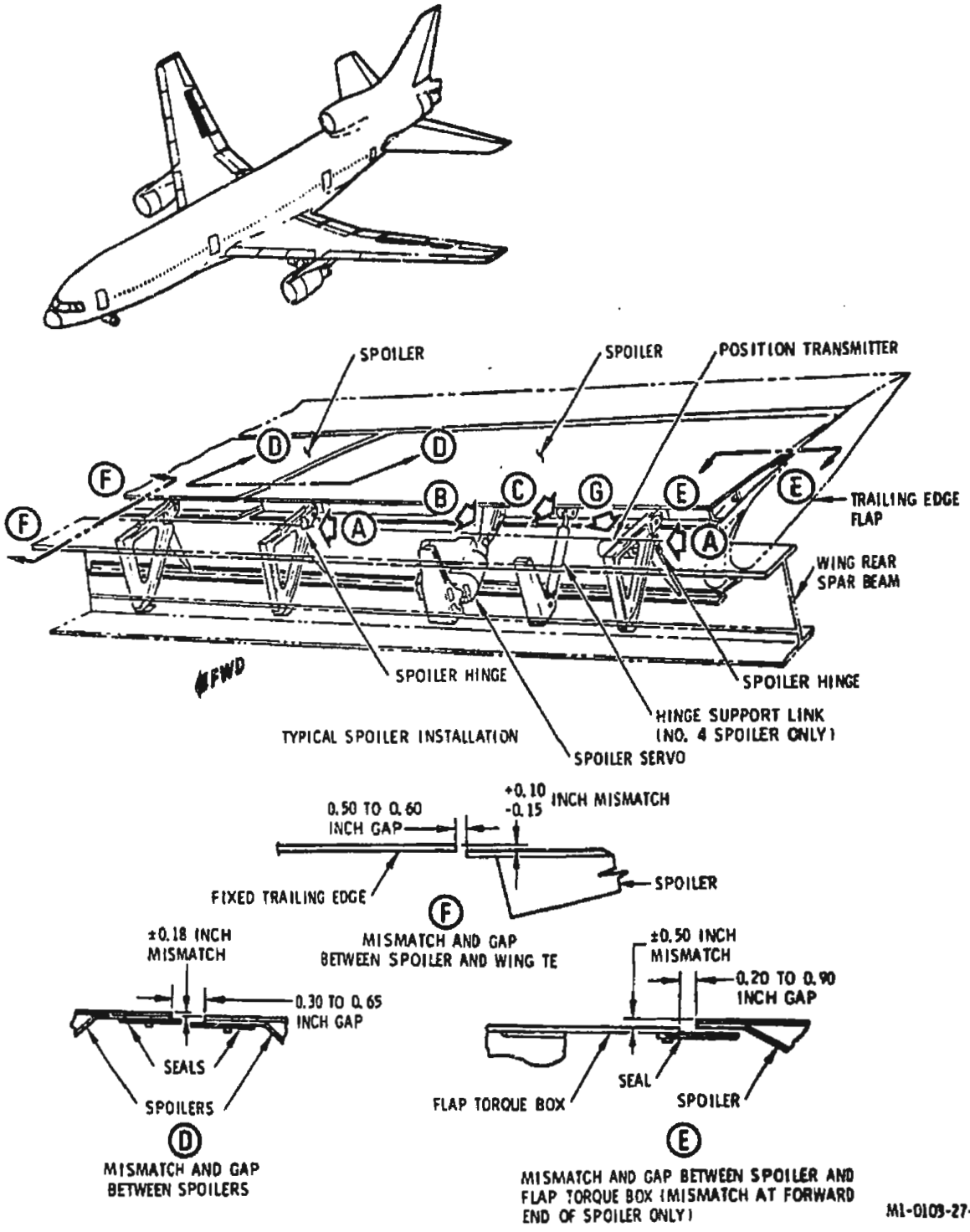
(8) Block spoiler in full up position to provide access to hinges.

(9) Disconnect bonding jumpers across hinges (Ref. Fig. 401).

(10) On left wing spoilers No. 4 and 5, and right wing spoiler No. 6, disconnect position transmitter link by removing connecting bolt.

(11) On spoiler No. 4 (both wings) disconnect hinge support link by removing spoiler attach bolt.

(12) Support spoiler and remove spoiler hinge bolts. Remove spoiler.



R Outboard Spoilers, Panels 3, 4, 5, and 6
R Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL

001B

B. Installation

(1) Verify that flaps are fully extended and spoilers are fully retracted.

(2) On spoilers 3, 4 and 6, verify clevis on inboard hinge fitting contains two press-fit flange bushings and clevis on outboard hinge fitting contains one press-fit and one slip-fit flange bushing.

On spoiler 5, verify clevis on inboard hinge fitting contains one press-fit and one slip-fit flange bushing and clevis on outboard hinge fitting contains two pressfit flange bushings.

R
R NOTE: On hinge fittings with one press-fit and one slip-fit flanged bushing, the press-fit flange bushing is installed with the flange located between the clevis arms. The slip-fit bushing is installed with the flange located outside the clevis arms.

(3) Lift spoiler into position.

(4) Lubricate hinge bolts with MIL-G-23827A grease. Install hinge bolts, washers, and nuts. Verify that countersunk washer is under bolt head and that countersink faces head (Ref. Fig. 401). Tighten nut to provide 0.002 to 0.005 inch gap between nut and washer. Install cotter pin P/N MS24665-304.

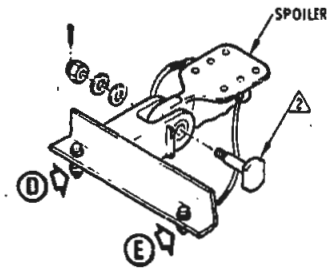
CAUTION: VERIFY THAT FLAT ON BOLT HEAD ALIGNS WITH ANTIROTATION SHOULDER ON HINGE.

(5) Install bonding jumpers by installing the attaching screws, washers, lockwashers, and nuts.

(6) On left wing spoilers No. 4 and 5, and right wing spoiler No. 6, attach position transmitter link to spoiler by installing the connecting bolt, washer, and nut. Install cotter pin P/N MS24665-153.

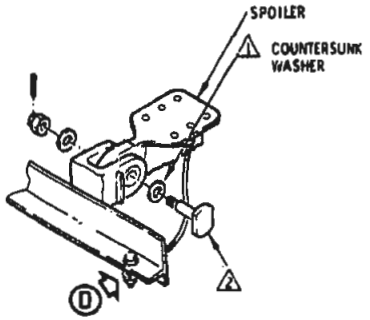
(7) On spoiler No. 4 (both wings) connect hinge support link by installing the connecting bolt, washer, and nut. Install cotter pin P/N MS24665-304 and lock-wire bolt. If necessary, adjust length of link so connecting bolt can be freely installed.

(8) Remove spoiler block and allow spoiler to fully retract.



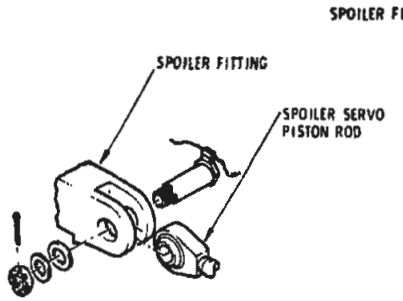
A

INBOARD HINGE SPOILER 3, 4, AND 6

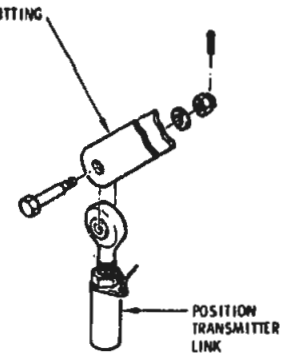


A

OUTBOARD HINGE SPOILER 3, 4 AND 6



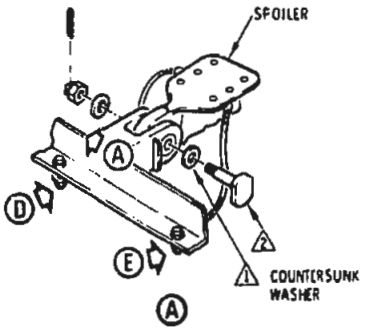
B



C

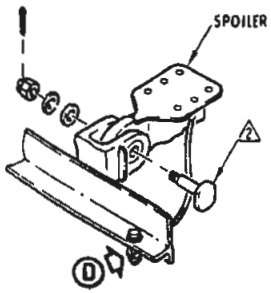
NOTE

POSITION TRANSMITTER ON SPOILERS 4 AND 5 LEFT WING AND 2 AND 6 RIGHT WING.



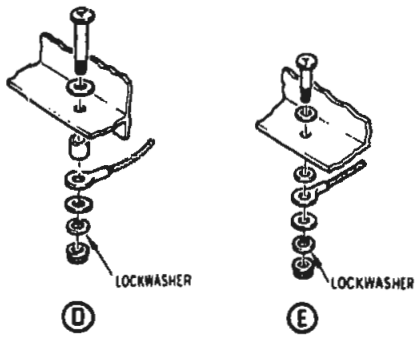
A

INBOARD HINGE SPOILER 5



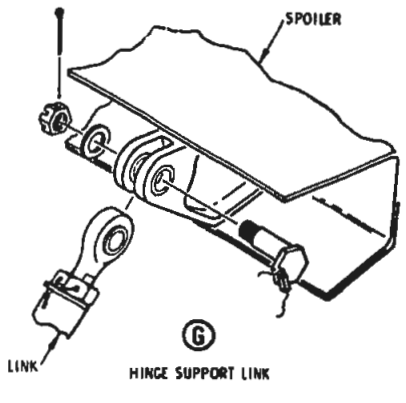
A

OUTBOARD HINGE SPOILER 5



D E

DETAILS OF BONDING STRAPS



G

HINGE SUPPORT LINK

NOTE

1. COUNTERSINK MUST FACE BOLT HEAD
2. LUBRICATE BOLT WITH MIL-G-23827A GREASE BEFORE INSTALLATION

G 517
M1-0101-27-422

R Outboard Spoilers, Panels 3, 4, 5, and 6
R Removal and Installation
R Figure 401 (Sheet 2)

EFFECTIVITY: ALL

001B

(9) Attach the servo piston rod to spoiler by installing the attaching bolt, washers, and nut. Install cotter pin MS24665-372 and lock-wire bolt.

CAUTION: ALIGN BOLT HEAD TANG WITH ANTIROTATION SHOULDER ON HINGE.

(10) Lubricate spoiler hinge and actuator fittings (Ref. 12-23-00).

(11) Remove tags from hydraulic control panels.

(12) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(13) Turn on hydraulic systems B and C (Ref. 29-11-00).

(14) For spoilers 5 and 6, fully retract flaps first to allow selector dwell actuator to couple spoilers 5 and 6 to speed brake system (Ref. 27-51-00).

(15) Move speed brake control lever from 0° to MAX for several full throw applications. Check that spoiler operates smoothly without binding.

(16) Place speed brake control lever at 0 degree. Spoilers will retract completely.

(17) Check for proper clearance between spoilers No. 3, 4, 5 and 6 and associated vanes (Ref. 27-51-00 Adjustment and Test, Para. 5G).

(18) With spoilers full down (piston bottomed), check that spoiler trailing edge is 0.12 to 0.18 inch below flap torque box upper skin contour if possible while maintaining required clearance between spoiler and vane. If not adjust spoiler servo length (Ref. 27-61-17, Removal and Installation) to move spoiler to

as close to the 0.20 inch minimum between spoiler and vane as possible.

(19) Check that gap and mismatch are within tolerance at the following locations (Ref. Fig. 401).

(a) Between spoiler panels.

(b) Between spoiler panel and flap torque box.

(c) Between leading edge of spoiler panel and wing trailing edge.

NOTE: Mismatch between spoiler and wing trailing edge can be affected by contour irregularities in the wing trailing edge. To properly check mismatch use the flat (wide) surface of a flexible steel 24 to 36 inch scale (a piece of 0.015 to 0.020 spring steel 0.50 inch wide can be used). Lay steel scale flat across spoiler to wing gap to eliminate contour irregularities and measure mismatch.

(20) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(21) Turn off electrical power if no longer required (Ref. 24-41-00).

R OUTBOARD SPOILERS, PANELS 3, 4, 5, AND 6 - INSPECTION AND CHECK

R 1. Referenced Procedures

R 24-41-00 External Power/Ground Servive System - Maintenance
R Practices

R 27-51-00 Flap Control System - Adjustment and Test

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 2. Inspection/Check

R A. Spoiler Freeplay

R (1) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF
R ALL FLIGHT CONTROL SURFACES AND GEAR DOOR
R TRAVEL AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (2) Turn on hydraulic power system A, and system C (Ref.
R 29-11-00).

R (3) Position flap lever in flight station to fully extend
R flaps (Ref. 27-51-00).

R (4) Verify speed brake lever in flight station to 0°
R (spoilers full down).

R (5) Turn off all hydraulic power (Ref. 29-11-00).

R (6) Grasp the spoiler at the trailing edge, midway of the
R total panel length.

R (7) Using a 6-inch scale, and with spoiler panel still at
R 0°, sight a reference (0-inch mark) from the spoiler
R trailing edge surface to the scale.

R (8) Manually, raise the spoiler, lifting it at the trailing
R edge as high as possible, following the normal path of
R travel.

R CAUTION: ONCE SPOILER FREEPLAY TRAVEL ENDS, DO NOT
R CONTINUE TO RAISE SPOILER PANEL.

R (9) Measure the distance the spoiler trailing edge moved,
R in comparison to the referenced 0-inch mark.

R (10) Compare the resulting distance with the following:

R Panel 3: .260 inch maximum

R Panel 4: .240 inch maximum

R Panel 5: .200 inch maximum

R Panel 6: .180 inch maximum

R NOTE: If any spoiler panel exceeds the maximum
R freeplay travel, inspect spoiler servo attach
R points and spoiler panel hinge points for
R excessive wear.

R (11) Turn on hydraulic power systems A and C (Ref.
R 29-11-00).

R (12) Raise flaps to 0° (full up) (Ref. 27-51-00).

R (13) Turn off hydraulic power systems A and C (Ref.
R 29-11-00).

R (14) Turn off electrical power (Ref. 24-41-00).

NO. 1 SPOILER CONTROLEX CABLE - REMOVAL AND INSTALLATION

1. General

Removal and installation procedures are the same for left and right controlex cables.

2. Equipment and Materials

R Rig pin, 5/16-inch diameter by 3 inches long (R3)

R Fish Scale, 0 to 15 pounds

R Cotter Pin, MS24665-149, or equivalent

R Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Door and Panels
R 24-41-00	External Power/Ground Service System - Maintenance Practices
27-61-17	Spoiler Servo Control - Removal and Replacement
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

R A. Removal

R WARNING: VERIFY HYDRAULIC SYSTEMS A AND B ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Remove following wing access panels to gain access to Controlex cable in wing (Ref. 6-40-00):

(a) Left wing: 541BB and 541CB

(b) Right wing: 641BB

R (2) At No. 1 spoiler servo, disconnect Controlex cable
R rod-end from servo by removing rod-end attach bolt (Ref. Fig. 401, Sheet 1).

R (3) Disconnect Controlex cable from anchor bracket in the wing as follows:

(a) Remove lock-wire and loosen locknut which locks articulating rod-end on Controlex cable threaded
R end rod. Remove articulating rod-end from
R Controlex cable.

R (b) Remove end seal nut from control cable main
R sleeve.

R (c) Remove locknut from main sleeve. Controlex cable is now free to be withdrawn from anchor bracket.

(4) Remove control cable clamps in wing area.

R (5) In left main wheel well, disconnect Controlex cable
R rod-end from torque tube lower arm by removing rod-end bolt. Unclamp Controlex cable from anchor bracket by removing lock-wire and loosening both locknuts on main sleeve. (Anchor bracket for right Controlex cable is located in hydraulic service center.)

(6) Remove Controlex cable clamps in fuselage area. Remove Controlex cable assembly.

(7) Remove articulating rod-end assembly from wheel well end of control cable for installation on replacement cable.

R B. Installation

R (1) Verify hydraulic systems A and B are shut off and hydraulic control panels tagged.

NOTE: Controlex cable is a precision ball bearing
R device and must be handled very carefully (Ref.
R Fig. 401, Sheet 3).

Do not use pliers or similar devices to grasp any surface of the control cable assembly.

Wrenches should always be used on the wrench flats of the control ends and housing fittings to prevent twisting of the control when torqueing nuts.

Controlex cable bends should have a minimum
R radius of seven inches (17.8 cm). The cable will bend more easily in the plane determined by the flat center race inside the control assembly (Ref. Fig. 401, Sheet 2).

R Do not apply any lubricant to any portion of Controlex assembly.

R Use only external stops to limit travel of sliding portion of the Controlex assembly.

R Do not force or slam sliding portion of Controlex cable against the internal stops.

(2) Prepare new Controlex cable for installation as follows:

R (a) Check for correct part number before uncoiling
R Controlex cable assembly.

R (b) Uncoil Controlex cable (Ref. Fig. 401, Sheet 2).
R Lay the Controlex cable on a flat surface and
R perform the two steps shown in Position 1.

(c) Determine the horizontal position of the center race (control cable bends more easily with center
R race horizontal). Check replacement cable to
R determine if there is any damage to center or
R outer races which will be cause for cable
R rejection (Ref. Fig. 401, Sheet 2).

(d) Make a visual check over entire cable control for cracks, abrasions or wear, and excessive end play.

R (e) Verify freedom of movement by pushing and pulling
R end rod by hand with cable laying straight.

R (f) Check the friction load per the chart using a fish
R scale or equivalent measuring device (Ref. Fig.
R 401 Sheet 3). If no-load friction is excessive, reject cable.

(3) Install cable by routing cable along installation path. Engage cable in cable clamps but do not tighten.

NOTE: Allow Controlex cable to assume normal position when installed. Do not force or twist cabling during installation.

(4) Install and connect Controlex cable to spoiler servo as follows:

(a) Install one locknut on main sleeve.

(b) Insert control cable through wing anchor bracket and install other locknut; do not tighten locknuts.

(c) Install and tighten end seal nut on main sleeve.

R (d) Place locknut and lockwasher on cable end rod.

R (e) Install articulating rod-end assembly onto cable
R end rod.

R (f) Verify proper end rod engagement using witness
R hole in articulating assembly.

R (g) Verify lockwasher tang is engaged in locking
R groove.

R (h) Tighten locknut and lock-wire.

R (i) Connect rod-end to spoiler servo input arm with
R bolt, washer, and nut. Install cotter pin.

R (j) Verify proper engagement of articulating assembly
R into rod-end using witness hole in rod-end.

(5) Install and connect Controlex cable to torque tube in wheel well as follows:

R (a) Place locknut and lockwasher on cable end rod.

R (b) Install articulating rod end assembly on control
R cable end rod.

R (c) Verify proper end rod engagement using witness
R hole in articulating assembly.

R (d) Verify lockwasher tang is engaged in locking
R groove.

R (e) Tighten locknut and lock-wire.

R (f) Position Controlex cable in slot of anchor bracket with a locknut on each side of bracket. Do not tighten locknuts.

R (g) Install rig pin R3 in main wheel well torque tube lower arm (spoiler full down, speedbrake lever full forward).

R (h) Temporarily insert bolt through torque tube lower arm and control cable rod-end.

(6) In wheel well (or hydraulic service center), tighten both jamnuts on control cable main sleeve to lock cable to anchor bracket. Do not twist or load control cable.
R Lock-wire locknuts.

R (7) Verify No. 1 spoiler is full down (piston bottomed) and spoiler input arm is against spoiler external down stop.

R (8) Tighten all Controlex cable clamps. Verify Controlex
R cable bends have a minimum radius of seven inches (17.8 cm).

(9) Rig Controlex cable as follows:

R (a) Verify No. 1 spoiler is full down (piston bottomed).

(b) Position spoiler No. 1 servo input arm 0.008 (±0.005) inch from spoiler servo down stop (clockwise stop, viewed from bottom).

(c) Tighten Controlex cable locknuts that clamp cable to anchor bracket. Lock-wire locknuts.

R (d) Verify gap between spoiler input arm and downstop
R is 0.008 (±0.005) inch.

R (10) Remove bolt temporarily installed in wheel well torque
R tube in Step 4B(5)(h).

R (11) Operate wheel well end of Controlex cable (including No. 1 spoiler servo) ±2 inches and check for smooth operation and loads as follows:

(a) Five to ten pounds maximum load in the up (push) direction. Controlex cable will not return to full down position by the spring reaction of the servo alone. It will require between zero and four pounds maximum assist force to return (pull) to full down position.

R (b) If load to drive or return the Controlex cable
R exceeds limits, perform Steps 4B(11)(c) through
R 4B(11)(e) to determine if control cable or servo is faulty.

(c) Disconnect rod-end at spoiler servo input arm.
R Operate Controlex cable from wheel well and check
R for smooth operation. Friction in control cable
R should be less than four pounds.

R (d) If loads in Step 4B(11)(a) are too high but loads
R in Step 4B(11)(c) are within limits, replace
R spoiler servo (Ref. 27-61-17).

R R R R (e) If loads in Step 48(11)(c) are too high, check cable run for minimum bend radius; also measure diameter of flexible portion of Controlex cable jacket over a distance of two feet from ends. The diameter should not be enlarged with respect to the rest of the control cable (0.38 inches nominal). Replace control cable if no-load friction exceeds four pounds.

(f) Reconnect rod-end to spoiler servo input arm.

(12) Connect control cable rod-end to torque tube in wheel well with bolt, washer, and nut. Install cotter pin.

(13) Remove rig pin from torque tube lower arm.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(14) Turn on electrical power (Ref. 24-41-00).

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

R (15) Pressurize hydraulic systems A and B (Ref. 29-11-00). Verify following:

R (a) No. 1 spoiler servos must not retract or extend (spoiler panel trailing edge must not move up or down from hydraulic power off position).

(b) On PFCS panel, release (out) SPOILER L&R1 switchlight. No. 1 spoiler panel trailing edge

must not move down more than 0.06 inch. After check, depress (in) SPOILER L&R1 switchlight.

R R R R (c) If requirements of Steps 4B(15)(a) and 4B(15)(b) cannot be met, recheck spoiler rigging per Step 4B(9). If rigging is correct, replace spoiler servo (Ref. 27-61-17).

R (16) Position flaps to 4 degrees.

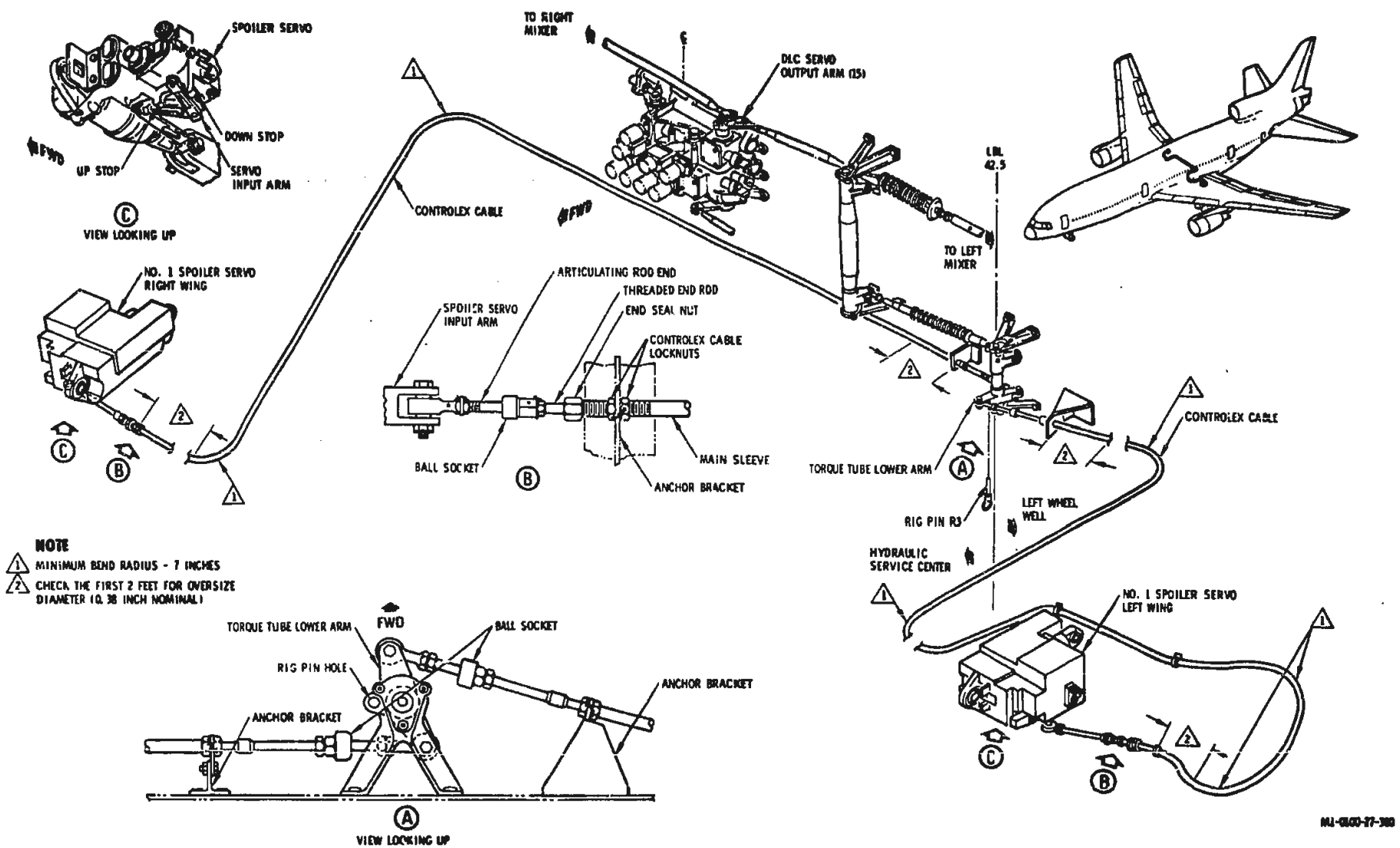
(17) R Operate speedbrake lever from zero to MAX spoiler for several cycles. Verify No. 1 spoilers operate normally. After check, position speedbrake lever to zero.

NOTE: If AC pumps are supplying hydraulic power, spoilers may operate erratically due to low hydraulic flows.

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-41-00).

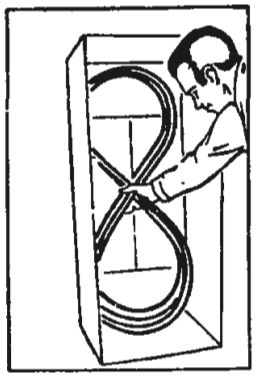
R R (20) Install access panels on wing removed in Step 4A(1)(Ref. 6-40-00).



Controlex Cable - Removal and Installation
Figure 401 (Sheet 1)

R
R
001B

EFFECTIVITY: ALL



1 THE CONTROLEX CONTROL IS SHIPPED IN A FIGURE EIGHT CONFIGURATION (WHEN LENGTH PERMITS). LIFT CONTROL FROM BOX

2 HOLD IT UPRIGHT IN BOTH HANDS

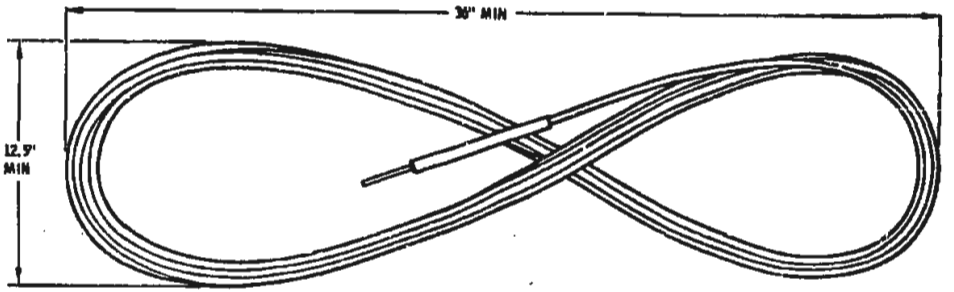
3 STARTING WITH THE END FITTING NEAREST YOU, PAY OUT THE LOOPS OF THE CONTROL, ONE AT A TIME

4 THE FINAL FIGURE EIGHT

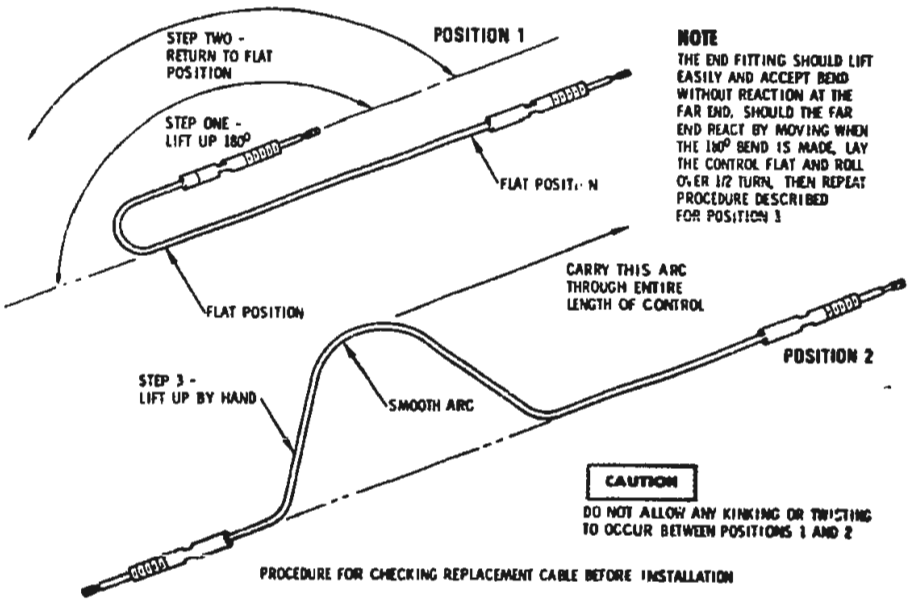
5 . . . WHICH IS ALSO UNFOLDED LIKE THE PREVIOUS LOOPS, WITHOUT FORCING OR TWISTING

6 THE CONTROL IS NOW READY FOR PRE-INSTALLATION CHECKOUT

NOTE
THESE SIMPLE STEPS ILLUSTRATE THE CORRECT HANDLING OF THE CONTROL. TO AVOID DAMAGE TO THIS PRECISION CONTROL, DO NOT COIL CONTROLEX LIKE A ROPE OR FORCE IT INTO POSITION. TO REFOLD CONTROL, REVERSE THE PROCEDURE STARTING WITH STEP 6



WARNING
STORAGE CONFIGURATION CANNOT BE COILED OR OPENED LIKE A LASSO


STEP TWO - RETURN TO FLAT POSITION
POSITION 1
STEP ONE - LIFT UP 180°
FLAT POSITION
FLAT POSITION
CARRY THIS ARC THROUGH ENTIRE LENGTH OF CONTROL
POSITION 2
STEP 3 - LIFT UP BY HAND
SMOOTH ARC

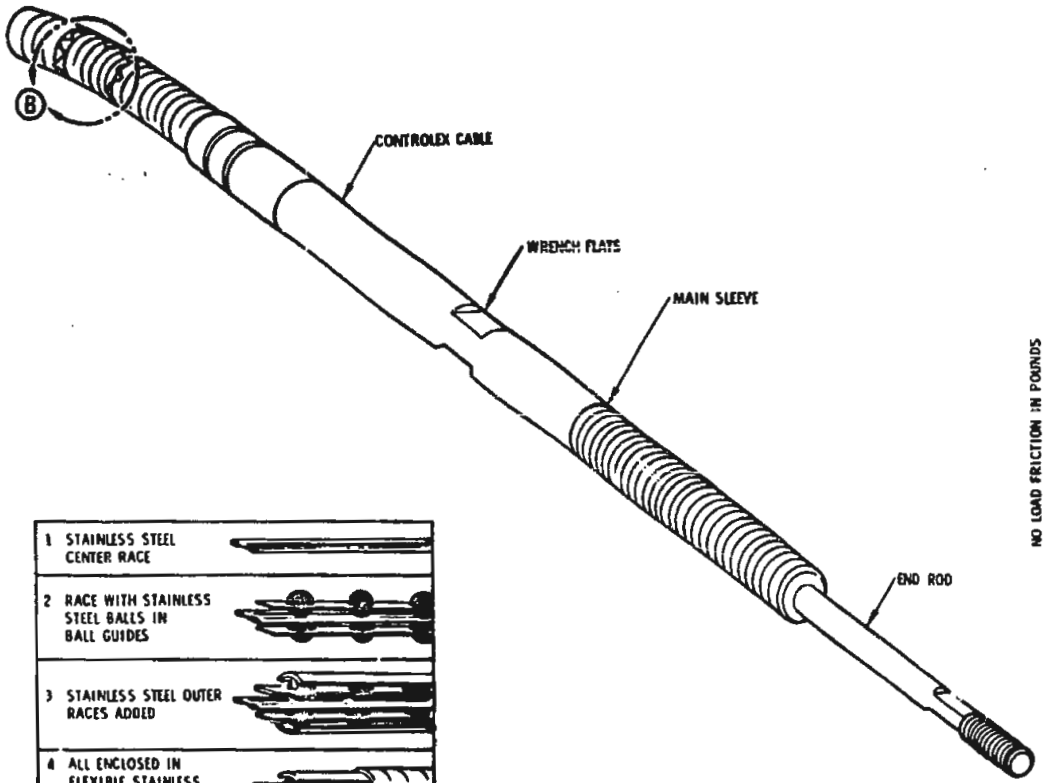
NOTE
THE END FITTING SHOULD LIFT EASILY AND ACCEPT BEND WITHOUT REACTION AT THE FAR END. SHOULD THE FAR END REACT BY MOVING WHEN THE 180° BEND IS MADE, LAY THE CONTROL FLAT AND ROLL OVER 1/2 TURN, THEN REPEAT PROCEDURE DESCRIBED FOR POSITION 1

CAUTION
DO NOT ALLOW ANY KINKING OR TWISTING TO OCCUR BETWEEN POSITIONS 1 AND 2

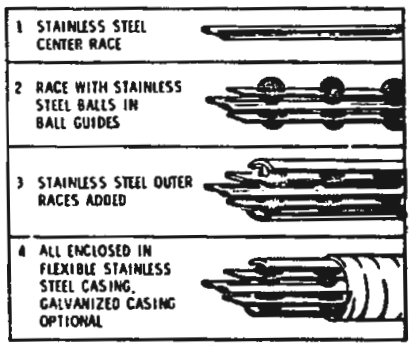
PROCEDURE FOR CHECKING REPLACEMENT CABLE BEFORE INSTALLATION

MI-0100-27-383

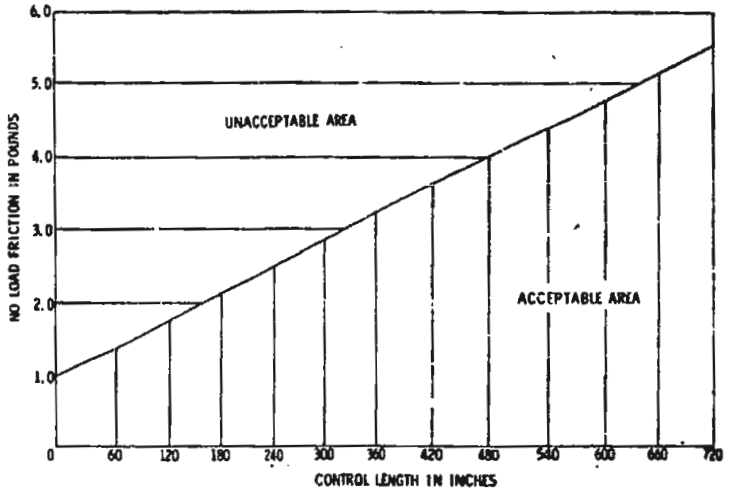
Controlex Cable – Removal and Installation
Figure 401 (Sheet 2)



Ⓐ
TYPICAL CONTROL CABLE END ASSEMBLY


1 STAINLESS STEEL CENTER RACE
2 RACE WITH STAINLESS STEEL BALLS IN BALL GUIDES
3 STAINLESS STEEL OUTER RACES ADDED
4 ALL ENCLOSED IN FLEXIBLE STAINLESS STEEL CASING. GALVANIZED CASING OPTIONAL

Ⓑ
CONTROLEX CABLE CONSTRUCTION



CONTROLEX CABLE NO LOAD FRICTION CHART

MI-1800-27-302

Controlex Cable - Removal and Installation
Figure 401 (Sheet 3)

R
R
001B EFFECTIVITY: ALL

DIRECT LIFT CONTROL (DLC) SERVO PRESSURE SWITCH REMOVAL AND INSTALLATION

1. Equipment and Materials

   Container, 1 quart

   Gasket (Ref. Fig. 401)

   Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

   O-ring (Ref. Fig. 401)

2. Referenced Procedure

   29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

   A. Removal

      WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

      (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker DLC SERVO - A or B.

      (2) Open hydraulic service center door 147AB.

      (3) Remove mount bolts and remove valve (Ref. Fig. 401).

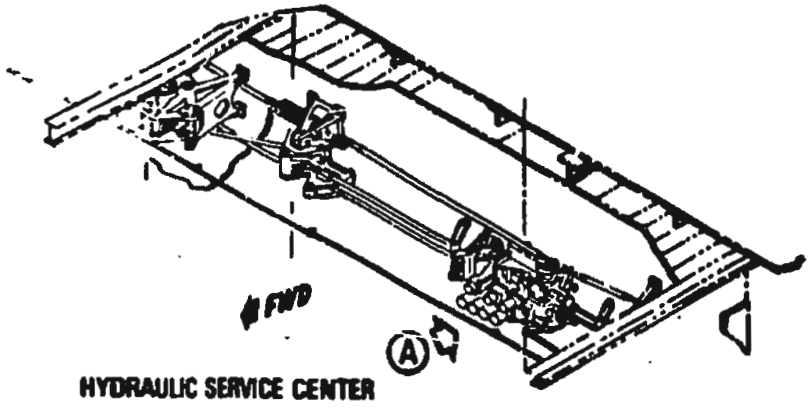
      (4) Remove and discard plate gasket.

      (5) Remove and discard preformed O-ring packing from switch electrical connection groove.

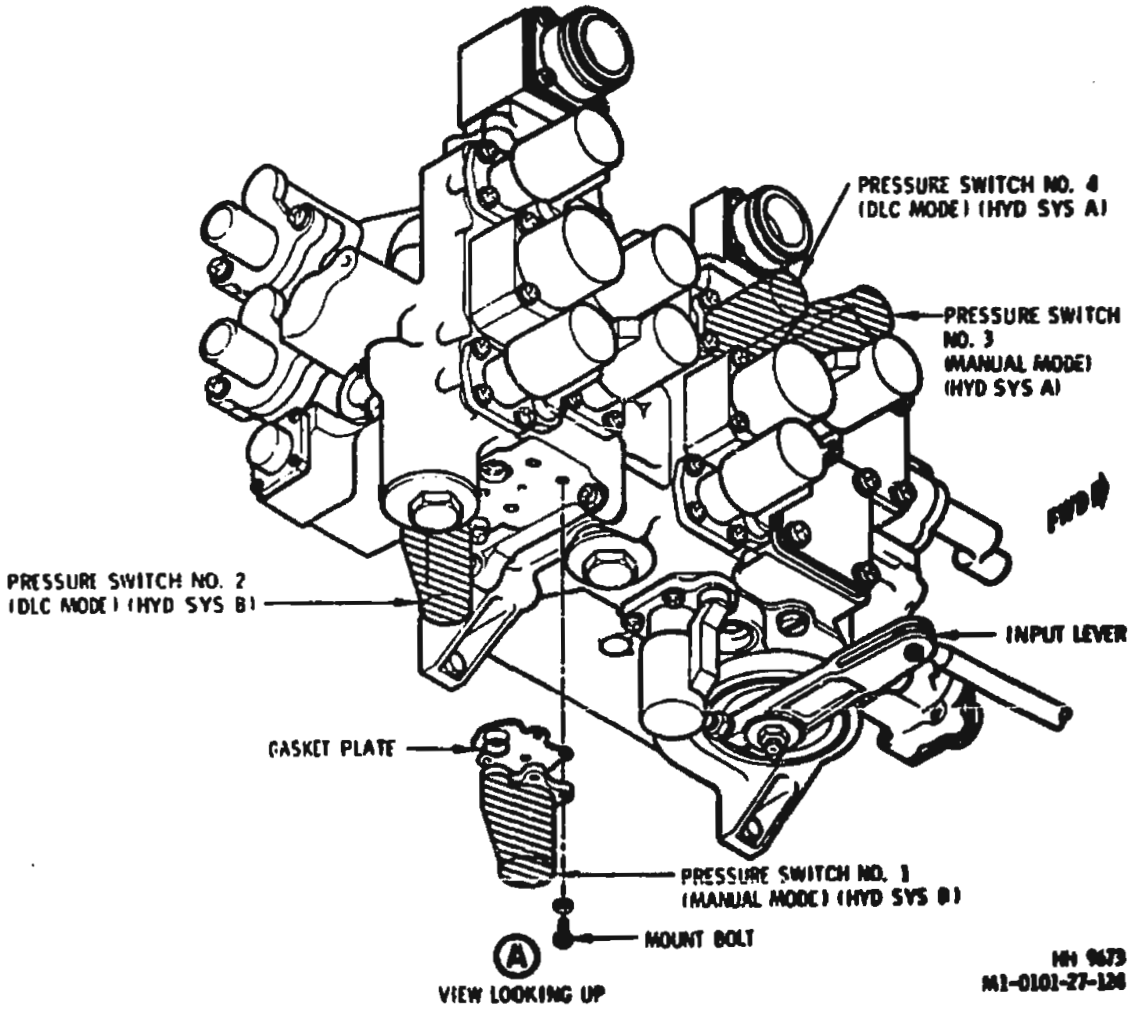
   B. Installation

      (1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

      (2) Install new preformed O-ring packing on switch electrical connection groove.



HYDRAULIC SERVICE CENTER



R Direct Lift Control (DLC) Servo Pressure Switch
R Removal and Installation
R Figure 401

R (3) Install new plate gasket and switch. Secure with mount
R bolts and lock-wire.

R (4) Remove tag and close circuit breaker opened in Step
R 3A(1).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES
R AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL
R AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (5) Remove tags installed at beginning of Paragraph 3.

R (6) Turn on hydraulic system A or B as applicable (Ref.
R 29-11-00).

R (7) Check switch for leaks.

R (8) Turn off hydraulic system (Ref. 29-11-00).

R (9) Close access door.

NO. 1 SPOILER SERVO PRESSURE SWITCH - REMOVAL AND INSTALLATION

1. General

R A pressure switch is installed on both left and right spoiler No. 1 servo. The removal and installation procedure is the same for the left or right pressure switch unless noted.

2. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032 inch diameter

O-ring and plate gasket (Ref. Fig. 401)

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-61-00	Spoiler and Speedbrake Control System - Fault Isolation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

CAUTION: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal (Ref. Fig. 401)

(1) Open and tag following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: SPOILER DWELL (B7)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: SPOILER SERVO B1, 4, 6 L&R (J16)

(2) Open applicable access panel in wing lower surface to gain access to spoiler servo (Ref. 6-40-00):

(a) For left wing, 541 CB

(b) For right wing, 641 BB

(3) On front of spoiler servo, remove four screws attaching pressure switch to servo.

(4) Remove pressure switch (Ref. Fig. 401).

NOTE: Unit on rear (rod end) of spoiler servo is a solenoid shutoff valve.

B. Installation (Ref. Fig. 401)

(1) Verify that O-ring and plate gasket are installed on replacement pressure switch (Ref. Fig. 401).

(2) Verify that electrical connector on switch servo are not contaminated with hydraulic oil. If they are, clean with approved solvent.

(a) Install pressure switch on spoiler servo.

R R (b) Install four attaching screws. Torque to 30 to 40 pound-inches and install lock-wire.

R R (3) Remove tags and close circuit breakers opened in Step A(1).

R (4) Verify that the following circuit breakers are closed:

(a) SPOILER DWELL - CB1-B8

(b) FLT CONT ALT ALERT - CB3-G9

(5) Remove tags from hydraulic control panels.

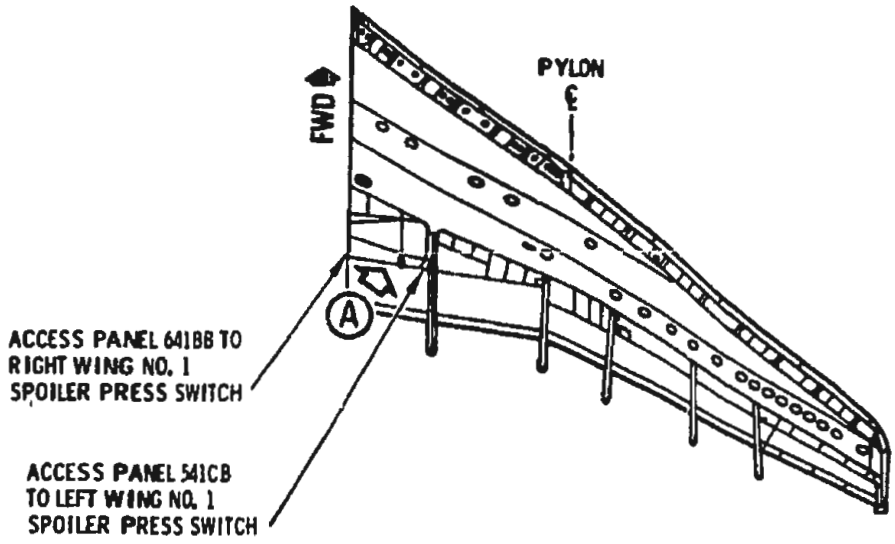
WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

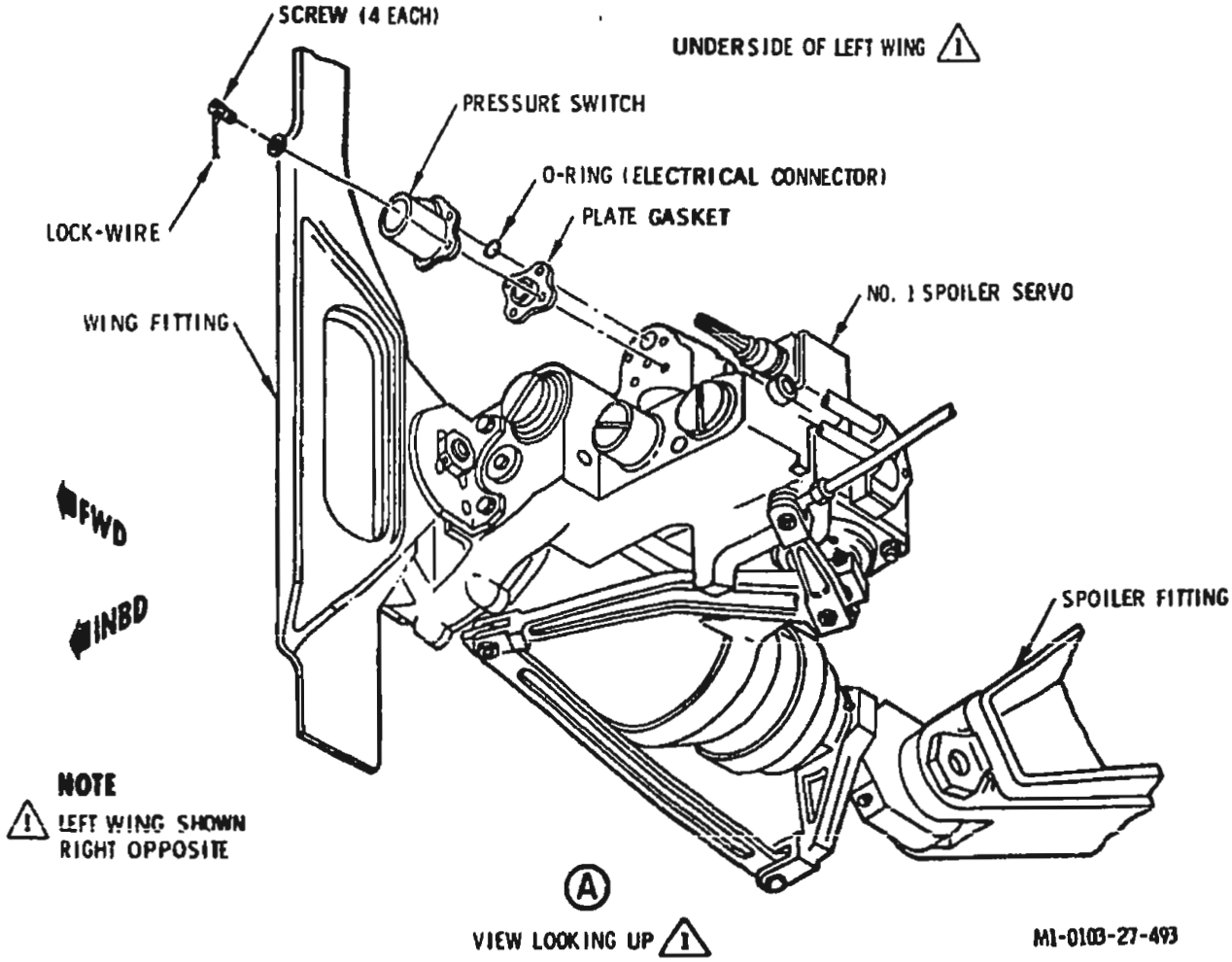
PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.


PYLON
℄
FWD
A
ACCESS PANEL 641BB TO RIGHT WING NO. 1 SPOILER PRESS SWITCH
ACCESS PANEL 541CB TO LEFT WING NO. 1 SPOILER PRESS SWITCH



R No. 1 Spoiler Servo Pressure Switch - Removal and Installation
R Figure 401

(6) Turn on electrical power (Ref. 24-41-00).

(7) Turn on hydraulic system B (Ref. 29-11-00).

(8) Verify that speedbrake lever is positioned to zero degrees (full forward).

(9) On PFCS panel (on pilots overhead panel), verify that SPOILER L&R1 switchlight is depressed (in) and switchlight OFF light is off.

(10) Verify that flaps are extended 4 degrees or more to actuate the No. 1 spoilers.

(11) With conditions in accordance with Steps (9) and (10), the ROLL SPEED BRAKE light of pilots annunciator panel must be off.

(12) On PFCS panel, release (out) SPOILER L&R1 switchlight to disable the No. 1 spoilers. Verify that switchlight OFF light and ROLL SPEED BRAKE light come on.

(13) On PFCS panel, depress SPOILER L&R1 switchlight. Verify that switchlight OFF light and ROLL SPEED BRAKE light go off.

R NOTE: If ROLL SPEED BRAKE light does not operate properly, refer to 27-61-00, Fault Isolation.

(14) Check spoiler servo with replaced pressure switch for hydraulic leakage.

(15) Close access door.

(16) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(17) Turn off electrical power if no longer required (Ref. 24-41-00).

R # SPOILER SERVO FILTER - REMOVAL AND INSTALLATION

R 1. General

R Spoiler servo filter removal and installation procedures are
R similar for all spoiler servo installations.

R 2. Equipment and Materials

R Lockwire, Fed Spec. QQ-W-390, 0.032 inch diameter, or equivalent

R 3. Referenced Procedures.

R	6-40-00	Exterior Access Doors and Panels
R	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
R	20-29-01	Fluid Lines and Fittings Assembly - Maintenance Practices
R	24-00-00	Electrical Power - Maintenance Practices
R	29-11-00	Hydraulic Power - Maintenance Practices

R 4. Removal/Installation

R A. Removal

R (1) Open applicable access panels on wing lower surface
R (Ref. 6-40-00):

R Spoiler No. 1; 541CB left wing, 641CB right wing

R Spoiler No. 2; 541FB left wing, 641FB right wing

R Spoiler No. 3; 561AB left wing, 661BB right wing

R Spoiler No. 4; 561BB left wing, 661BB right wing

R Spoiler No. 5; 561CB left wing, 661CB right wing

R Spoiler No. 6; 561CB left wing, 661CB right wing

R WARNING: VERIFY HYDRAULIC POWER IS OFF, THE ACCUMULATORS
R ARE DEPRESSURIZED AND HYDRAULIC PANELS ARE TAGGED
R AGAINST OPERATION PRIOR TO DISCONNECTING ANY
R HYDRAULIC LINE OR COMPONENT.

R (2) Turn off hydraulic power, depressurize accumulators and
R tag FE/SO Hydraulic System panel, zone 215, and
R Hydraulic Service Center Hydraulic Servicing panel;
R zone 147, against operation for applicable hydraulic
R systems (Ref. 29-11-00):

R Spoiler No. 1; "B" left wing, "B" right wing

R Spoiler No. 2; "A" left wing, "D" right wing

R Spoiler No. 3; "C" left wing, "C" right wing

R Spoiler No. 4; "B" left wing, "B" right wing

R Spoiler No. 5; "C" left wing, "C" right wing

R Spoiler No. 6; "B" left wing, "B" right wing

R (3) Remove three screws attaching hydraulic line manifold
R to spoiler servo (Ref. Fig. 401).

R (4) Loosen "B" nut on end of manifold hydraulic line and
R move manifold away from servo.

R (5) Remove screws attaching hydraulic manifold plate seal
R and remove plate seal.

R (6) Remove spoiler servo filter from cavity in servo under
R plate seal.

R (7) If spoiler servo filter is not to be installed
R immediately, install protective covers on hydraulic
R manifold fitting and servo pad.

R B. Installation

R WARNING: VERIFY HYDRAULIC POWER IS OFF AND FE/SO HYDRAULIC
R SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE
R CENTER HYDRAULIC SERVICING PANEL, ZONE 147, ARE
R PLACARDED AGAINST OPERATION.

R (1) Remove protective covers from hydraulic manifold
R fitting and servo pad if installed.

R (2) Install spoiler servo filter in cavity in servo
R hydraulic manifold pad (Ref. Fig. 401).

R (3) Inspect mating surfaces on servo, plate seal, and
R hydraulic line manifold for cleanliness, burrs and
R nicks.

R (4) position plate seal on servo and attach with two
R mounting screws.

R (5) Attach hydraulic manifold to servo with three screws.
R Torque screws 70 to 80 lb in. and install lockwire.

R (6) Torque "B" nut on end of manifold hydraulic line (Ref.
R 20-29-01).

R (7) Remove hydraulic panel placards.

R (8) Turn on electrical power (Ref. 24-00-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HUDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL
R FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL
R AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND
R IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN
R CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER
R SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH
R AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS
R MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT
R CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4
R SECONDS FULL STROKE).

R (9) Turn on applicable hydraulic systems (Ref. 29-11-00):

R SPOILER No. 1; "B" left wing, "B" right wing

R Spoiler No. 2; "A" left wing, "D" right wing

R Spoiler No. 3; "C" left wing, "C" right wing

R Spoiler No. 4; "B" left wing, "B" right wing

R Spoiler No. 5; "C" left wing, "C" right wing

R Spoiler No. 6; "B" left wing, "B" right wing

R (10) Position flaps to engage speedbrake handle with
R spoilers as follows:

R (a) Spoiler servo No. 1: position flaps to 4 or more
R degrees.

R (b) Spoiler servos No. 2, 3 and 4: flaps may be in any
R position. flaps may be in any position.

R (c) Spoiler servos No. 5 and 6: position flaps full
R up.

R NOTE: Use hydraulic systems A and/or C to operate
R flaps.

R CAUTION: DO NOT OPERATE SPOILERS UNLESS HYDRAULIC PRESSURE
R HAS BEEN ON FOR AT LEAST FIVE MINUTES TO ENSURE
R PROPER FILLING OF ALL SERVO CAVITYS AND PREVENT
R SERVO OSCILLATION.

R (11) After hydraulic power has been on for at least five
R minutes, cycle speedbrake handle through five full
R applications to bleed servos of air. Following
R bleeding operation, spoilers should move smoothly
R without roughness.

R NOTE: If filter in more than one servo was installed
R it may be necessary to reposition flaps and
R repeat bleeding procedure.

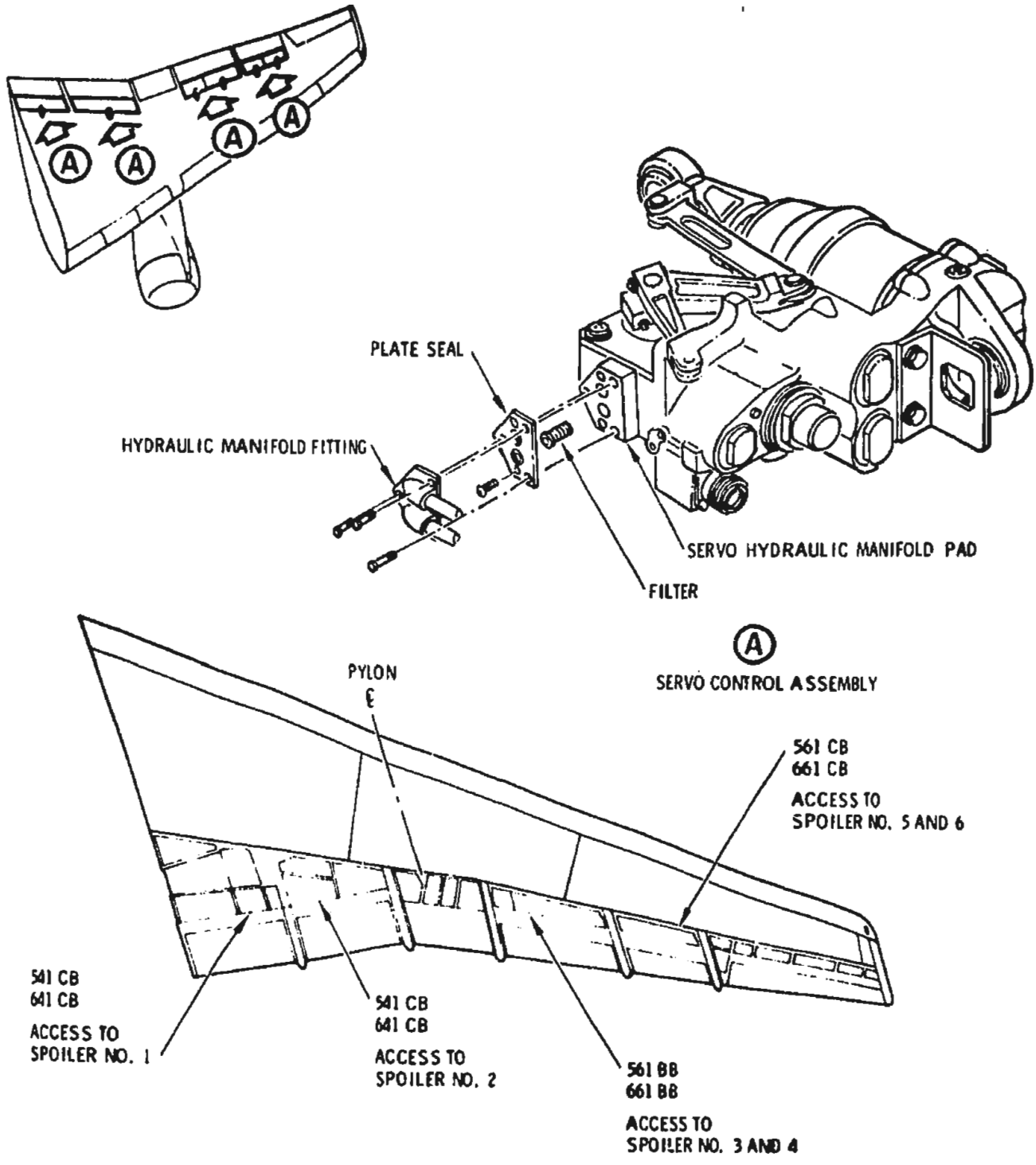
R (12) Check spoiler servo hydraulic manifold and manifold
R hydraulic line "B" nuts for leaks.

R (13) Close spoiler servo access panels.

R (14) Service hydraulic systems reservoirs (Ref. 12-13-01).

R (15) Turn off hydraulic power if no longer required (Ref.
R 29-11-00).

R (16) Turn off electrical power if no longer required (Ref.
R 24-00-00).



UNDERSIDE OF LEFT WING

NOTE

LEFT WING SHOWN, RIGHT WING SIMILAR

M1-0000-27-1123

R Spoiler Servo Filter - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

SPOILER MIXER BUNGEE CARTRIDGE - REMOVAL AND INSTALLATION

1. General

The spoiler mixer bungee should be replaced if defective with a bungee of the same spring weight. A serviceable bungee may be replaced with a bungee having a different weight spring to correct faults in other components. Refer to Fault Isolation 27-61-00 to determine the correct bungee spring weight from the following list.

CR 1556403-101 22 lbs. Preferred by MO 71N99.

CR 1556403-103 10 lbs. Removed by MO 71N99.

CR 1556403-105 10 lbs. (Slightly Higher Tolerance Than 1556403-103) Removed by MO 71N99.

CR 1556403-107 22 lbs. (Made Up Of Different Parts Than 1556403-101) Preferred by MO 71N99.

CR 1630515-101 14 lbs. (Preferred Spare) Removed by MO 71N99.

NOTE: When installing 1630515-101 Bungee, SB27-241 must be incorporated in order to fit rig pin through roll output cam and mixer frame.

2. Equipment and Materials

Rig pins 5/16-inch diameter, 3 inches long (R3) (1 each) and 5/16 inch diameter, 5 inches long (R5) (4 each) (Part of B735 Kit)

Aileron Support Tool, PN BF90, or equivalent

MS24665-149 Cotter Pin (2 each)

3. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL ZONE 215, AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

(1) Remove all electrical power (Ref. 24-41-00).

(2) On pilots overhead circuit breaker panel CB1, zone 211, open and tag circuit breakers SPOILER DWELL DC and AC, (B7, B8).

(3) Verify that speedbrake lever is full forward (0 degrees).

(4) Open access doors 147AB for access to hydraulic service center and place placards on hydraulic control panels (Ref. 6-40-00).

(5) Position inboard aileron, on same side replacement spoiler mixer bungee cartridge to neutral (±0.12 inch) and install aileron support tool (Ref. 27-11-00, Fig. 513).

(6) Gain access to spoiler mixer frames through main landing gear wheel wells (rear bulkhead on right or left side).

(7) Install rig pin (R5) through spoiler mixer frame, and roll output cam, and speedbrake link at rear of mixer (Ref. 27-61-12, Fig. 401, Sheet 1).

(8) Disconnect spoiler mixer bungee cartridge from input arms by removing castellated nuts, washers, and bolts.

R B. Installation

(1) Verify circuit breakers listed in Step 4A(2) are open and tagged.

(2) Verify that speedbrake lever is full forward (0 degrees).

(3) Verify that rig pins listed in Step 4A(7) are still in place and secure.

(4) Place spoiler mixer bungee cartridge between input arms of mixer (Ref. Fig. 401).

NOTE: Make sure that adjustable end is secure before installation.

CR If a P/N 1630515-101 (15 lb. force) Bungee is being installed, verify bungee overall length must be stretched (extended) 0.08 to 0.16 inch to allow for installation of bolts.

CR CR If a P/N 1556403-XXX (22 lb. force) Bungee (TWA preferred) is being installed, verify bungee overall length must be stretched (extended) 0.16 to 0.28 inch to allow for installation of bolts.

(5) Install bolts, washers, castellated nuts, and cotter pins.

(6) Remove all rig pins.

(7) Remove tags and close circuit breakers, opened in Step 4A(2).

(8) Turn on electrical power (Ref. 24-21-00).

(9) Verify flaps are extended and electrical actuator on top of mixer is in a fully retracted position. (Actuator retract dimension is 7.03 [±0.10 inch] between attaching bolt centers).

(10) Remove aileron support tool.

(11) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4 SECONDS FULL STROKE).

(12) Turn on all four hydraulic systems (Ref. 29-11-00).

(13) Slowly rotate the flight station control wheels through several full roll applications. Verify that spoilers follow up-aileron movement (use surface position indicator). Full roll input deploys spoilers 40 degrees. Visually check mixer operates smoothly without binding and check for clearance between mixer pushrods and surrounding structure.

(14) Move flight station speedbrake control lever through several full spoiler applications. Verify spoilers 1 through 4 on both wings follow speedbrake lever movement. (Full speedbrake input deploys spoilers 60 degrees). Return speedbrake lever full forward to 0° spoilers. Verify mixer operates smoothly.

(15) Fully retract flaps. Verify actuator on mixer extends smoothly.

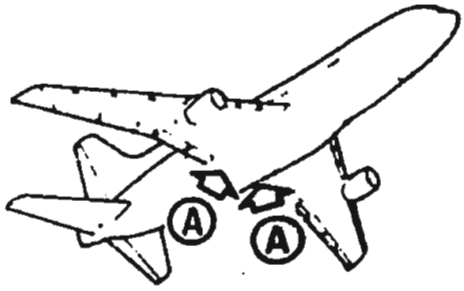
(16) Slowly rotate control wheel through a full left and right roll application. Verify that spoilers do not respond to aileron inputs and mixer operates smoothly.

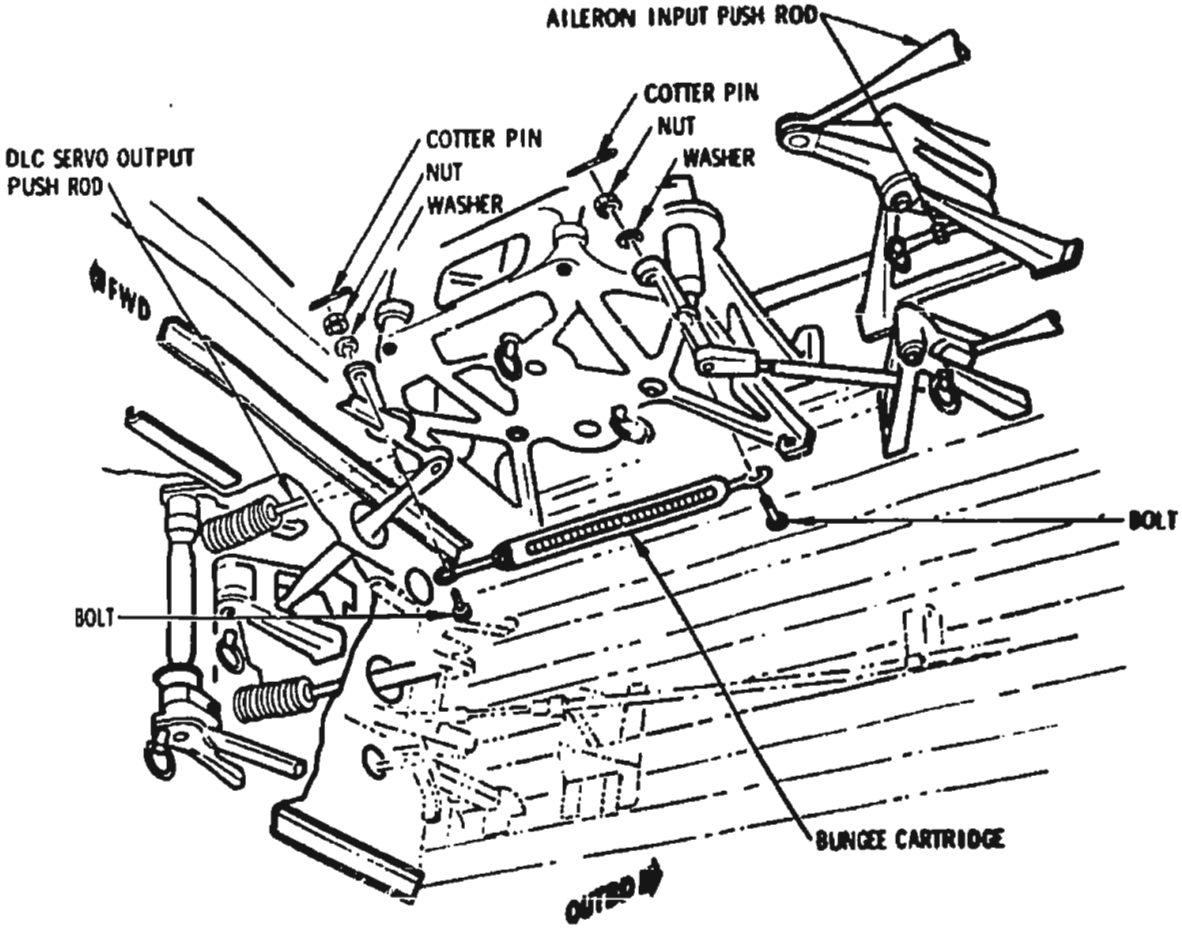
(17) Move speedbrake control lever from 0° to MAX and back to 0°. Verify that spoilers 2 through 6 follow speedbrake lever movement and mixer operates smoothly.

(18) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(19) Turn off electrical power if no longer required (Ref. 24-41-00).

(20) Close all access openings.





LEFT MIXER
VIEW LOOKING UP, INBOARD
A

MI-0000-27-899

R Bungee Cartridge - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
0018

R # DLC OVERRIDE BUNGEE ASSEMBLY - REMOVAL AND INSTALLATION

R 1. General

R There are two DLC override bungee assemblies installed on the
R aircraft. One is located in the upper rear left corner of the
R hydraulic service center, zone 147, and is installed between the
R DLC servo output arm and the speedbrake input arm on the left
R mixer. A second bungee is located in the upper rear right
R corner of the hydraulic service center and is installed between
R DLC servo output arm and speedbrake input arm on the right
R mixer.

R The bungee assembly is assembled with a spring preload of 115 to
R 140 pounds and should be disassembled in accordance with
R Overhaul Manual 27-61-11 only. This spring preload does not
R affect removal or installation.

R Removal and installation of the right and left bungee assemblies
R are identical.

R 2. Equipment and Materials

R Lock-wire, Fed Spec QQ-W-390, TEMP A, 0.032 inch diameter, or
R equivalent

R 3. Referenced Procedures

R 27-61-00 Spoiler and Speedbrake Control System - Adjustment
R and Test

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 4. Removal/Installation

R A. Removal

R (1) Shut off hudraulic systems A, B, C, and D (Ref.
R 29-11-00). Tag Flight Engineer/Second Officer panel,
R zone 215, and hydraulic service panel, zone 147.

R (2) On FE/SO overhead circuit breaker panel (CB2), open and
R tag 1, 2, 3 LMTR (J14), DLC SERVO A and B (H14, H15).

R (3) Place speedbrake lever in full forward (0-degree)
R position. Install tag to prevent operation.

R (4) Gain access to bungee assembly in hydraulic service
R center.

R (5) Disconnect push rods from both ends of bungee assembly.
R Tie push rods out of way.

R (6) Remove nut, bolt, and washer securing bungee assembly
R to idler arm. Remove bungee assembly.

R NOTE: Disassembly of the bungee assembly requires
R special restraining fixtures and should be done
R in accordance with Overhaul Manual 27-61-11
R only.

R B. Installation

R (1) Verify hydraulic system A, B, C, and D are off. Verify
R tags are installed on FE/SO panel and hydraulic service
R panel.

R (2) On FE/SO overhead circuit breaker panel (CB2), verify
R 1, 2, 3 LMTR (J14) and DLC SERVO A and B (H14, H15) are
R open and tagged.

R (3) Verify speedbrake lever is in full forward (0-degrees)
R position and tag is installed.

R (4) Position and align fitting/frame end of bungee assembly
R in relation to idler arm and secure with bolt, washer,
R and nut.

R (5) Connect push rods at both ends of bungee assembly. Do
R NOT tighten locknut at this time.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R WARNING: PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF
R ALL FLIGHT CONTROL SURFACES AND GEAR DOOR
R TRAVEL AREAS.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R CAUTION: USE OF AC PUMPS TO OPERATE SPOILERS ON THE GROUND
R IS NOT RECOMMENDED. LIMITED FLOW OF AC PUMPS CAN
R CAUSE PRESSURE OSCILLATIONS AND DAMAGE THE SPOILER
R SERVO CONTROL VALVE. USE HIGH FLOW SYSTEMS SUCH
R AS ATM OR HYDRAULIC GROUND SOURCES. IF AC PUMPS
R MUST BE USED, DO NOT OPERATE ANY OTHER FLIGHT
R CONTROLS AND OPERATE SPOILERS SLOWLY (MINIMUM 4
R SECONDS FULL STROKE).

R (6) Turn on hydraulic systems A, B, C, and D (Ref.
R 29-11-00).

R (7) On FE/SO overhead circuit breaker panel (CB2), remove
R tags and close 1, 2, 3 LMTR (J14), DLC SERVO A and B
R (H14, H15).

R (8) Perform spoiler and speedbrake control system
R adjustment and test (Ref. 27-61-00).

R (9) Tighten push rod locknuts and install lock-wire.

R (10) Remove tags from FE/SO panel, speedbrake lever, and
R hydraulic service panel.

R (11) Return aircraft to service.

SPOILER POSITION INDICATING SYSTEM - DESCRIPTION AND OPERATION

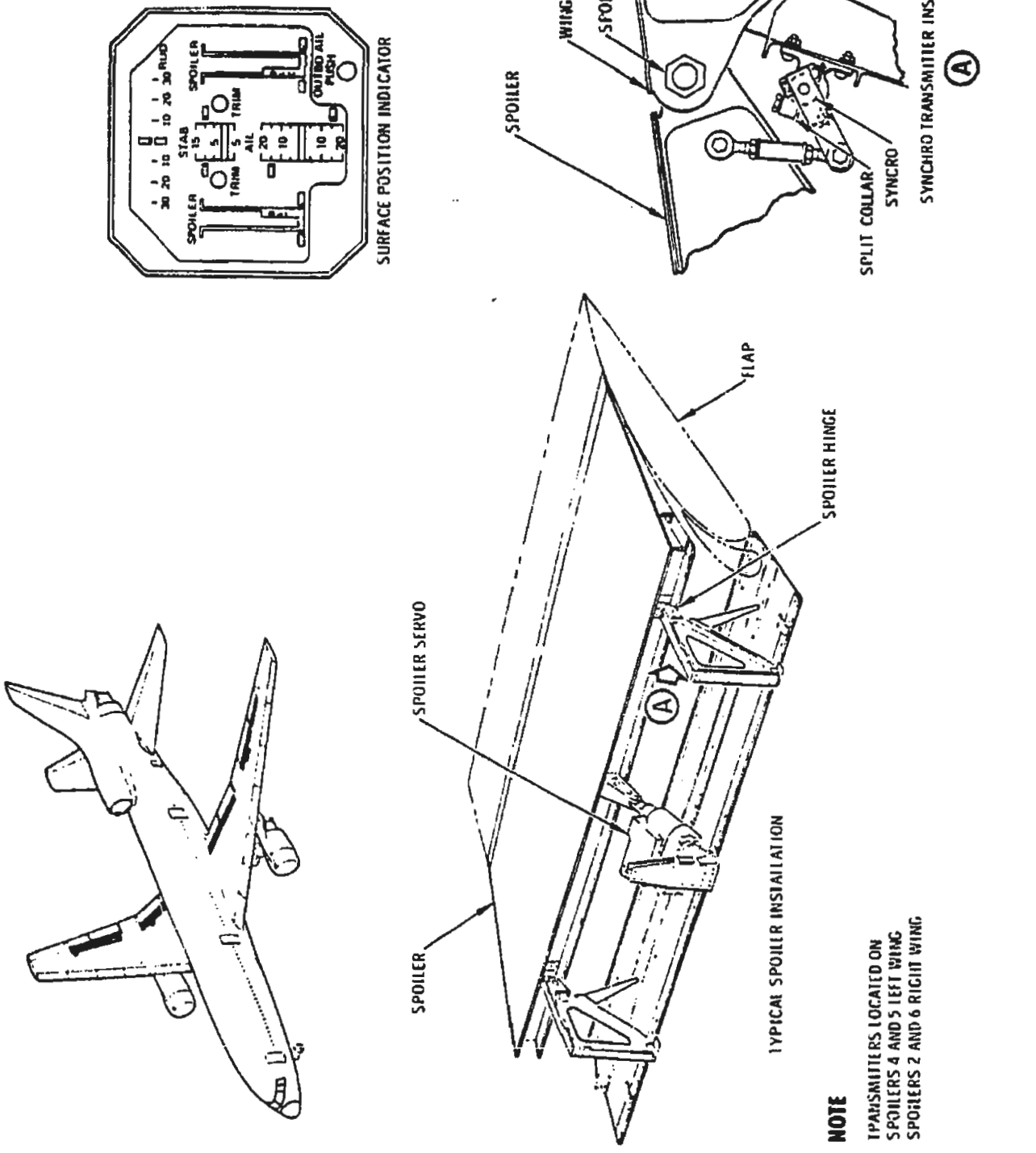
1. General

The spoiler position indicating system consists of a surface position indicator mounted on the pilots main instrument panel and a synchro transmitter coupled to spoiler panels four and five on the left wing and spoiler panels two and six on the right wing. (Ref. Fig. 1).

The indicator spoiler scales consist of four pointers to display spoiler position. The inboard spoiler pointers display the position of spoiler four on the left wing and spoiler two on the right wing. When the Direct Lift Control (DLC) servo is operating in the automatic mode (flaps and throttles positioned for landing) then the inboard spoiler pointers would be in the DLC portion of the display. This represents 16 degrees of spoiler extension. The outboard spoiler pointers show the position of spoiler five on the left wing and spoiler six on the right wing (Ref. Fig. 2). Full scale travel of the four spoiler pointers represents 60 degrees of spoiler extension.

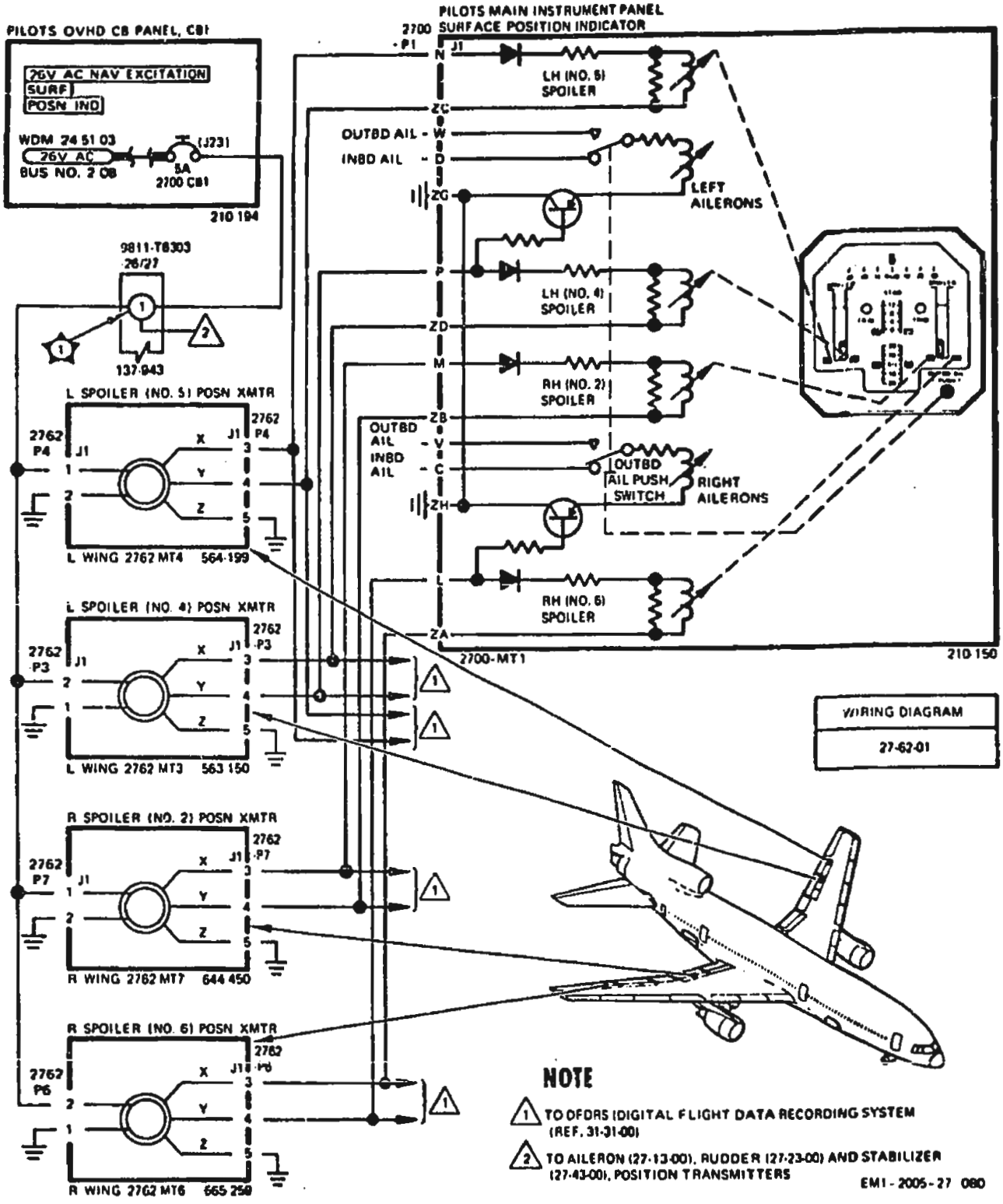
The transmitter installation consists of a synchro, bracket-mounted to the wing trailing edge structure. The synchro is held in the bracket by a split collar arrangement. Loosening the collar locking bolt and rotating the synchro body provides for adjustment of the null position. The synchro actuation arm is link connected to a bracket mounted to the spoiler surface. The link is adjustable so that the linkage geometry can be adjusted to maintain the scale factor of one degree synchro rotation per one degree surface travel.

2. Surface Position Indicator (Ref. 27-00-00)



R
R

Spoiler Position Indicating System
Figure 1



R Spoiler Position Indicating System Electrical Schematic
R Figure 2

R EFFECTIVITY: ALL

0018

R SPOILER SURFACE POSITION INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for
R fault isolation any time a fault is reported or suspected. The
R PREREQUISITES listed at the top of each fault isolation diagram
R must be satisfied prior to starting fault isolation. Uncommon
R abbreviations are defined on the fault diagram or schematic.

R If the flight crew reports a problem by using a fault code
R number, the code number can be found in the Fault Isolation
R Reference Table in the Chapter 27 Fault Code Index. The index
R specifies the exact maintenance manual section, fault isolation
R diagram, and block number on the diagram where the fault
R isolation procedure starts. Schematics are included at the end
R of the section to supplement the fault code diagrams or as an
R aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed
R discussion of the Fault Isolation Reporting Method (FIRM) and
R use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in
R this section.

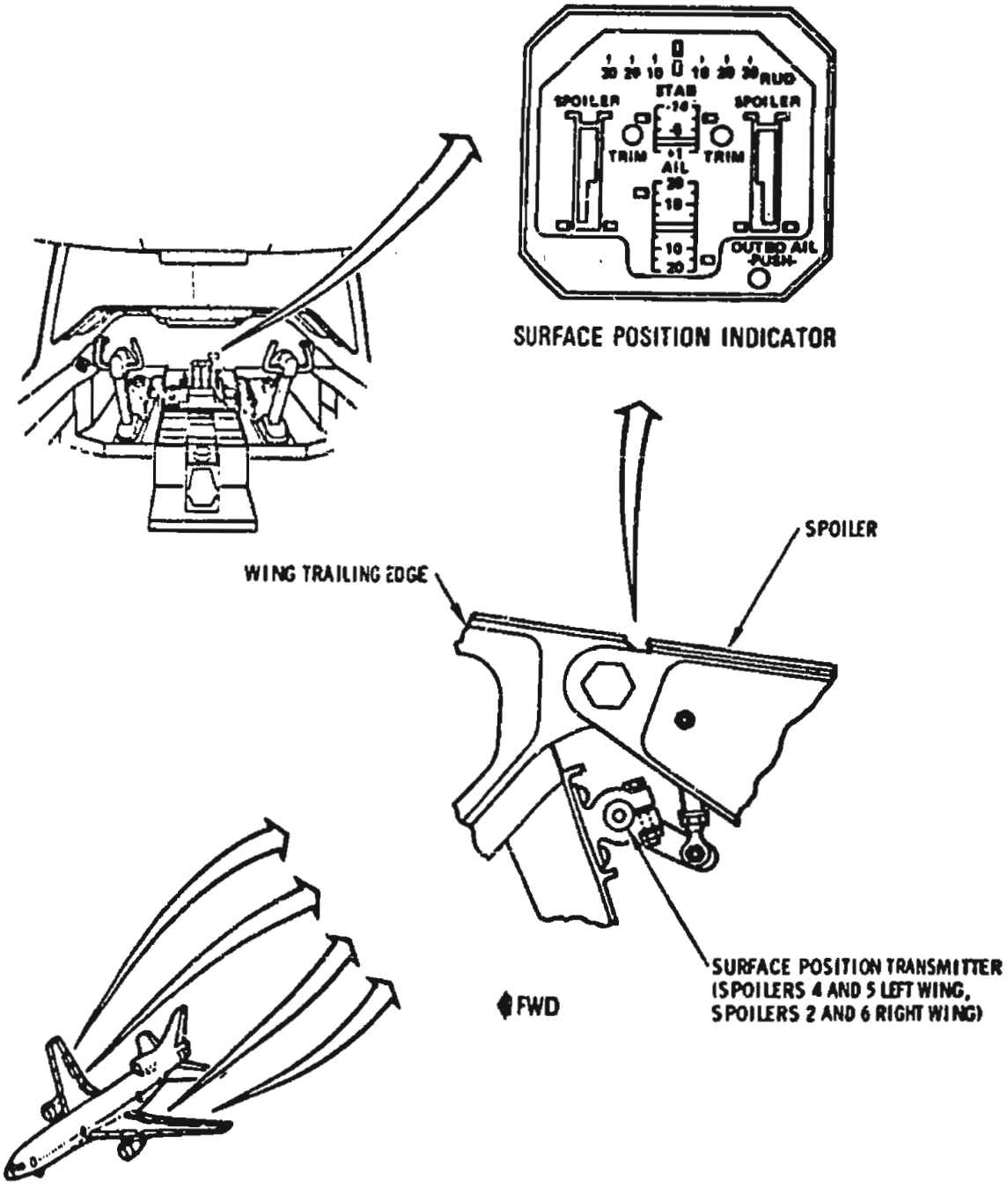
FIGURE	TITLE
101	Component Locator Index
102	Component Locator Diagram
103	Spoiler Position Indicating System Malfunction
SCHEM 1	Spoiler Position Indicating System Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
INDICATOR, SURFACE POSITION	1	PILOTS CENTER INSTRUMENT PANEL	
TRANSMITTER, SURFACE POSITION SPOILERS	4	SPOILERS 4 AND 5 LEFT WING; 2 AND 6 RIGHT WING	

M1-0000-27-763

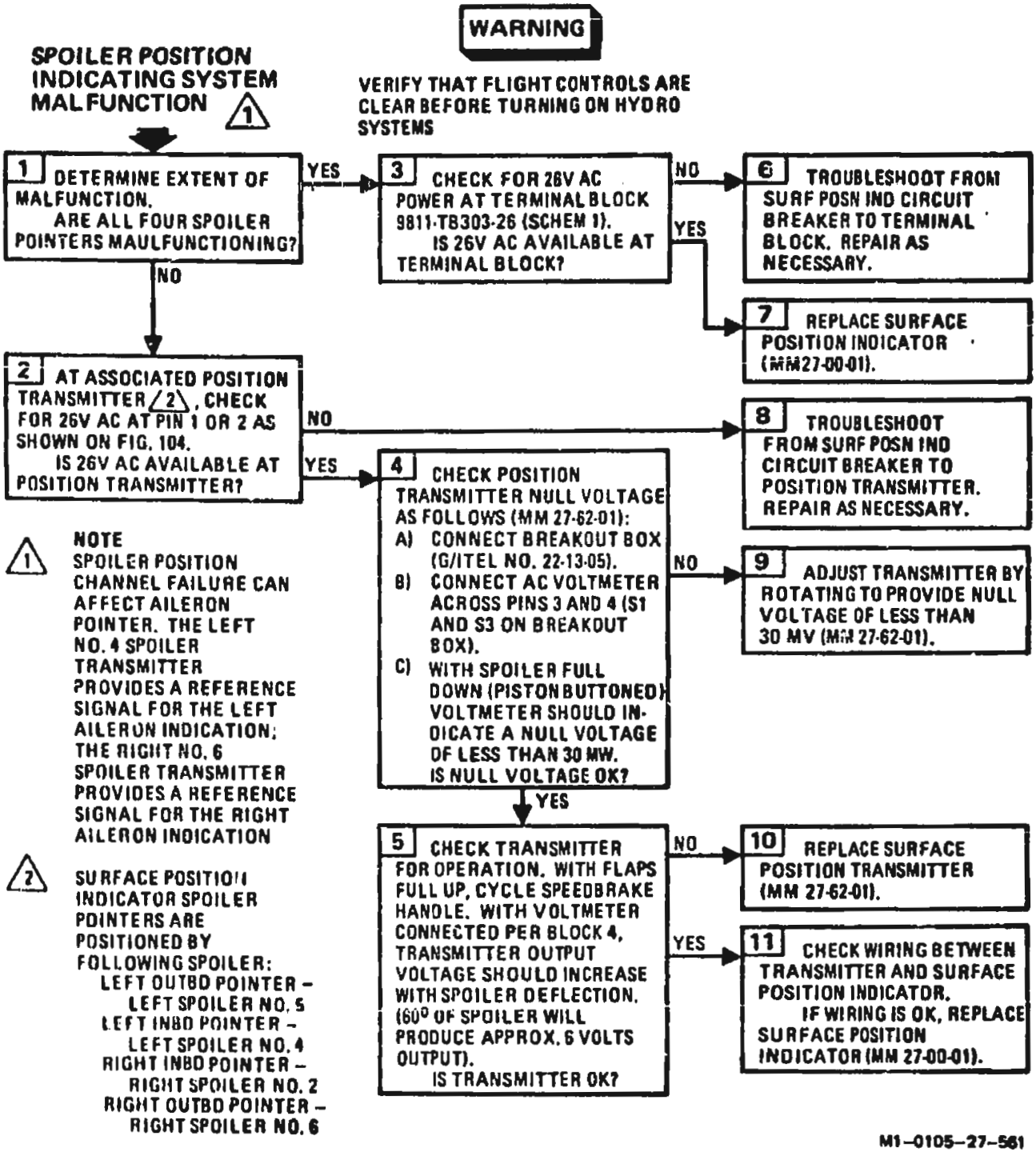
Component Locator Index
Figure 101

R
R
R
R
001B EFFECTIVITY: ALL

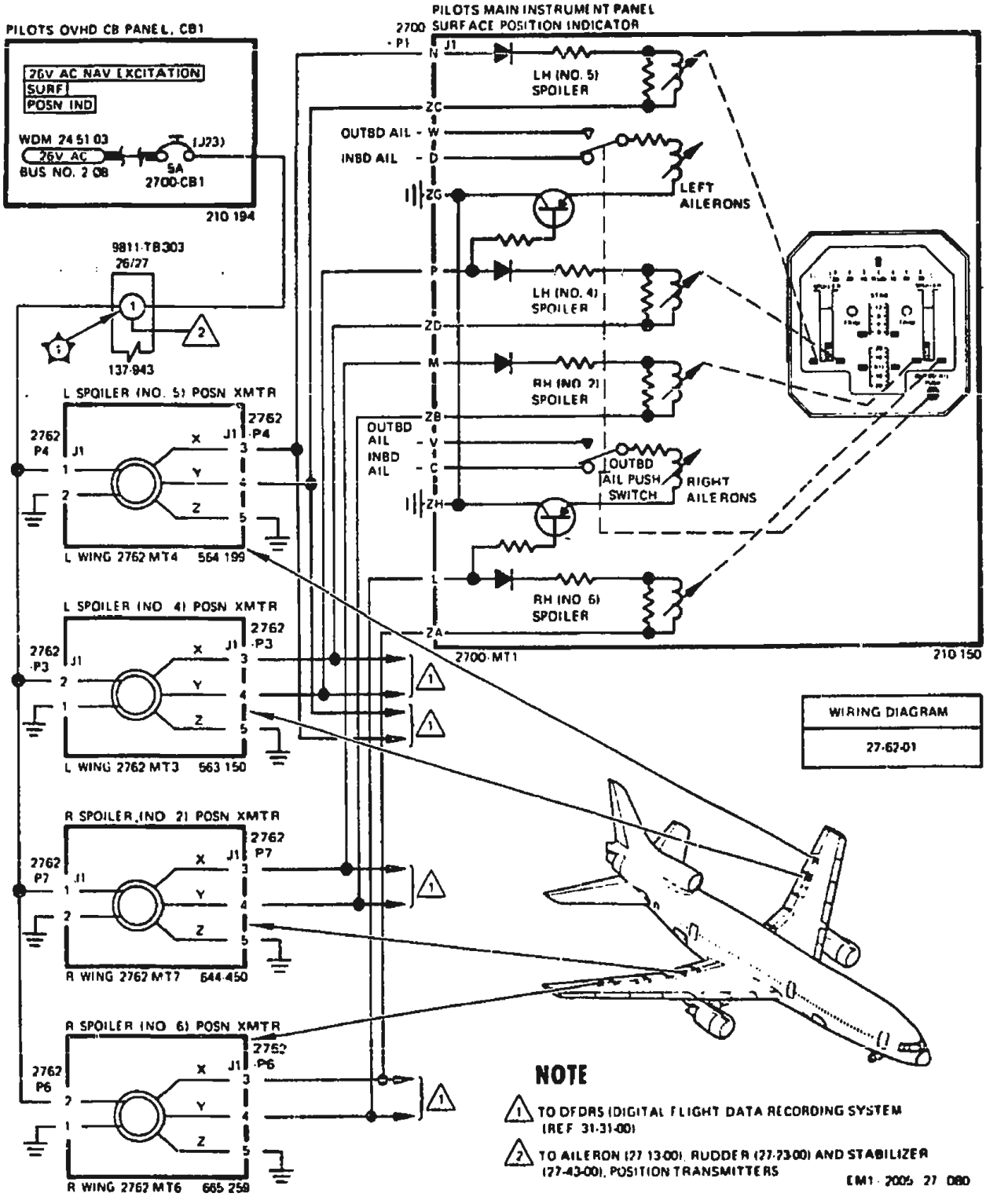


Component Locator Diagram
Figure 102

PREREQUISITES
ELECTRICAL POWER (MM 24-00-00)
HYDRAULIC POWER SYSTEM (A, B, C, D) (MM 29-11-00)
CB'S: 1J23


WARNING
VERIFY THAT FLIGHT CONTROLS ARE CLEAR BEFORE TURNING ON HYDRO SYSTEMS
SPOILER POSITION INDICATING SYSTEM MALFUNCTION 1
1 DETERMINE EXTENT OF MALFUNCTION. ARE ALL FOUR SPOILER POINTERS MAULFUNCTIONING?
YES
NO
2 AT ASSOCIATED POSITION TRANSMITTER 2, CHECK FOR 26V AC AT PIN 1 OR 2 AS SHOWN ON FIG. 104. IS 26V AC AVAILABLE AT POSITION TRANSMITTER?
NO
YES
3 CHECK FOR 26V AC POWER AT TERMINAL BLOCK 9811-TB303-26 (SCHEM 1). IS 26V AC AVAILABLE AT TERMINAL BLOCK?
NO
YES
6 TROUBLESHOOT FROM SURF POSN IND CIRCUIT BREAKER TO TERMINAL BLOCK. REPAIR AS NECESSARY.
7 REPLACE SURFACE POSITION INDICATOR (MM27-00-01).
8 TROUBLESHOOT FROM SURF POSN IND CIRCUIT BREAKER TO POSITION TRANSMITTER. REPAIR AS NECESSARY.
4 CHECK POSITION TRANSMITTER NULL VOLTAGE AS FOLLOWS (MM 27-62-01):
A) CONNECT BREAKOUT BOX (G/ITEL NO. 22-13-05).
B) CONNECT AC VOLTMETER ACROSS PINS 3 AND 4 (S1 AND S3 ON BREAKOUT BOX).
C) WITH SPOILER FULL DOWN (PISTON BUTTONED) VOLTMETER SHOULD INDICATE A NULL VOLTAGE OF LESS THAN 30 MV. IS NULL VOLTAGE OK?
NO
YES
9 ADJUST TRANSMITTER BY ROTATING TO PROVIDE NULL VOLTAGE OF LESS THAN 30 MV (MM 27-62-01).
5 CHECK TRANSMITTER FOR OPERATION. WITH FLAPS FULL UP, CYCLE SPEEDBRAKE HANDLE. WITH VOLTMETER CONNECTED PER BLOCK 4, TRANSMITTER OUTPUT VOLTAGE SHOULD INCREASE WITH SPOILER DEFLECTION. (60° OF SPOILER WILL PRODUCE APPROX. 6 VOLTS OUTPUT). IS TRANSMITTER OK?
NO
YES
10 REPLACE SURFACE POSITION TRANSMITTER (MM 27-62-01).
11 CHECK WIRING BETWEEN TRANSMITTER AND SURFACE POSITION INDICATOR. IF WIRING IS OK, REPLACE SURFACE POSITION INDICATOR (MM 27-00-01).
1 NOTE
SPOILER POSITION CHANNEL FAILURE CAN AFFECT AILERON POINTER. THE LEFT NO. 4 SPOILER TRANSMITTER PROVIDES A REFERENCE SIGNAL FOR THE LEFT AILERON INDICATION; THE RIGHT NO. 6 SPOILER TRANSMITTER PROVIDES A REFERENCE SIGNAL FOR THE RIGHT AILERON INDICATION
2 SURFACE POSITION INDICATOR SPOILER POINTERS ARE POSITIONED BY FOLLOWING SPOILER:
LEFT OUTBD POINTER – LEFT SPOILER NO. 5
LEFT INBD POINTER – LEFT SPOILER NO. 4
RIGHT INBD POINTER – RIGHT SPOILER NO. 2
RIGHT OUTBD POINTER – RIGHT SPOILER NO. 6
M1-0105-27-561

Spoiler Position Indicating System Malfunction
Figure 103



R Spoiler Position Indicating System Electrical Schematic
R SCHEM 1

EFFECTIVITY: ALL

001B

SPOILER SURFACE POSITION TRANSMITTER (SINGLE) REMOVAL AND INSTALLATION

1. Equipment and Materials

CR None

2. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal (Ref. Fig. 401)

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker 26 VAC NAV EXCITATION - SURF POSN IND (J23).

R CAUTION: PRIOR TO GROUND OPERATION OF WING FLAPS, OBSERVE FOLLOWING TO PREVENT SPOILER SELECTOR DWELL ACTUATOR STALL: AILERONS FAIRED ±10 DEGREES; SPEEDBRAKE LEVER WITHIN 2 INCHES OF FULL FORWARD.

(2) Gain access by moving flaps to 10 degrees or more as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on hydraulic system C (Ref. 29-11-00).

(b) Set flap control handle in the 10 degrees or more.

(c) Turn off hydraulic system C (Ref. 29-11-00).

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(3) Disconnect electrical connector from transmitter (Ref. Fig. 401).

(4) Remove clamp bolt from arm at transmitter shaft end.

(5) Remove transmitter mount clamp bolt and remove transmitter.

B. Installation (Ref. Fig. 401)

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

WARNING: VERIFY THAT ALL HYDRAULIC POWER IS TURNED OFF AND HYDRAULIC CONTROL PANELS TAGGED.

(2) Verify that spoiler is in fully down position (piston bottomed).

(3) Align EZ (electrical zero) index mark on transmitter shaft with EZ mark on housing.

(4) Insert transmitter partially into mount clamp to allow clearance to connect arm. Install transmitter so that EZ marks are visible.

(5) Hold arm in position and insert transmitter into mount clamp and transmitter shaft into arm. Verify that EZ marks are still aligned.

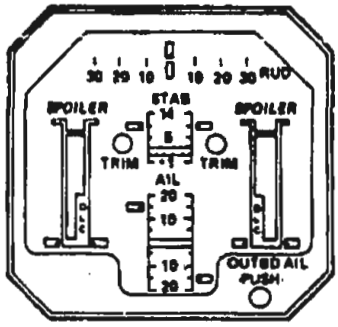
CAUTION: TRANSMITTER MUST BE ALIGNED SINCE INTERNAL STOPS WILL BE DAMAGED IF SHAFT IS ROTATED BEYOND 90 DEGREES FROM EZ MARK.

(6) Install bolt, washer, and nut in arm. Tighten bolt.

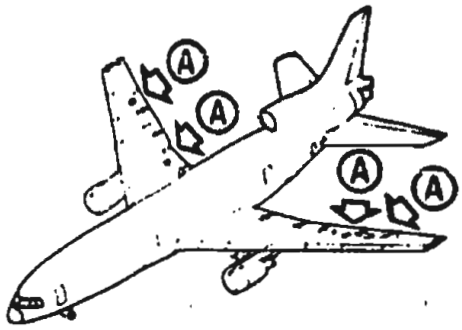
(7) Verify that bolt groove in transmitter housing is aligned with mounting clamp holes. Install bolt, washer, and nut in transmitter mount clamp.
CR Temporarily tighten bolt. Connect transmitter
CR electrical connector.

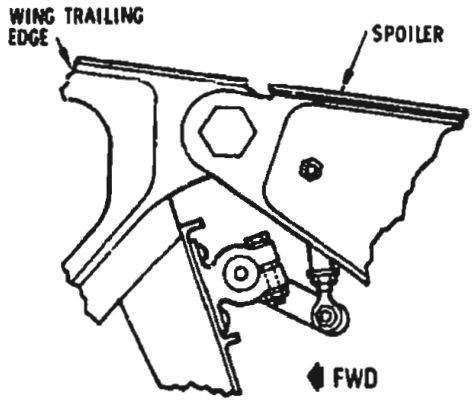
CR (8) Close circuit breaker opened in Step A (1).

(9) Verify that spoiler is full down (piston bottomed).



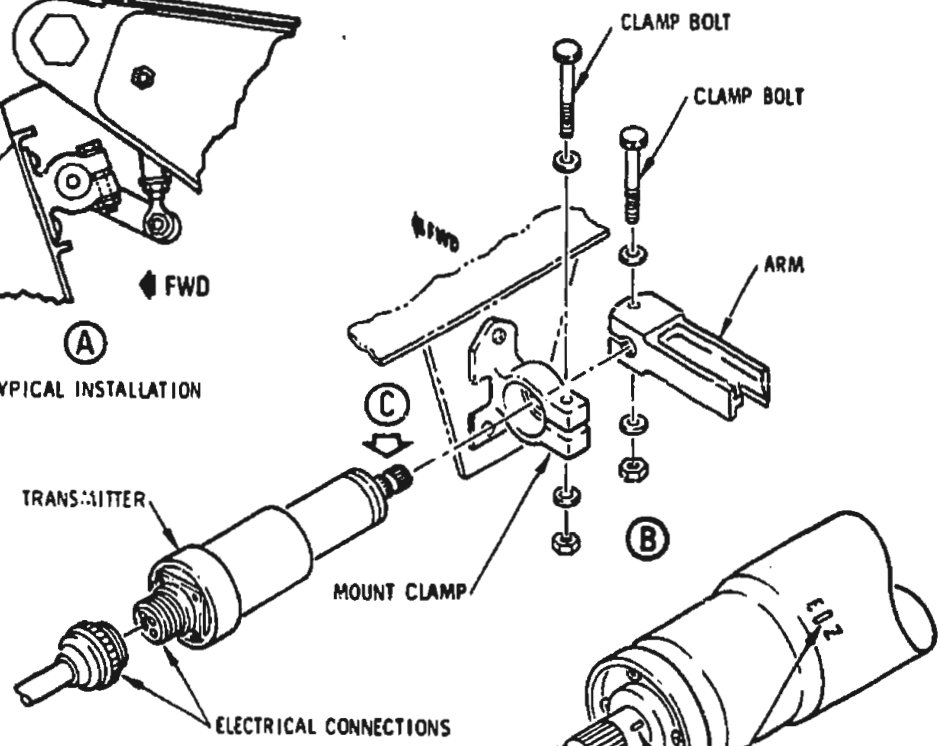
SURFACE POSITION INDICATOR
(PILOTS MAIN INSTRUMENT PANEL)





A

TYPICAL INSTALLATION



NOTE

TRANSMITTERS MOUNTED AT SPOILERS 4 AND 5 LEFT WING, SPOILERS 2 AND 6 RIGHT WING

SHAFT EZ ALIGNMENT MARKS (ELECTRICAL ZERO)

C ROTATED 180°

M1-0101-27-449

R Spoiler Surface Position Transmitter (Single)
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

(10) Adjust transmitter as follows:

C (a) With spoilers full down (piston bottomed) rotate
C transmitter housing until affected spoiler pointer
C on surface position indicator moves up off bottom
C stop.

C (b) Slowly rotate transmitter housing in reverse
CR direction until bottom edge of pointer just
CR touches bar at low end of scale.

C (c) Pull Surf. Posn. Ind. C/B J23 on CB1 and verify
CR that spoiler pointer does not move or drops
C slightly but no more than one half a pointer.

C (d) Torque mount clamp bolt 30-35 pound-inches.
C Verify that surface position indicator has not
C changed.

(11) On flight station surface position indicator, verify that the associated SPOIL pointer is aligned with bar at low end of scale. Left wing No. 5 spoiler operates left outboard pointer. Left wing No. 4 spoiler operates left inboard pointer. Right wing No. 2 spoiler operates right inboard pointer. Right wing No. 6 spoiler operates the right outboard pointer.

(12) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(13) Turn on affected hydraulic system (Ref. 29-11-00):

(a) System B for left spoiler No. 4 and right spoiler No. 6.

(b) Systems B and C for left spoiler No. 5 (system B to operate DLC servo).

(c) Systems B and D for right spoiler No. 2.

(14) Perform operational check of spoiler transmitter as follows:

(a) Set flap control handle in the 0-degree position.

(b) Move SPEEDBRAKE control lever on pilots center console from 0 degrees to MAX and back to 0 degrees. Verify that surface position indicator
CR follows spoiler travel, and does not reverse
CR direction in first few degrees of travel.

(c) Visually verify that transmitter linkage operates freely.

(15) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(16) Turn off electrical power if no longer required (Ref. 24-41-00).

LEADING EDGE SLAT SYSTEM - DESCRIPTION AND OPERATION

1. General

The leading edge slat system (Ref. Fig. 1) comprises seven slats on each wing. Three slats (No. 1, 2, and 3) are located inboard of the engine pylon and four (No. 4, 5, 6, and 7) are located outboard of the pylon. Each slat panel is supported by two radial tracks roller-mounted to wing structure and is operated by a single jackscrew type actuator as shown on Fig. 2. All actuators are driven through a common torque tube drive train by a power drive unit (PDU) located in the left wing root. The PDU incorporates two hydraulic motors pressurized by hydraulic systems A and C. In case of a single hydraulic system failure, the remaining system and motor are capable of extending the
R slats. Slat extension against high aerodynamic loads may be
R slightly slower with only one system in operation. The inboard slats extend 28 degrees; the outboard slats extend 30 degrees. Operation of the leading edge slat system is controlled by the flap control handle.

A slat monitor panel on the Flight Engineer/Second Officers panel is provided to allow the flight crew to determine the status of each individual slat panel. It is operated by a proximity switch sensor at each slat. The slat monitor panel also includes a slat position indicator and a switch to allow shutting down the slat system in case of a malfunction. The indicator has two pointers; one pointer for each wing. Each pointer is driven by a position transmitter located on the outboard end of the torque tube drive system in the wing.

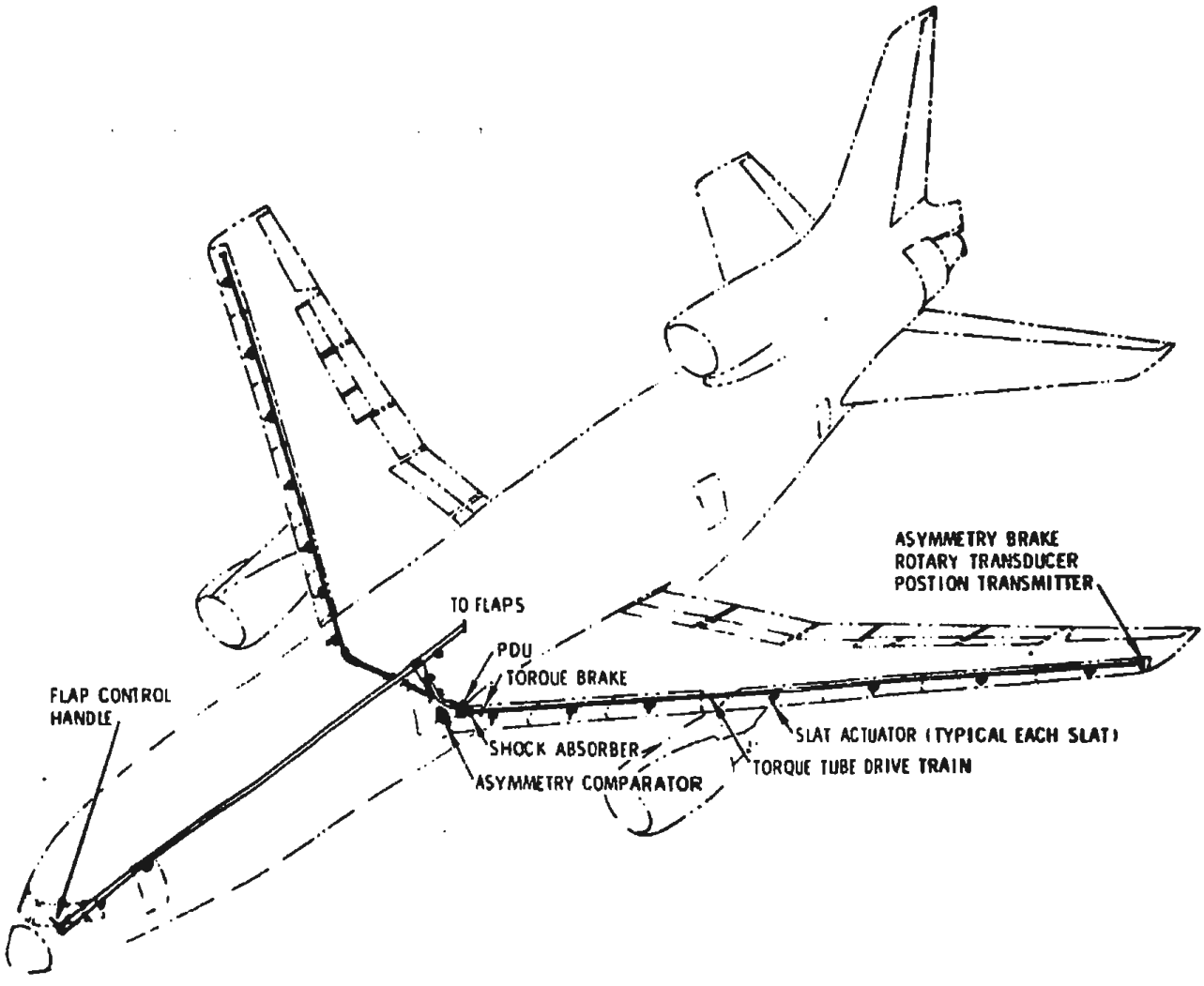
An asymmetry control system is provided to shut down the slat system and hold panels in position under load when a significant asymmetrical condition develops. It includes an asymmetry brake and a rotary transducer in each wing at the outboard end of the torque tube drive system; an asymmetry comparator is located in the midelectrical service center, zone 137. The system limits slat asymmetry, as measured at the transducers, to approximately six degrees.

The slat position indicating system is described in 27-82-00.

2. Operation

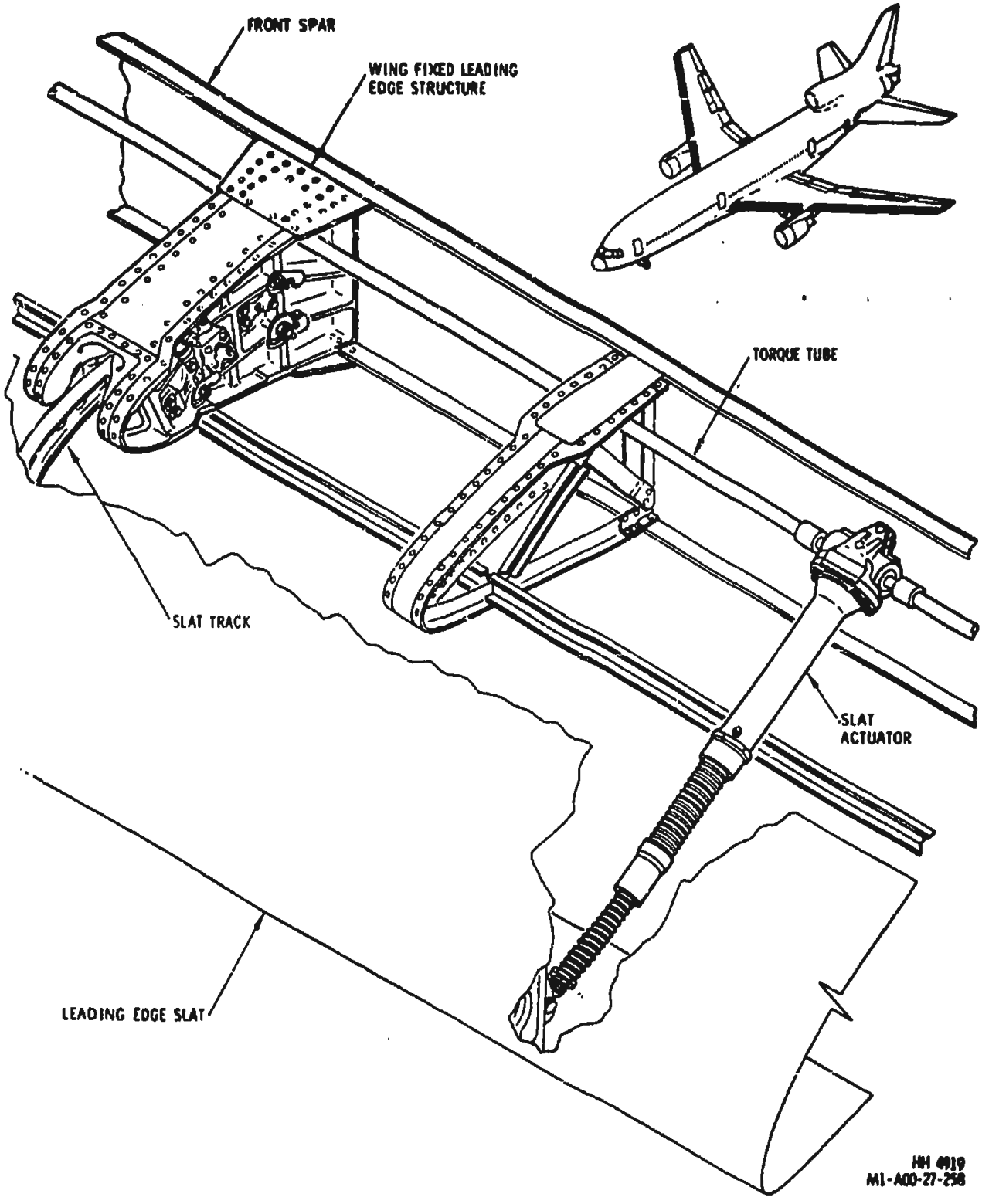
A. General (Ref. Fig. 3)

The leading edge slats are operated by the hydraulic-driven power drive unit (PDU). PDU operation is initiated by the flap control handle through an input cable system and a



MI-A00-27-251

Slat System Components Location
Figure 1



Slat Installation
Figure 2

start-up switch. The start-up switch is located on the flap-and-slat cable quadrant in the midelectrical service center, zone 137. It operates in series with limit switches in the PDU command signal regulator to deenergize and open the solenoid shutoff valves on the PDU whenever the slats are not in the selected position. The shutoff valves are subsequently energized closed to shut down the PDU under the following conditions:

(1) Slats fully extended or retracted as selected by flap control handle.

(2) Slat asymmetrical condition.

(3) Failure in slat control cable system.

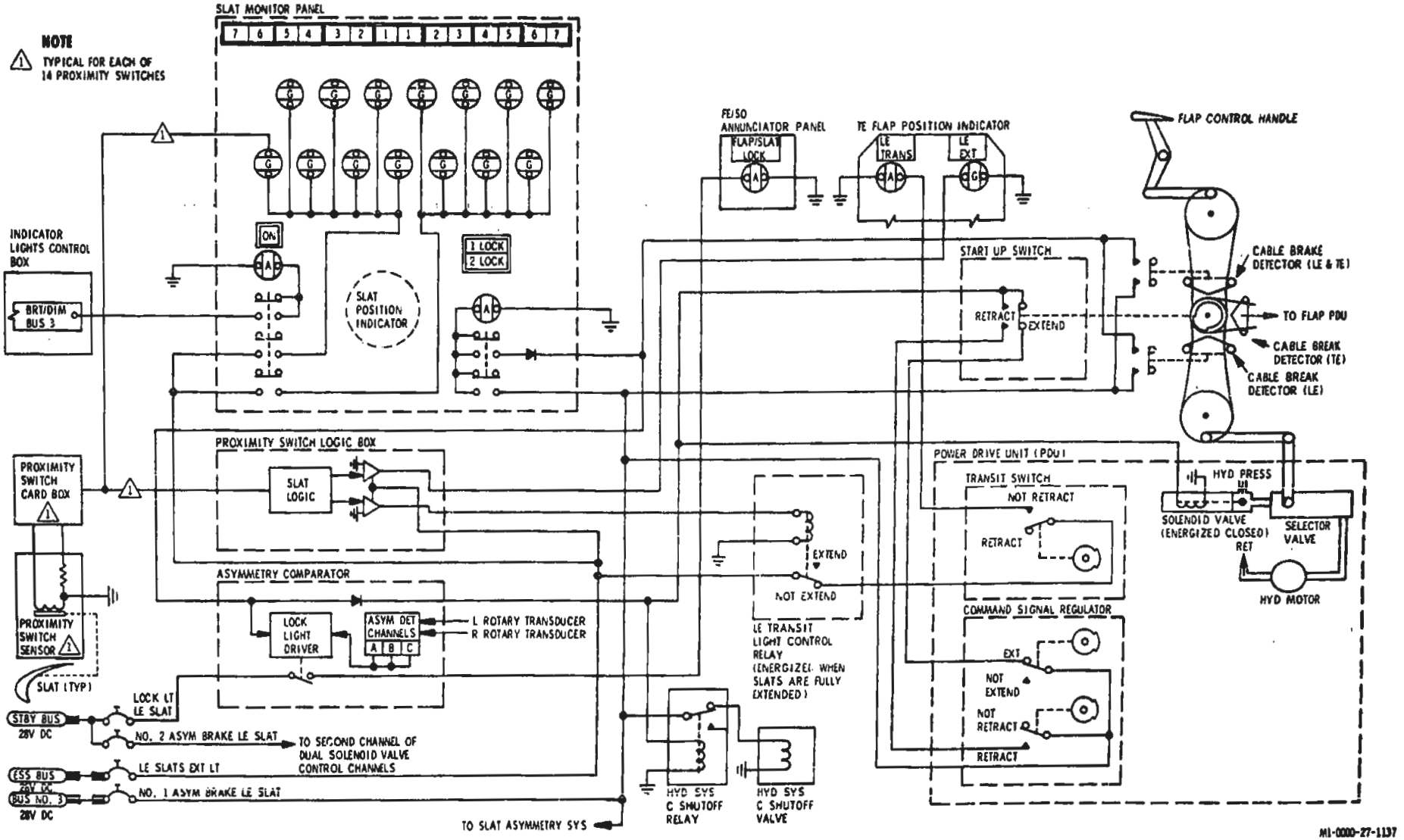
(4) Manual operation of slat lock switch.

A transit switch on the PDU operates in conjunction with the LE transit light control relay to energize the LE TRANS light on the T. E. flap position indicator. The relay contacts are closed (relay deenergized) when the slats are not fully extended. The transit switch is closed when the slats are not fully retracted. Thus, when the slats are in transit between fully extended and fully retracted, the relay and the transit switch will complete a series circuit to the L E TRANS light. It should be noted that the slats must be extended to test the LE TRANS light.

B. Normal Operation

Movement of the flap control handle from the zero-degree flaps-up position first energizes the slat system and then the flap system; the surfaces then extend simultaneously. Approximately ten seconds are required for the slats to fully extend. The flap handle cannot be moved beyond the four-degree flap position until the finger-latch on the underside of the handle is depressed to release a pawl from the detent. The flap handle can then be set to any position. The slats cannot be selected to stop in an intermediate position; they are normally either fully retracted or fully extended. When the slats reach their full travel, the extend limit switch in the PDU command signal regulator closes and completes a circuit to energize the solenoid shutoff valves closed and shut down the PDU.

When the flap control handle is moved in the flaps-up direction, the finger-latch under the handle must be depressed at the four-degree detent; this permits the flap handle to be moved to the UP position. The flaps and slats then retract simultaneously.



R Slat Control Schematic
R Figure 3

C. Slat Monitor Operation

When the leading edge slats do not indicate fully extended during approach, the slat segment lights on the slat monitor panel at the Flight Engineer/Second Officer station can be utilized to determine which slats are not extended. The slat segment lights are enabled by operating the slat monitor switch; the individual green segment lights are then energized by the slat proximity switches. The corresponding light for each slat will be energized when the slat is fully extended. If one or more slats are verified to be not fully extended, the slat actuation system can be shut down and locked by operating the SLAT LOCK switch on the monitor panel. This energizes the solenoid valves on the PDU closed to prevent subsequent unexpected slat operation during a critical phase of the final approach and landing.

D. Asymmetry Control Operation (Ref. Fig. 4)

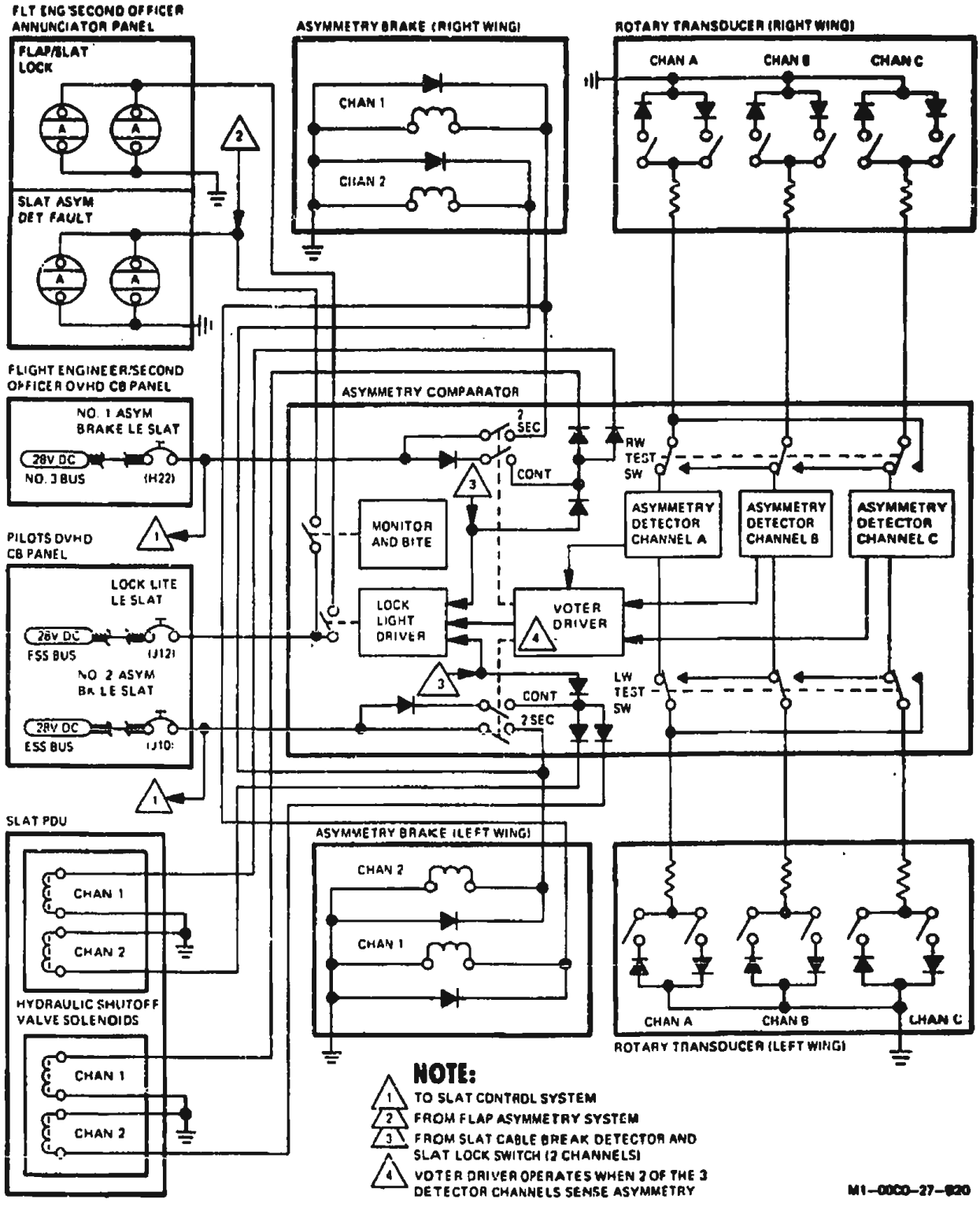
Signals from two rotary transducers, one mounted on each slat asymmetry brake, are compared by the slat asymmetry comparator. When the voter driver senses an asymmetric condition in two of the three detector channels, the hydraulic solenoid valves on the PDU are energized closed, the asymmetry brakes are tripped to the applied position, and the FLAP/SLAT LOCK light on the Flight Engineer/Second Officer annunciator panel is energized.

3. Slat Input Control System

A. Description

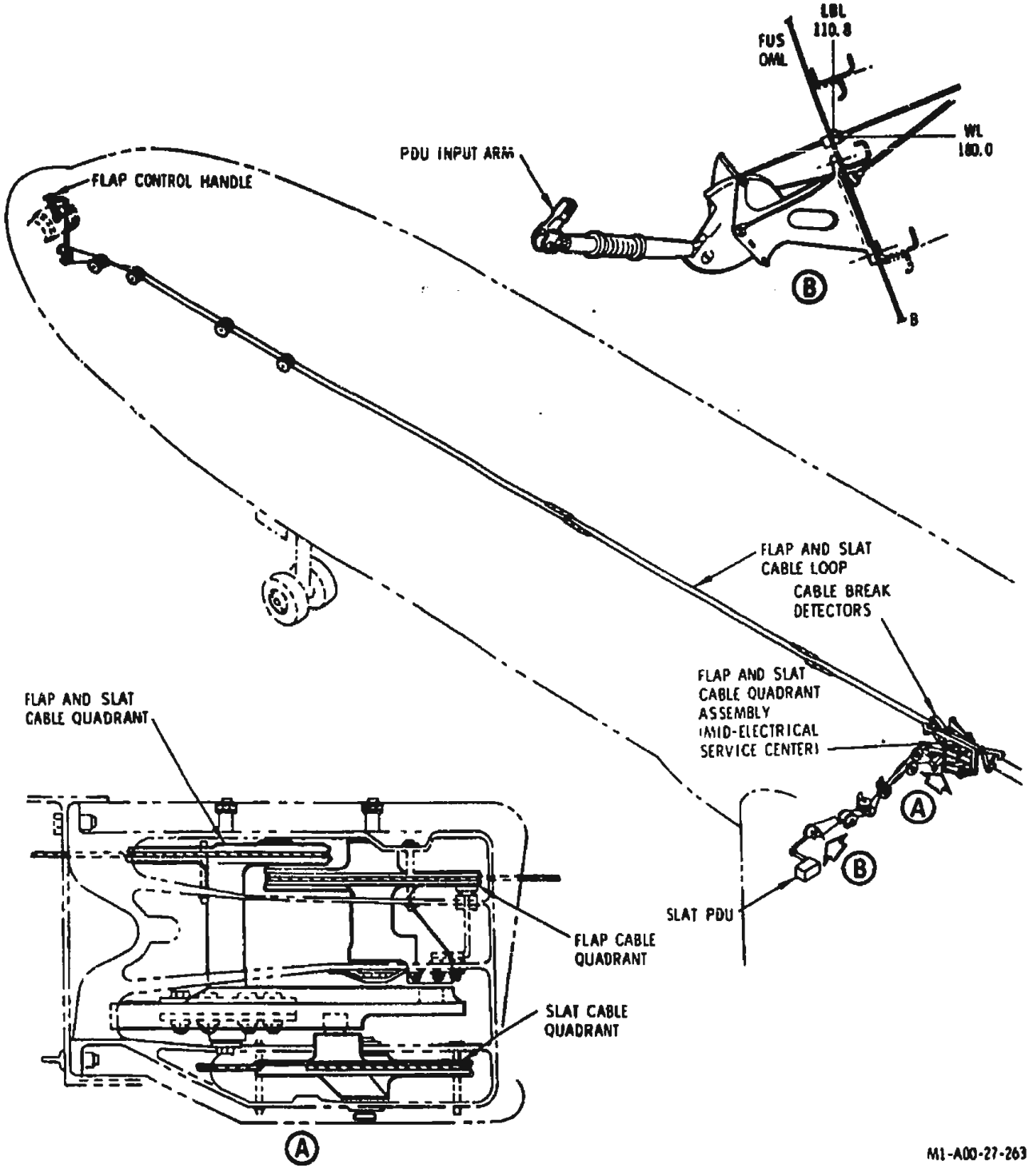
The input control system to the leading edge slat power drive unit (PDU) utilizes cables connected to the flap-and-slat cable quadrant located in the mid electrical service center, zone 137 (Ref. Fig. 5). The slat cable quadrant is operated by a programming cam mechanism. The radius of the slot in the cam plate is such that the slat cable quadrant is actuated only during the first portion of cam follower travel in the cam slot. The remainder of the cam slot radius is constant and there is no further displacement of the slat cable quadrant when the flap control handle is moved beyond the four-degree flap position.

A slat cable break detector, similar to those in the flap control cable system, is installed adjacent to the flap-and-slat cable quadrant. It incorporates switches which operate to energize the solenoid valves on the PDU when cable tension is lost.



R Slat Asymmetry Control Simplified Schematic
R Figure 4

EFFECTIVITY: ALL



Slat Input Control System
Figure 5

Cable turnbuckles and quadrant rig pin holes are provided to facilitate system rigging.

4. Power Drive Unit

A. Description

The power drive unit (PDU) consists of a gearbox, two hydraulic motors, a brake, two hydraulic valve modules, two position indicator switch packs, a command signal regulator switch pack, and the feedback mechanism. The PDU weighs approximately 100 pounds and is installed in the left wing root on the forward side of the front spar. The following components are line replaceable units:

(1) Hydraulic motors

(2) Position indicator switch packs

(3) Command signal regulator switch pack

(4) Filter elements

(5) Shutoff-and-restricting valves

(6) Flow limiter valves

(7) Brake valves

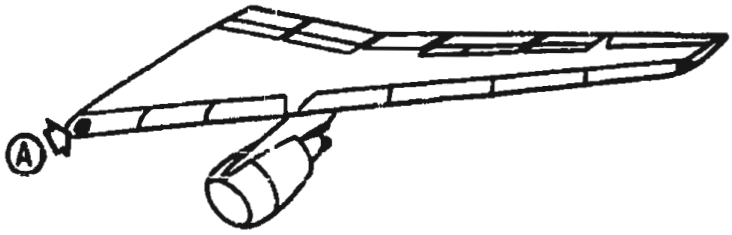
(8) Free wheel valves

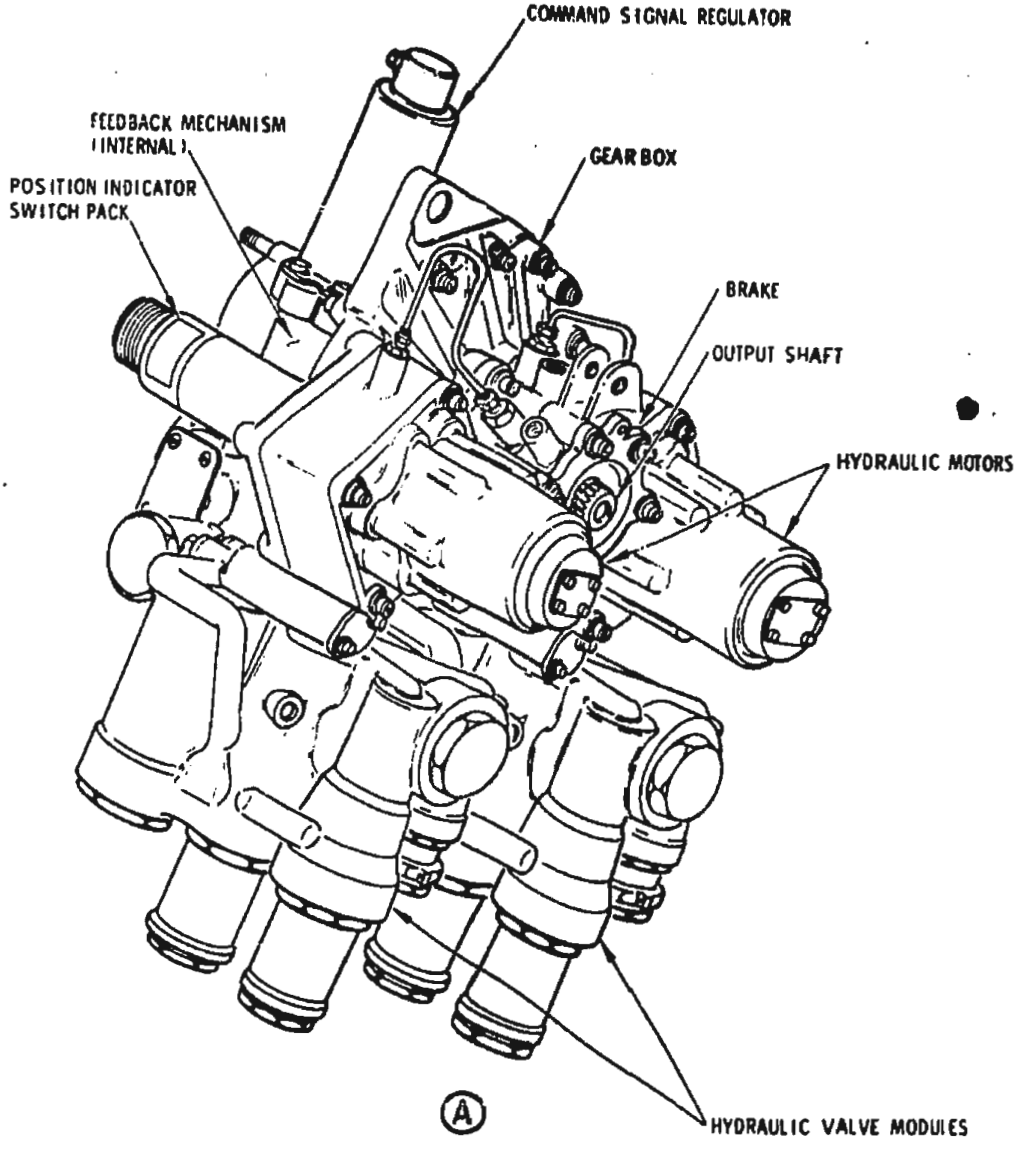
(9) Solenoid shutoff valves

B. Operation

When the flap control handle is moved out of the flaps-up position, slat PDU operation is initiated by a start-up switch which de-energizes and opens the PDU solenoid shutoff valves. As the shutoff valves open, hydraulic signal pressure actuates the free wheel valves to isolate the two pressure paths to the motors, opens the shutoff-and-restricting valves, pressurizes the selector valves, and opens the brake valves. The brake is thus released and hydraulic operating pressure is supplied to the motors.

The motor speed of 2900 rpm is reduced through the gearbox to 600 rpm at the output shaft. During operation, the feedback mechanism gradually repositions the selector valves to restrict fluid flow to the motors; output shaft speed is





HM 6569
MI-A00-27-269

Power Drive Unit
Figure 6

thus reduced to 60 rpm during the final one-eighth of slat travel.

When the slats reach full travel, the limit switches in the command signal regulator are actuated to energize the solenoid valves closed and shut off hydraulic pressure to the motors. As the pressure drops, the spring-actuated brakes will be applied to hold the slats in position.

C. Gearbox

The PDU gearbox incorporates the gearing to connect the hydraulic motors to the output shaft. It also provides support for all other components and for mounting the PDU in the aircraft.

D. Hydraulic Valve Modules

The two hydraulic valve modules are identical and comprise the lower portion of the PDU. Each valve module consists of a housing, a 25-micron filter, and six valves. All components, except the selector valve and housing, are line replaceable. The location of each replaceable item is identified by raised letters on the housing (Ref. Fig. 8 and 9).

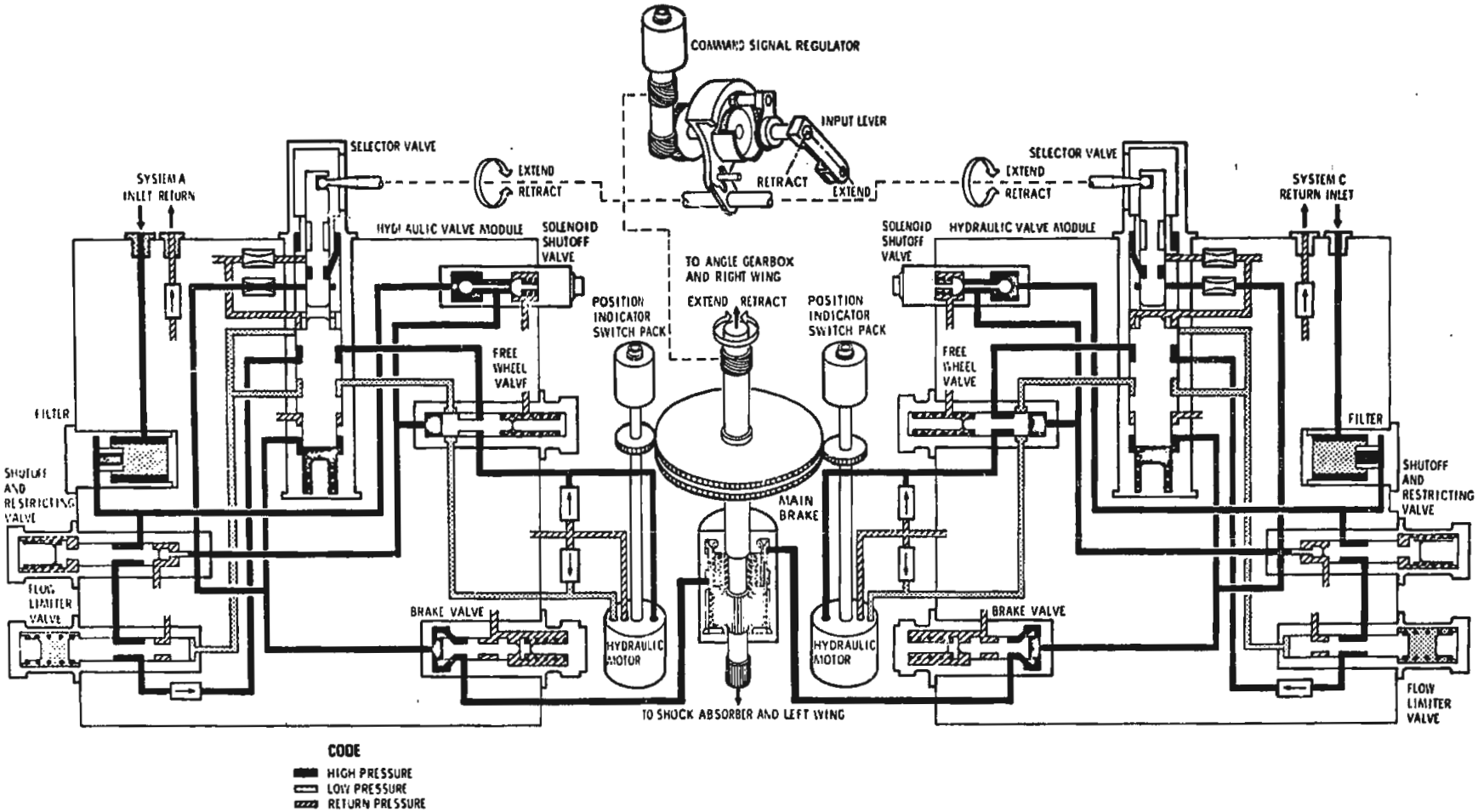
(1) The boosted selector valve determines direction of motor rotation. It is controlled mechanically by the input lever and the feedback mechanism.

(2) The solenoid shutoff valve is normally open and is operated by dual redundant circuits. It controls hydraulic signal pressure to the free wheel valve, shutoff-and-restricting valve, selector valve, and brake valve (Ref. Fig. 3).

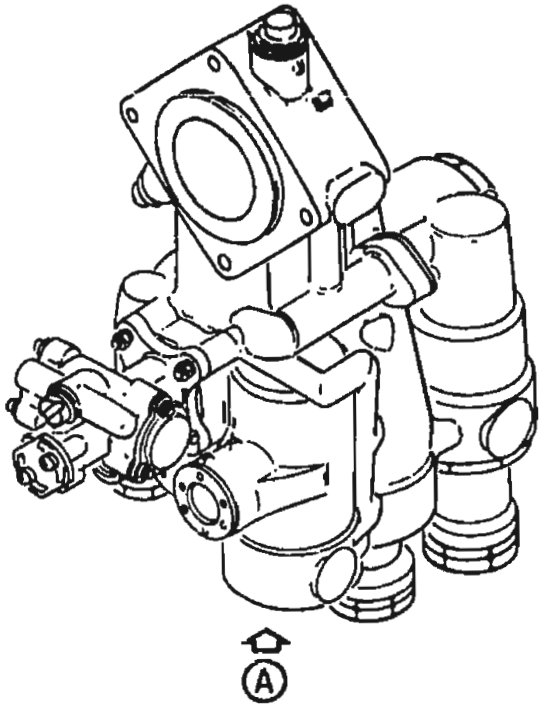
(3) The shutoff-and-restricting valve controls hydraulic operating pressure to the motor. During ground operation with the auxiliary hydraulic power system, it functions as a restricting valve to maintain normal pressure at reduced flow. The signal pressures to the selector valve and the brake valve also pass through this valve.

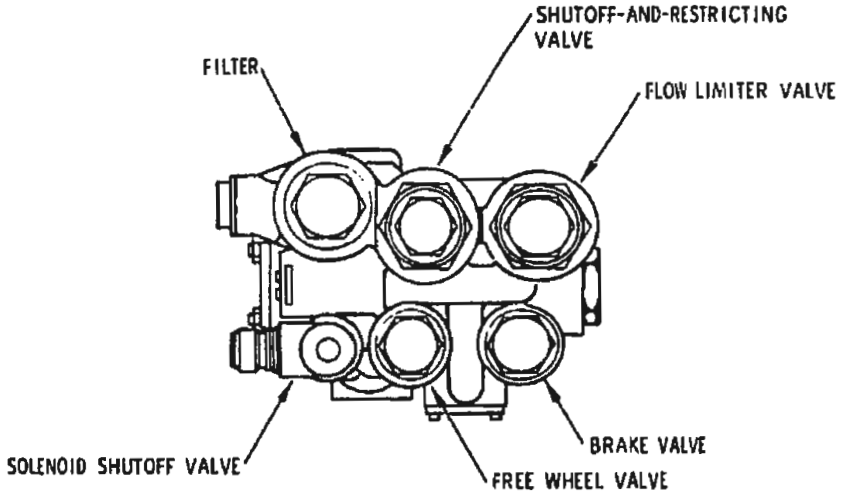
(4) The flow limiter valve controls fluid flow to the motor to prevent overspeed.

(5) The brake valve opens at 1800 psi to supply hydraulic pressure to release the brake. The snap-action valve is either open or closed; it does not permit partial pressurization of the brake.



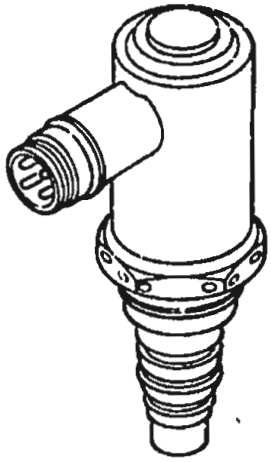
PDU Mechanical Schematic
Figure 7



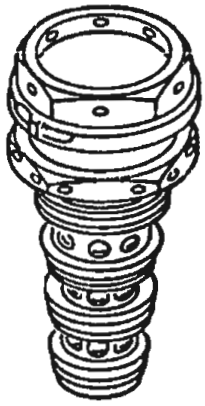


HH 5091
M1-A00-27-271

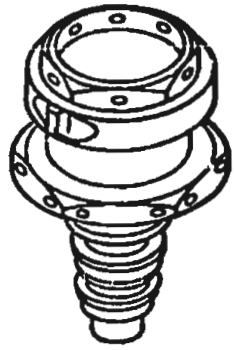
Hydraulic Valve Module
Figure 8



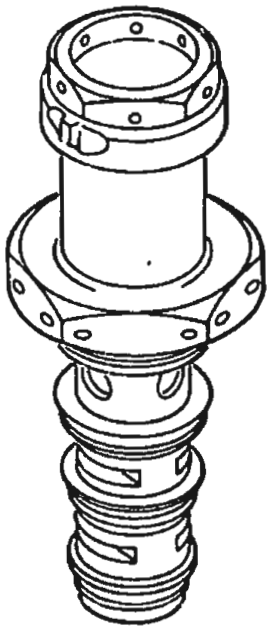
SOLENOID SHUTOFF VALVE



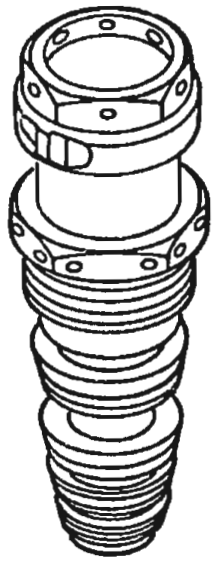
FREE WHEEL VALVE



BRAKE VALVE



SHUTOFF AND RESTRICTING VALVE



FLOW LIMITER VALVE

HH 6553
AII-ADO-27-272

Hydraulic Valves
Figure 9

(6) The free wheel valve acts as a bypass to interconnect the pressure lines to the motor when system hydraulic pressure drops. This allows the motor in an inoperative hydraulic system to free wheel without fluid restriction in either pressure line.

E. Hydraulic Motors

The piston-type hydraulic motors are flange-mounted at the top of the valve modules. Motor speed is 2900 rpm at a pressure of 2450 psi and a flow of 8.6 gpm. The direction of motor rotation is controlled by the selector valve which directs hydraulic pressure to one of the two pressure inlet ports on the motor.

F. Brake

The PDU brake is installed on the output shaft between the motors. It is spring actuated and hydraulically released.

G. Feedback Mechanism

The feedback mechanism comprises worm gearing from the output shaft to a ring gear segment which operates a Geneva mechanism. It controls the selector valve position in conjunction with the input lever.

H. Command Signal Regulator

The command signal regulator is also driven by worm gearing from the output shaft. It incorporates two cam-actuated limit switches which energize the shutoff valves closed when full slat travel is reached.

I. Position Indicator Switch Packs

Two position indicator switch packs, each containing four switches, are driven by the hydraulic motors. The switches control various circuits which are dependent upon slat position.

5. Torque Tubes

A. Description

The torque tube drive train utilizes a total of 42 torque tubes to transmit torque from the power drive unit to the leading edge slat actuators and asymmetry brakes (Ref. Fig. 10). The torque tubes are 1-1/4 or 1-1/2 inch diameter aluminum tubing; the ends are steel splined shafts and couplings. Each coupling consists of one crowned-spline

shaft, one fixed-spline shaft, and the interconnecting spline coupling sleeve. The torque tube bearing supports are mounted in brackets attached to structure. Each consists of a permanently lubricated bearing and support. Loop retainers are installed to restrain broken or disconnected tubes.

6. Angle Gearbox

A. Description

Two angle gearboxes are used to change direction in the torque tube drive train across the fuselage from the power drive unit (PDU) to the right wing (Ref. Fig. 11). One gearbox is attached to the PDU in the left wing root; the other is installed in the right wing root. The gearbox housing is an aluminum casting. It contains a one-to-one ratio gear set, bearings, and shafts.

7. Shock Absorbers

A. Description

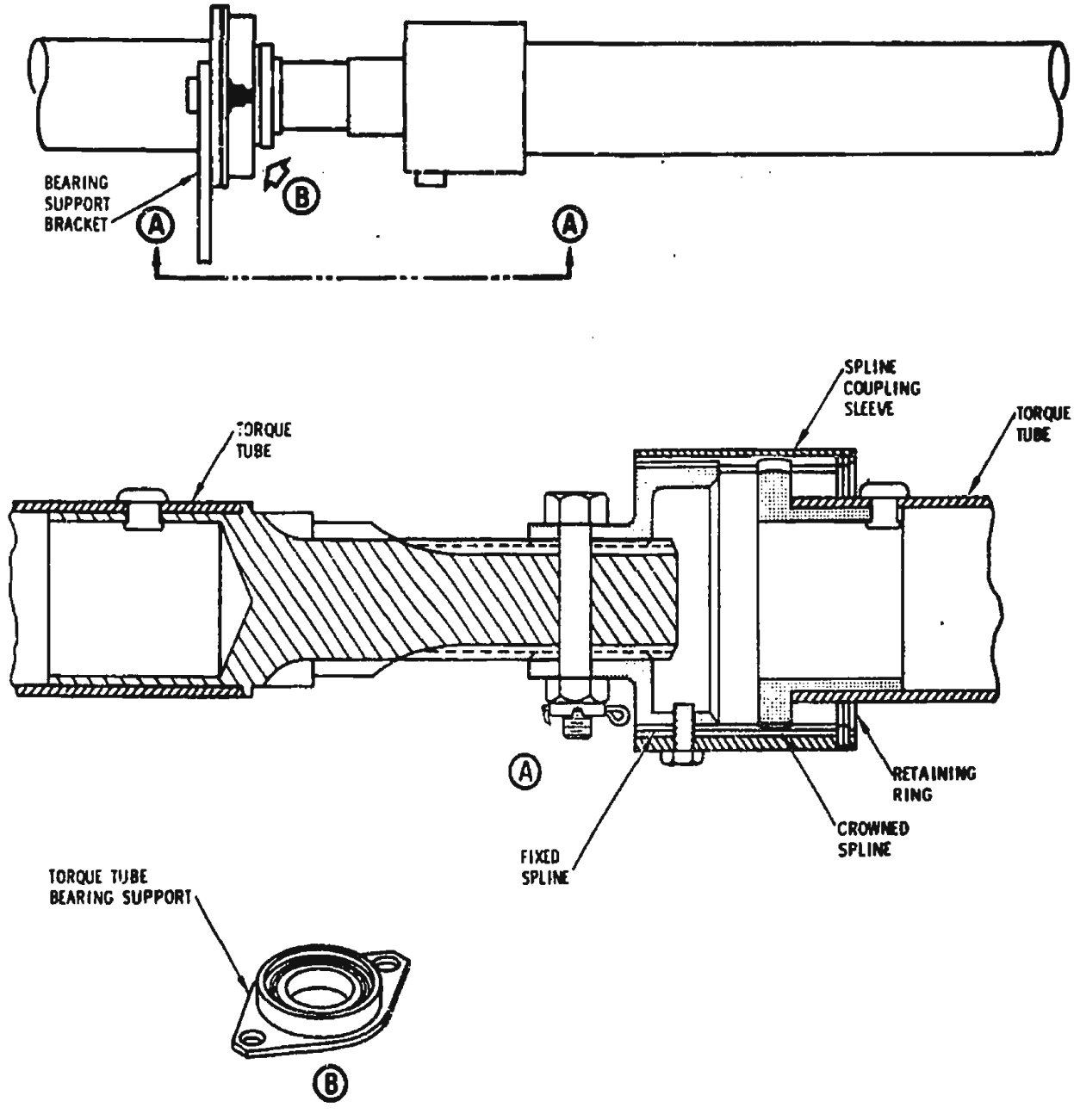
The single shock absorber is installed between the power drive unit and the torque limiting brake in the left wing drive train (Ref. Fig. 12). It reduces the impact of dynamic loads and prevents actuation of the torque limiting brake due to short-duration torque inputs. The shock absorber incorporates a torsionally resistant rubber cylinder enclosed in a six-bolt housing.

The right wing drive train does not utilize a shock absorber since the additional interconnecting torque tubes through the fuselage provide a similar shock absorbing capability.

8. Torque Limiting Brake

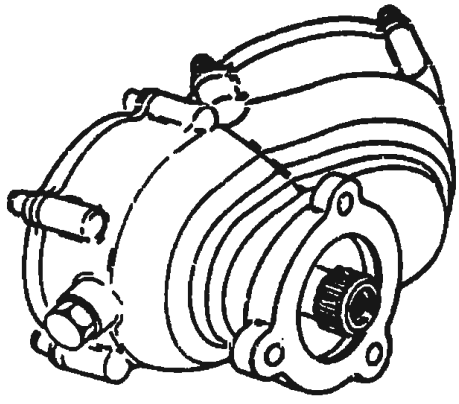
A. Description and Operation

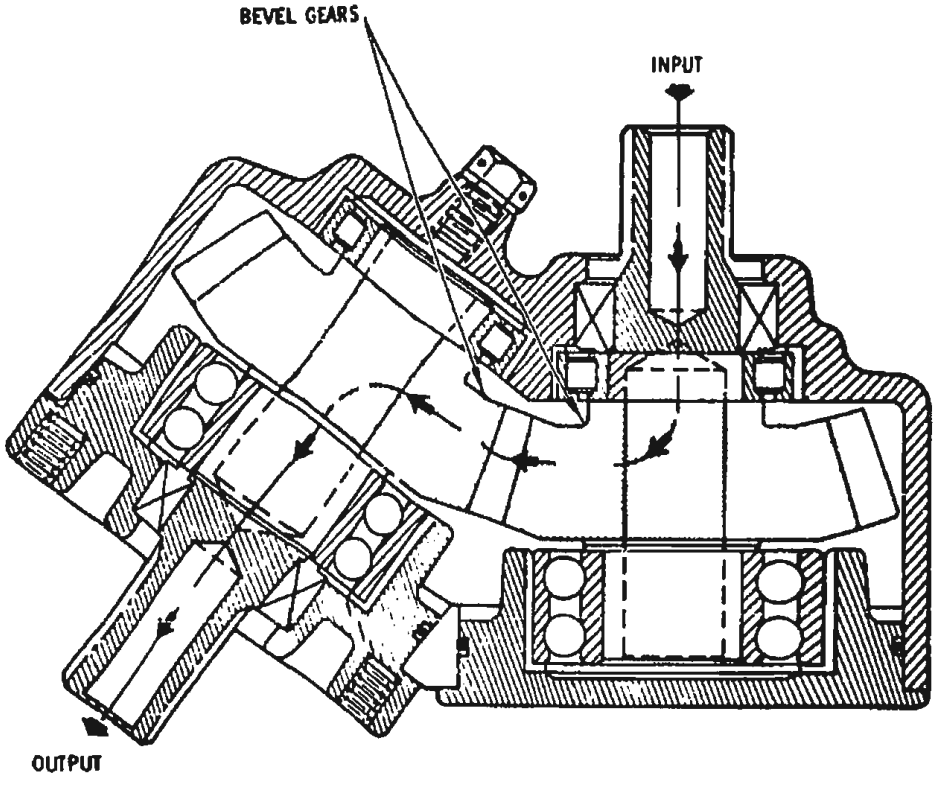
Two torque limiting brakes are installed in the torque tube drive train (Ref. Fig. 13). One is located inboard of the No. 1 inboard slat actuator in each wing. Either will lock the drive train when an abnormal torque load condition occurs. The brake is designed to operate at a torque of approximately 1000 inch-pounds. It incorporates a ball-ramp assembly, brake discs, and a set of Belleville springs. In case of excessive torque, the three balls are forced up the ramp to overcome the Belleville springs and set the brake.



HH 6567
M1-A00-27-264

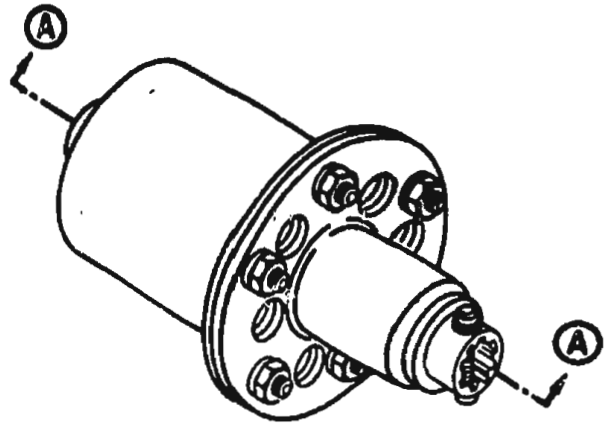
Torque Tube Interconnect
Figure 10

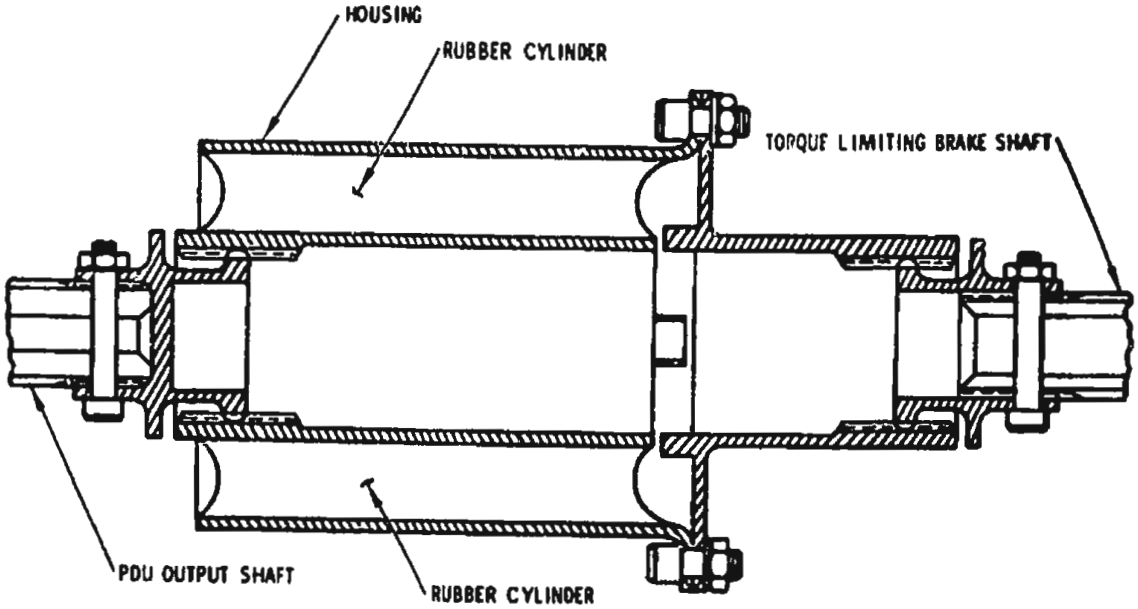




MM 6566
MI-A00-27-262

Angle Gearbox
Figure 11





HH 6586
M1-A00-27-265

Shock Absorber
Figure 12

When the torque is reversed, the brake is released. No trip indication is provided.

9. Slat Actuator

A. Description and Operation

The leading edge slat actuators are installed in the wing fixed leading edge on the forward side of the front spar (Ref. Fig. 14). The gearbox end of the actuator is clevis-mounted to the front spar and an adjustable rod end on the jackscrew attaches to a clevis in the slat. The inboard and outboard actuators are similar but are not interchangeable. Each actuator comprises a reduction gearbox and a telescoping two-section jackscrew with extend and retract stops.

A torque limiter is built into the gearbox to protect the actuator from excessive torque. It is a spring-type device which locks when the applied torque exceeds the limit torque setting, and automatically releases when the torque drops below the limit torque setting. However, if the actuator torque limiter locks, the main torque limiting brake will also lock, thus stalling the system. When the actuator torque limiter locks, a cam on the input shaft releases a spring device on the outside of the gearbox to serve as a trip indicator.

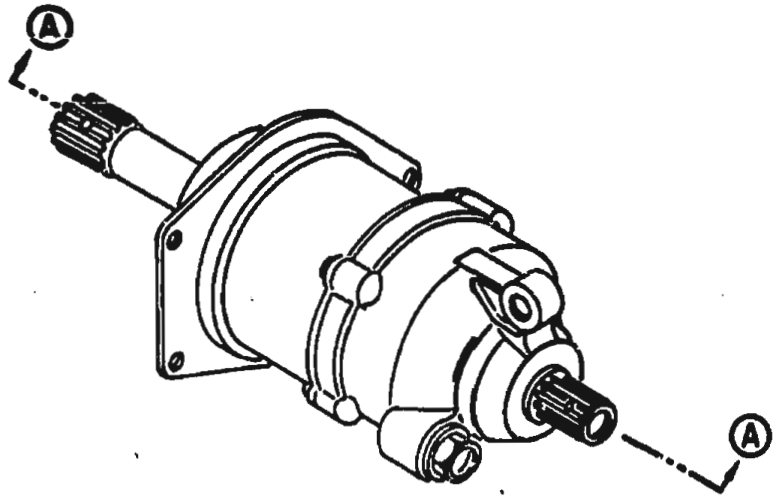
10. Inboard Slats

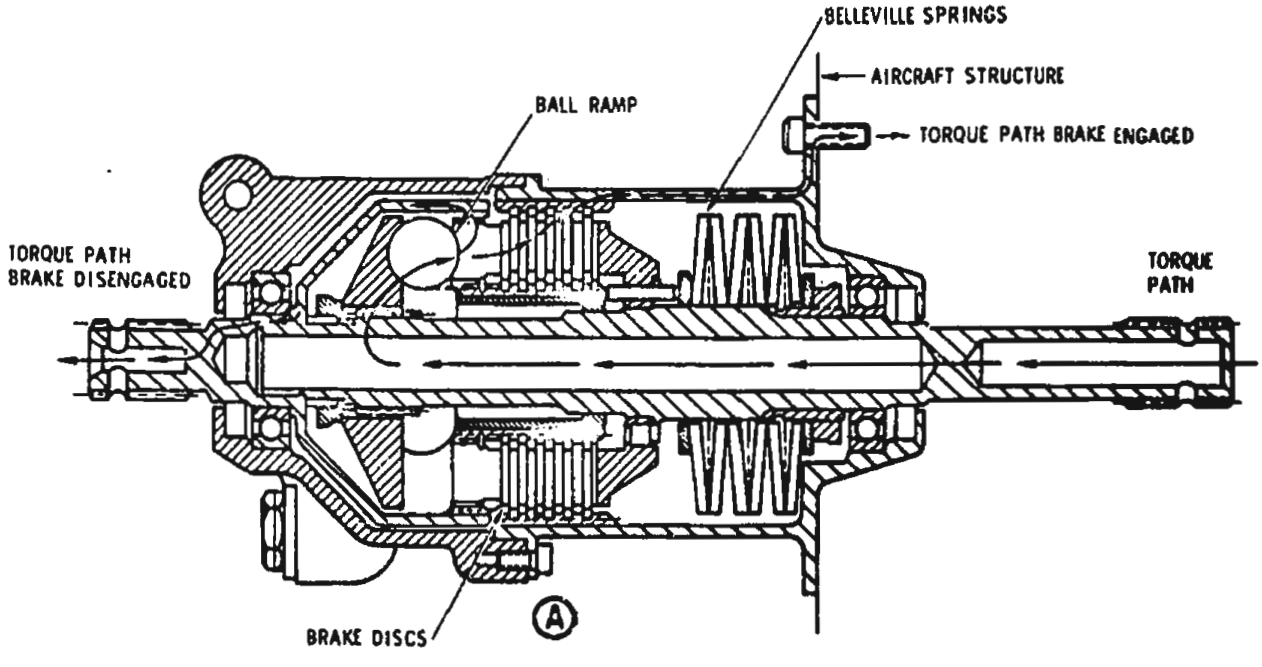
A. Description

Each of the three inboard slats, left and right, measures approximately nine feet long with a chord width of two and one-half feet.

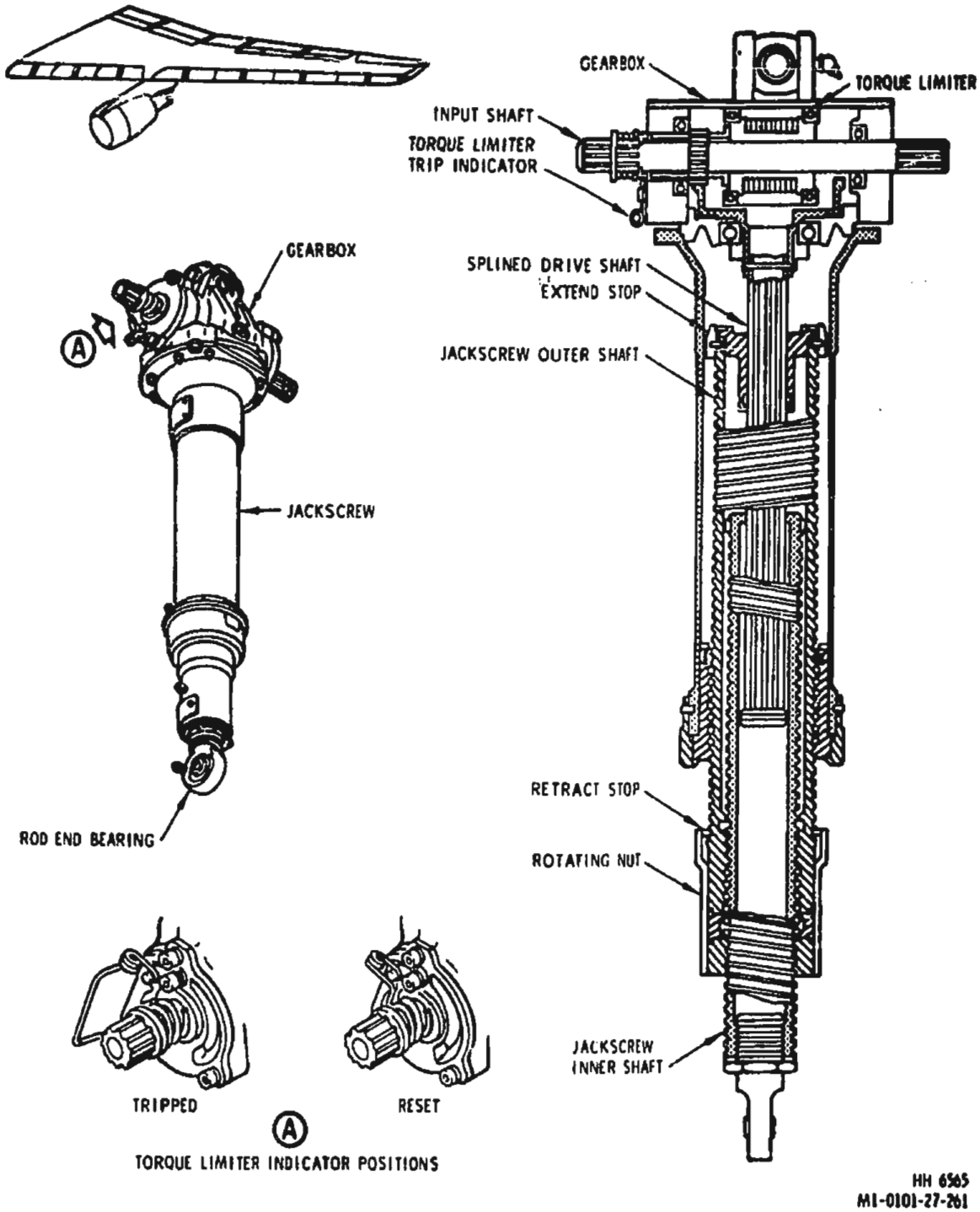
The slats are attached to the wing fixed leading edge through three forged ribs in each slat (Ref. Fig. 15). The center forged rib is the actuator rib and is the attach point for the slat acutator. On either side of the actuator rib are the track ribs to which the slat tracks are connected by a link and three bolts. To adjust the slat in relation to the track, one of the link bolts incorporates an eccentric bushing.

The inboard slat tracks are made of two titanium channels welded together to form a box section. Stop brackets are installed on the tracks to act as bumpers for the adjustable track stops.

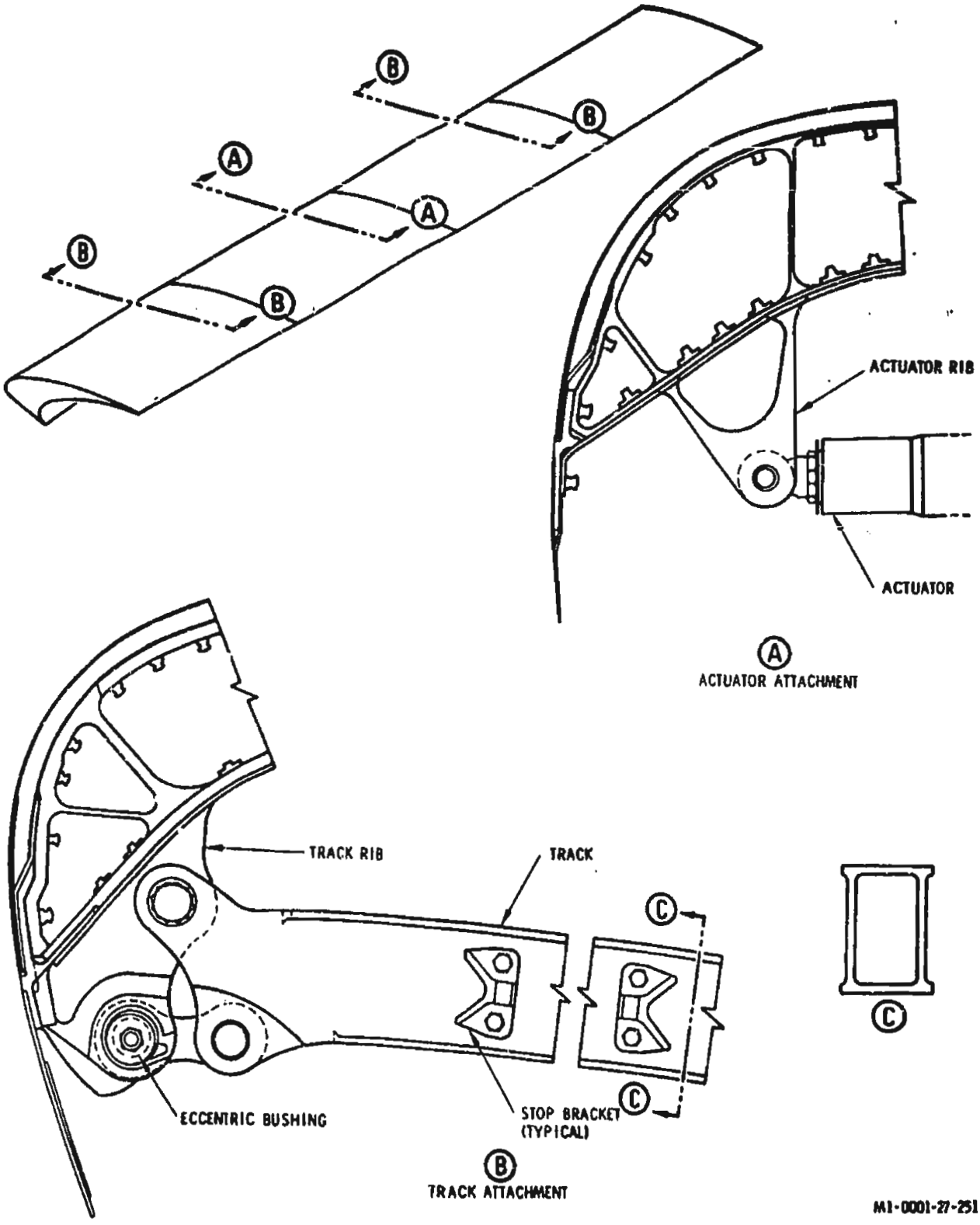




Torque Limiting Brake
Figure 13



Slat Actuator
Figure 14



R Inboard Slat Attachments
R Figure 15

EFFECTIVITY: ALL

001B

Inter-slat seals are attached to, and interconnect the outer skin panels of interfacing slats. Seals are also provided for the slat ends and trailing edges.

On aircraft 001-031 with SB57-097 and 032-999, two snubbers are incorporated on each inboard slat. Their purpose is to maintain the upper trailing edge in surface contact with the wing fixed leading edge when the slats are retracted. The snubbers are integral with forged ribs located on the inner surface of the slats. The snubber rollers are supported by the leading edge ribs which are part the wing fixed leading edge structure. Eccentric adjusting bolts provide for adjustment of the snubber rollers.

11. Outboard Slats

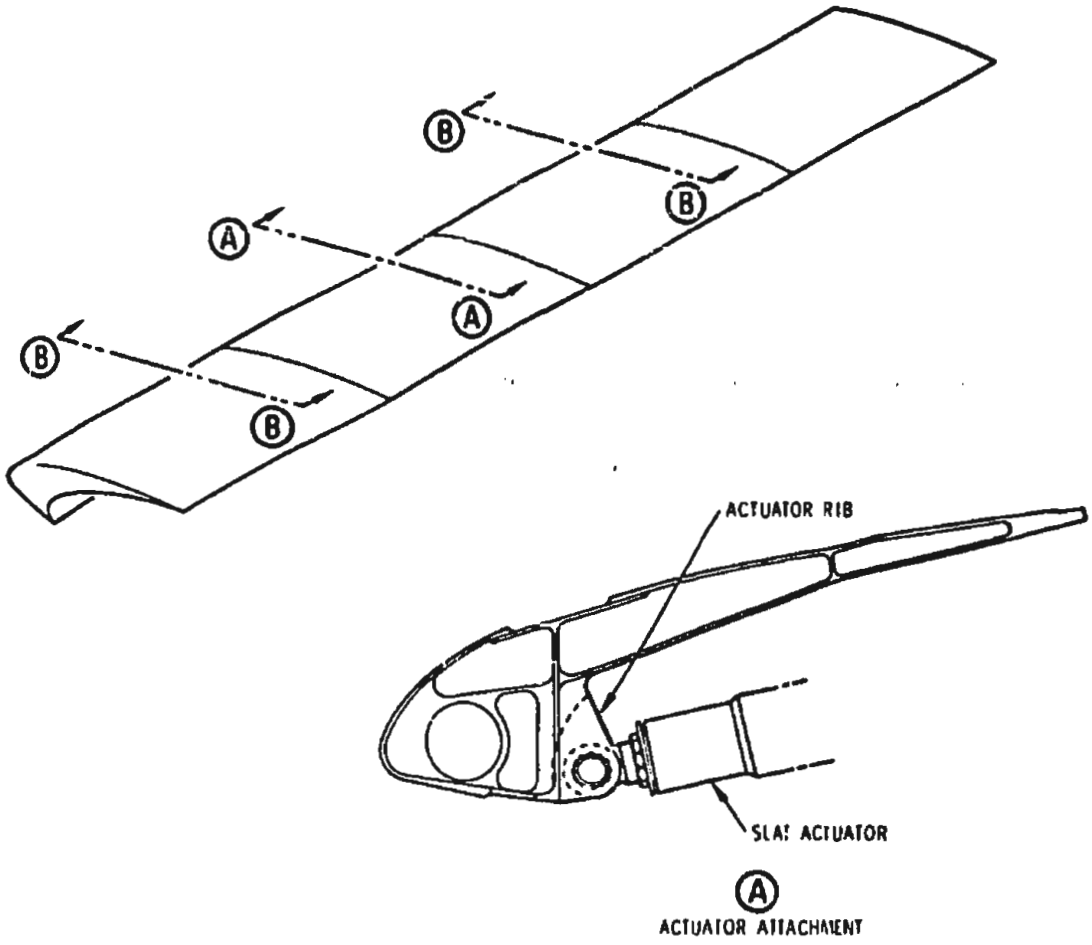
A. Description

Each of the four outboard slats, left and right, measures approximately thirteen feet long with a chord width of two and one-half feet.

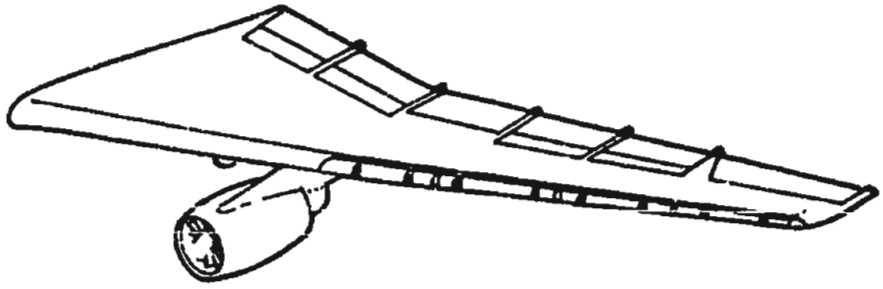
The slats are attached to the wing fixed leading edge through three forged ribs in each slat (Ref. Fig. 16). The center forged rib is the actuator rib and is the attach point for the slat actuator. On either side of the actuator rib are the track ribs to which the slat tracks are connected by a link and three bolts. To adjust the slat in relation to the track, one of the link bolts incorporates an eccentric bushing. The inboard track clevis attachment to the rib utilizes a flanged bushing which prevents spanwise movement of the slat. At the outboard track clevis attachment, a plain bushing is used to allow for slat expansion when the anti-icing system is operating.

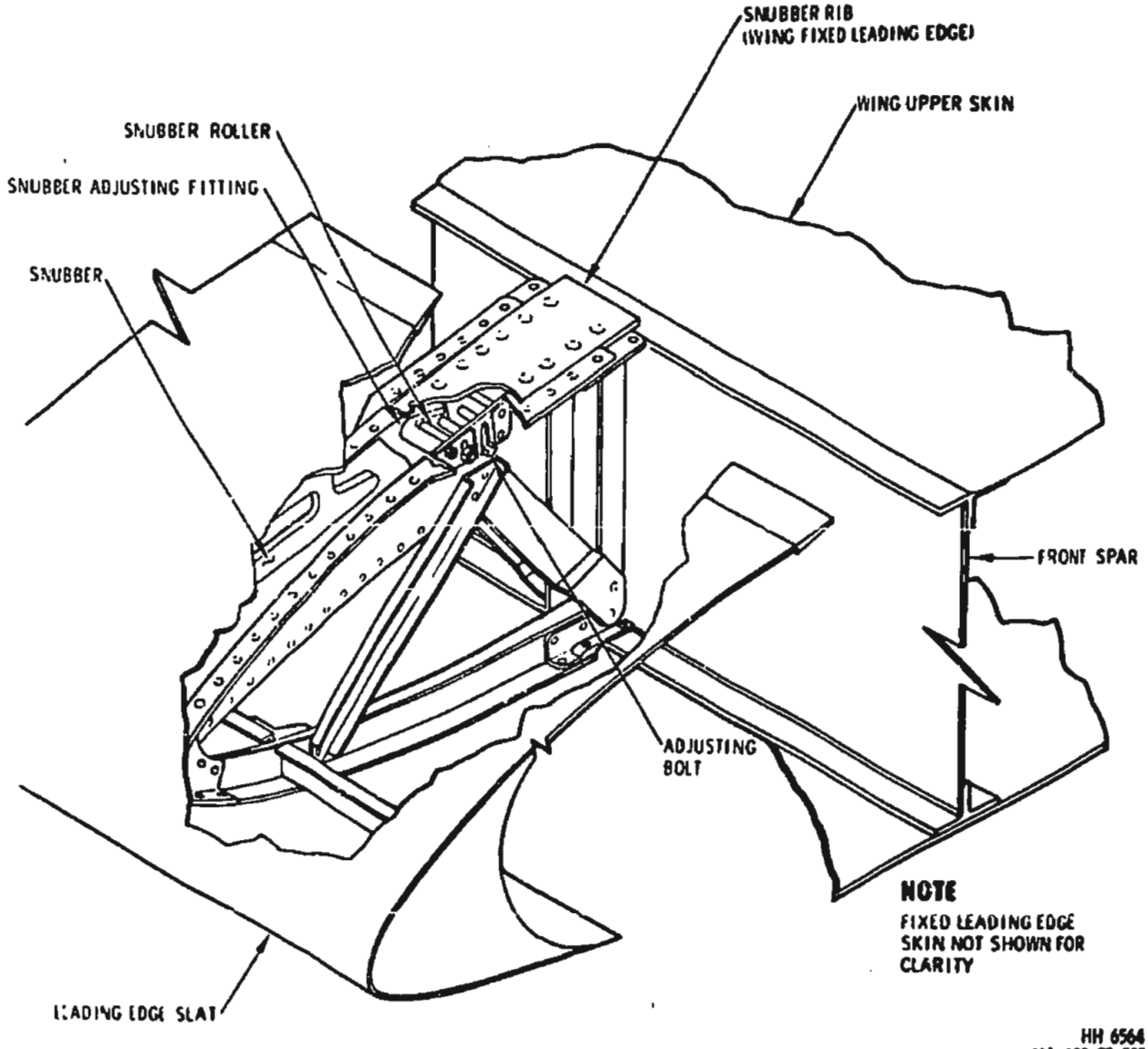
The outboard slat tracks are made of steel with an H-cross-section. Integral webs in the track channel act as bumpers for the adjustable track stops.

Two snubbers are incorporated on each outboard slat (Ref. Fig. 17). Their purpose is to maintain the upper trailing edge in surface contact with the wing fixed leading edge when the slats are retracted. The snubbers are integral with forged ribs located between the actuator rib and the track ribs. The snubber rollers are supported between nose ribs in the wing fixed leading edge. Serrated mounting surfaces provide for adjustment of the snubber roller support.



Outboard Slat Attachments
Figure 16





Outboard Slat Snubbers
Figure 17

The outboard slats are of such length that a racking tendency can develop when effective airloads are not equal on either side of the slat actuator. This could result in jamming of the slat system or rupture of the anti-icing duct connector bellows. To limit the amount of racking, bumper fittings are installed at the interfacing ends of slats to form a loose-fitting tongue and groove joint (Ref. Fig. 18).

The outboard slats are anti-iced with engine bleed air through a perforated "piccolo" duct in the slat nose (Ref. Fig. 19). Bleed air enters the first outboard slat (No. 4) through a telescoping duct located inboard of the inboard track. Flexible bellows connect the piccolo duct sections between slats. A boot seals each slat end rib around the duct.

Inter-slat seals are attached to the outer skin panels of adjacent slats. Seals are also provided for slat ends and trailing edges.

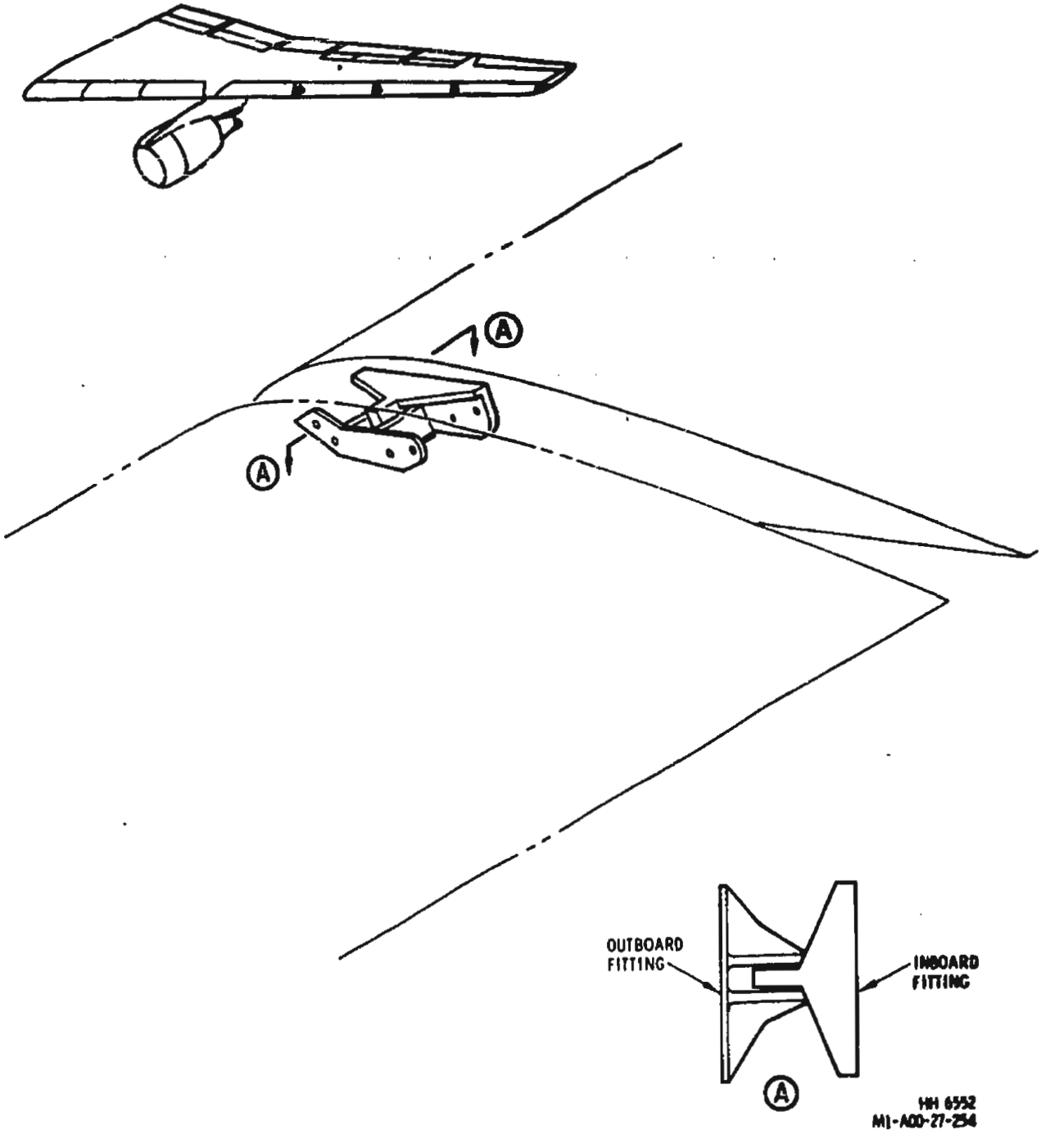
12. Leading Edge Slat Track Rollers and Stops

A. Description

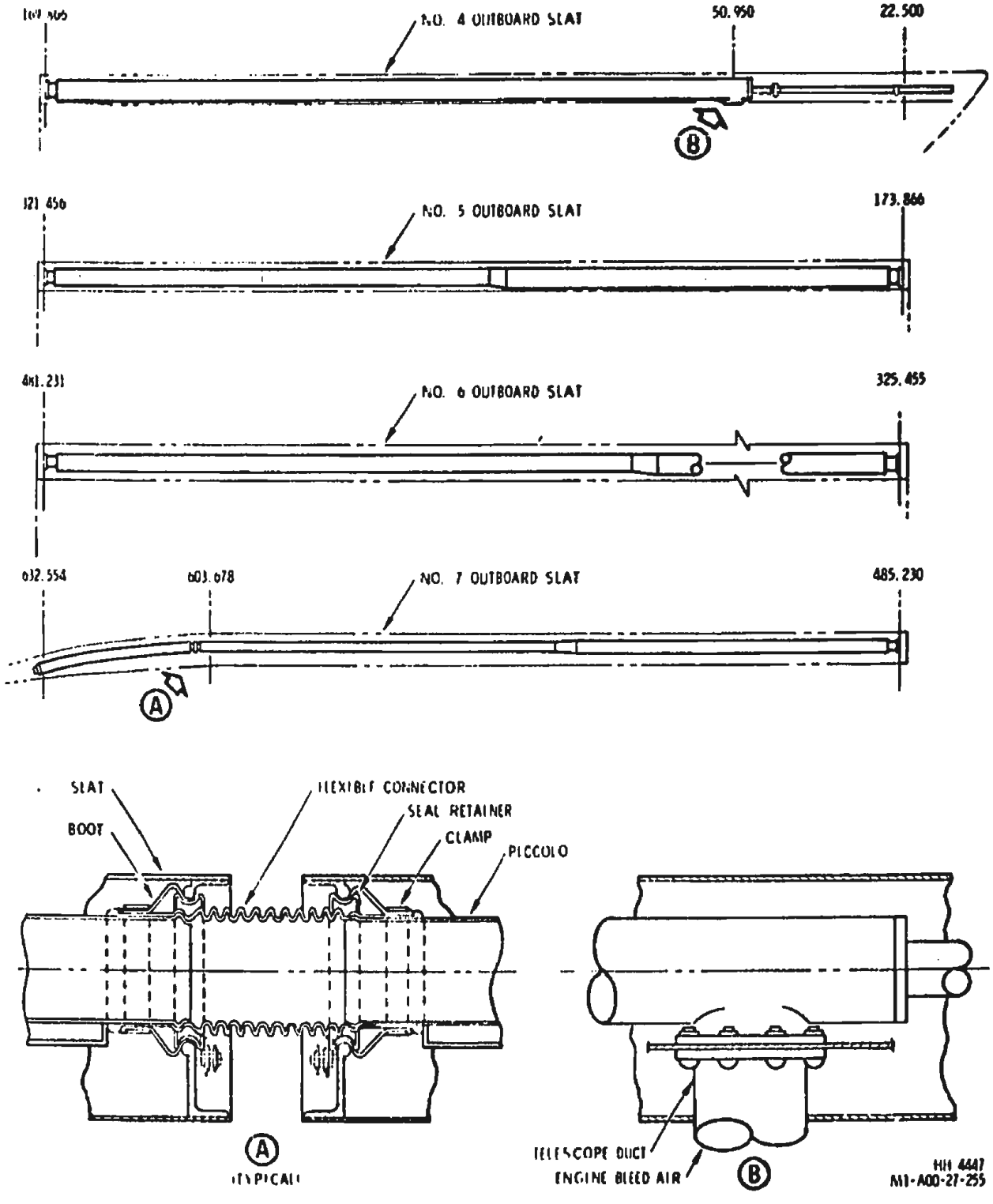
Each slat track is supported in the wing fixed leading edge by two sets of rollers, one forward and one aft (Ref. Fig. 20). Each set is comprised of upper and lower main rollers to carry vertical loads, and thrust rollers on either side to absorb lateral loads. The rollers are standard sealed needle roller bearings. Between the forward and aft sets of rollers, an adjustable stop assembly is installed to limit slat track travel in each direction.

The upper and lower main rollers are sized according to load at each location and mounted on shafts between the track ribs. A single roller is installed on each shaft except in the case of the smaller diameter rollers at the inboard slat locations; two rollers are used on each shaft at these locations. The roller shaft is mounted in eccentric bushing type adjusters to provide vertical adjustment of the rollers. Rotation of the adjuster will raise or lower the roller shaft. The adjustment is maintained by a steel locking plate. A grease fitting is installed in each end of each shaft.

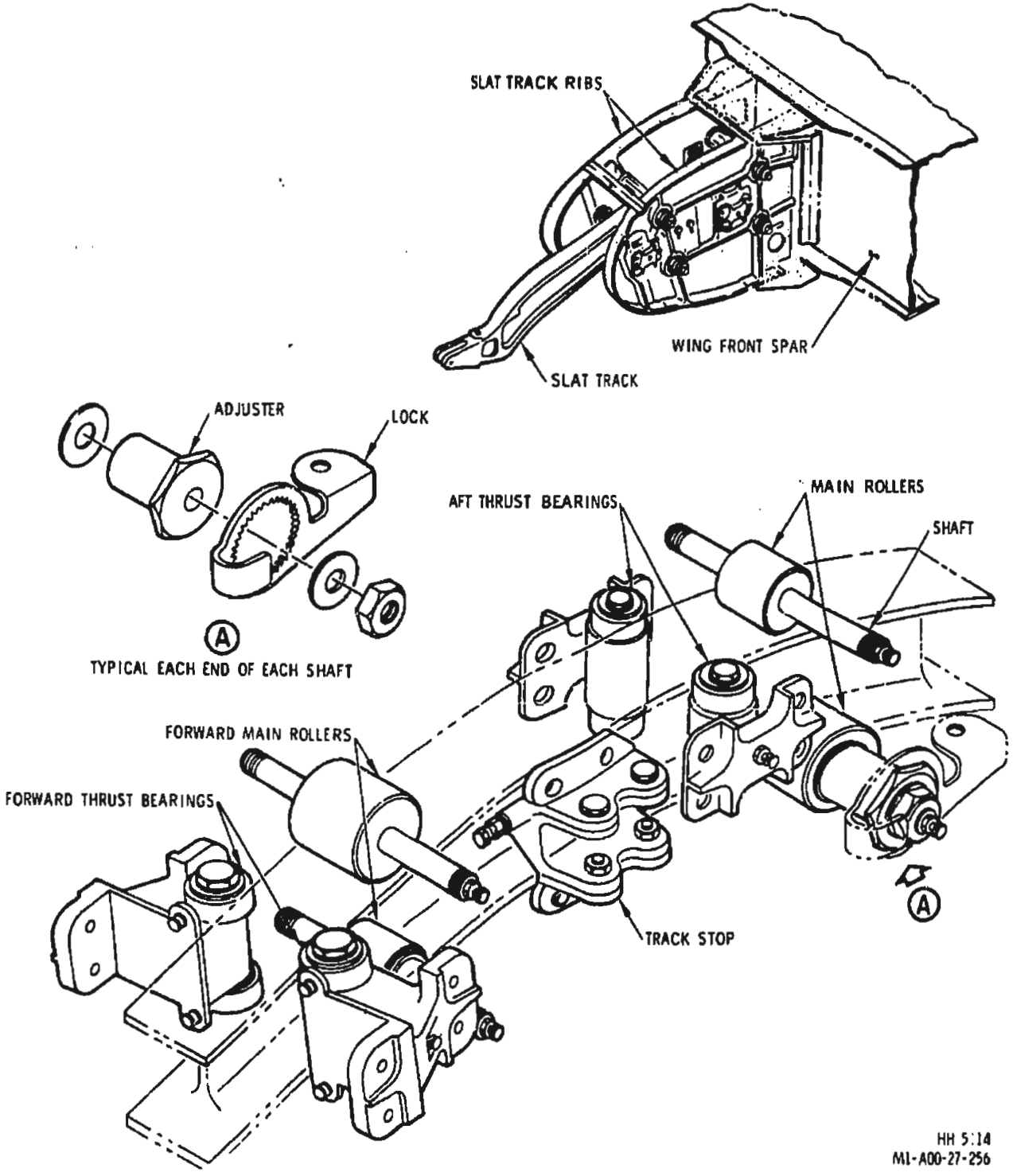
The two thrust rollers on each side are mounted in a single fitting attached to rib structure. The rollers are adjustable by shimming the fitting. A grease fitting in each fitting provides lubrication to both rollers.



Outboard Slat-to-Slat Bumper Fittings
Figure 18



Outboard Slat Anti-icing
Figure 19



Leading Edge Slat Track Rollers and Stops
Figure 20

13. Slat Asymmetry Comparator

A. Description

The slat asymmetry comparator is identical to the flap asymmetry comparator (Ref. Fig. 21). Both are installed in the mid electrical service center, zone 137.

The asymmetry comparator utilizes signals from the rotary transducers which are driven by the torque tube drive train in each wing. Three separate detection channels are provided.

The comparator contains BITE circuits which are designed to compare signals between channels in the various sections of the asymmetry system. The BITE circuits will energize the SLAT ASYM DET FAULT light on the Flight Engineer/Second Officers annunciator panel if a problem exists in any one or more of the following parts of the asymmetry system:

(1) Right wing asymmetry brake solenoid 1 and 2.

(2) Left wing asymmetry brake solenoid 1 and 2.

(3) Hydraulic system A shutoff valve solenoid 1 and 2.

(4) Hydraulic system C shutoff valve solenoid 1 and 2.

(5) External 28VDC comparator power supply 1 and 2.

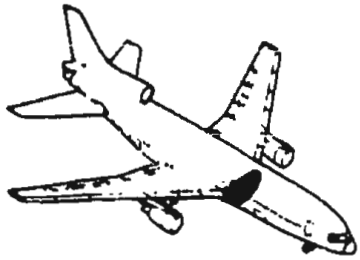
(6) Internal 5VDC comparator power supply channels 1, 2, and 3.

(7) Comparator asymmetry detector channels 1, 2, and 3.

The comparator also contains a fault isolation control panel which includes two test switches and three fault indication lights, one for each detection channel. The test switches are used to isolate the fault to a transducer or the comparator.

B. Operation

Each detector channel of the comparator generates a running comparison of switch actuations in both transducers. When one transducer has produced three switch actuations more than the other, an asymmetry signal is supplied to the voter driver. If the voter driver senses asymmetry in two of the three detector channels, it initiates signals to energize the asymmetry brakes and the power drive unit (PDU) solenoid shutoff valves. The signal to the asymmetry brakes is maintained for two seconds; the signal to the PDU solenoid



FAULT ISOLATION PROCEDURE

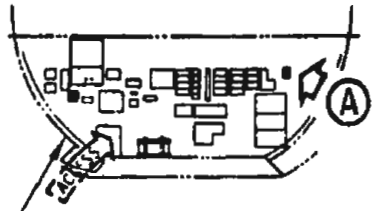
1. EXTEND THE FLAPS AND SLATS. IF A FAULT ISOLATION CHAN IND LIGHT FLASHES ON AND OFF WHILE THEY ARE IN MOTION, NOTE THE FLASHING CHANNEL AND RESET THE COMPARATOR BY CYCLING THE CIRCUIT BREAKERS IN ACCORDANCE WITH THE MAINTENANCE MANUAL. (IF NO LIGHTS FLASH OR IF THE ASYM DET FAULT LIGHT COMES BACK ON AFTER RESET, SEE STEP 5).

CAUTION:
DEPRESSING OR RELEASING THE TROUBLE TEST SWITCH WHILE THE FLAPS OR SLATS ARE MOVING MAY CAUSE THE SYSTEM TO LOCK UP.

2. DEPRESS AND HOLD THE LEFT WING TROUBLE TEST SWITCH AND RETRACT THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE LEFT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
3. DEPRESS AND HOLD THE RIGHT WING TROUBLE TEST SWITCH AND EXTEND THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE RIGHT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
4. IF IN STEP 2 AND 3 THE SAME CHAN IND LIGHT AS STEP 1 FLASHES, REPLACE THE ASYMMETRY COMPARATOR.
5. IF NO CHAN IND LIGHTS FLASH INDICATING NORMAL COMPARATOR AND TRANSDUCERS, OR IF RESETTING THE CIRCUIT BREAKERS DO NOT CLEAR ASYM DET FAULT LIGHT, REFER TO MAINTENANCE MANUAL CHAPTER 27-81 FLAPS FOR 27-81 SLATS), FAULT ISOLATION SECTION FOR ISOLATION TO SHUT OFF VALVES, BRAKE SOLENOIDS, 28 VOLT SUPPLIES, OR COMPARATOR.

NOTE: IF THE FLAP/SLAT SYSTEMS AND THE ASYMMETRY COMPARATOR INDICATIONS ARE NORMAL BUT THE COCKPIT INDICATION IS ABNORMAL, REFER TO THE ILCS TEST IN THE MAINTENANCE MANUAL CHAPTER 33-17-00, PAGE 501.

(DECAL FOR -115 COMPARATOR)



FAULT ISOLATION PROCEDURE

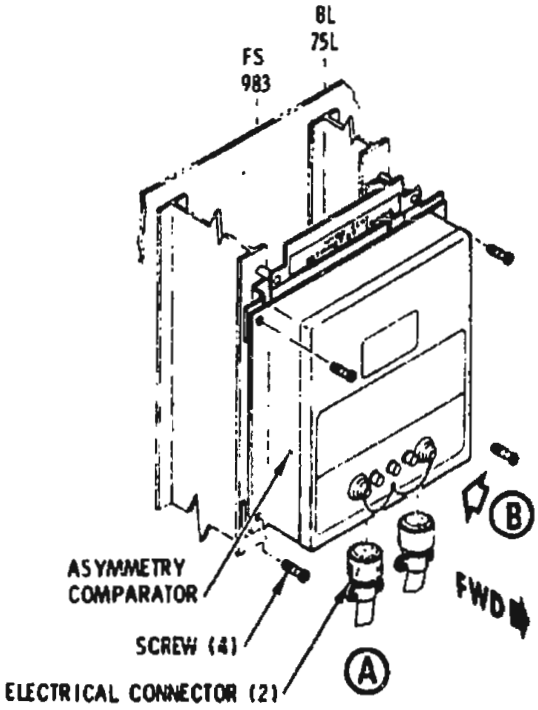
WITH FLAPS/SLATS MOVING, FULLY DEPRESS LEFT WING TROUBLE TEST SWITCH. WHILE CHAN IND IS OFF AND HOLD FOR AT LEAST FIVE SECONDS. RELEASE ONLY WHEN CHAN IND OFF. REPEAT WITH RIGHT WING TROUBLE TEST SWITCH.

CAUTION: PRESSING EITHER TROUBLE TEST SWITCH WHILE THE CHAN IND IS ON WILL CAUSE ASYMMETRY LOCKUP

IF THE LIGHTED CHAN IND EXTINGUISHES AND ANOTHER CHAN IND ILLUMINATES FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THE SWITCH CAUSING THE CHANGE.

IF CHAN IND DOES NOT CHANGE POSITION FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE THE COMPARATOR 672838.

(DECAL FOR -111 COMPARATOR)



FAULT ISOLATION PROCEDURE

WITH FLAPS / SLATS MOVING, PRESS AND HOLD LEFT WING THEN RIGHT WING TEST SWITCH FOR AT LEAST FIVE SECONDS EACH.

IF CHANNEL INDICATOR CHANGES POSITION FOR EITHER SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THAT SWITCH CAUSING CHANGE.

ALL OTHER COMBINATIONS OF FAILURES INDICATE A FAULTY COMPARATOR 672838

(DECAL SHOWN FOR -109 COMPARATOR)

B

M1-0003-27-350

Slat Asymmetry Comparator
Figure 21

valves is continuous. At the same time, a signal is supplied to the lock light driver which energizes the FLAP/SLAT LOCK light on the Flight Engineer/Second Officer annunciator panel.

When the voter driver senses asymmetry in only one channel, the BITE circuitry will energize the SLAT ASYM DET FAULT light on the annunciator panel

14. Asymmetry Brake

A. Description and Operation

An asymmetry brake is located at the outboard end of the torque tube drive train in each wing (Ref. Fig. 22). It is actuated by a signal from the asymmetry comparator or by the integral overspeed governor and is capable of holding 1700 inch-pounds of input torque. Provisions are incorporated for mounting and driving the asymmetry rotary transducer and the slat position transmitter.

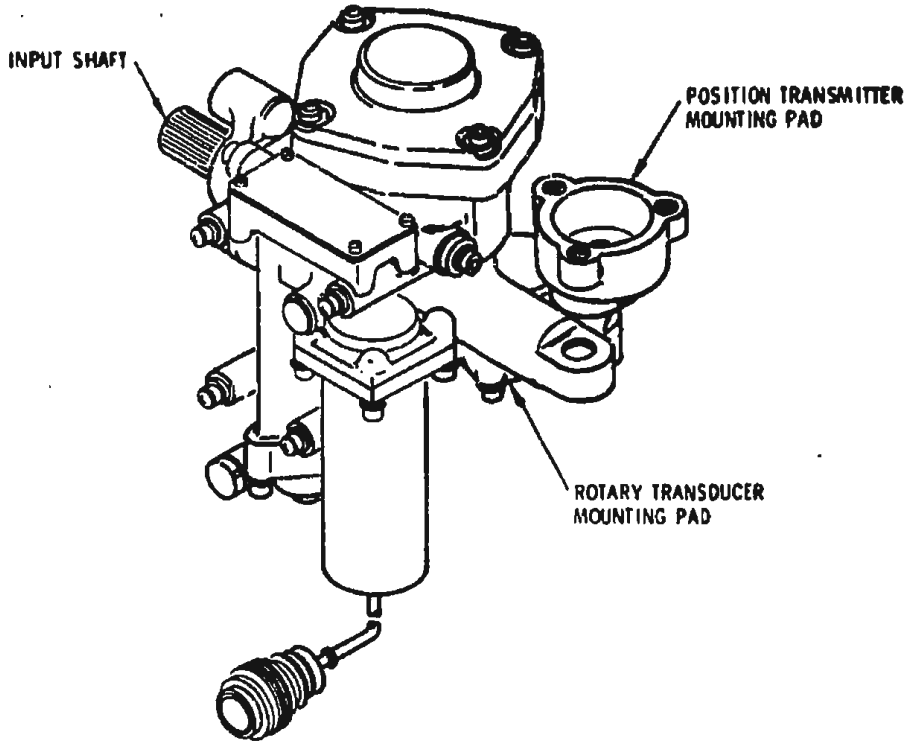
The asymmetry brake incorporates a roller ramp and cam mechanism which releases Belleville springs to set the brake. The roller ramp is actuated by a solenoid energized from the asymmetry comparator when asymmetry is detected, or by the governor when an overspeed occurs. A trip indicator and a wrench-operated reset device are provided.

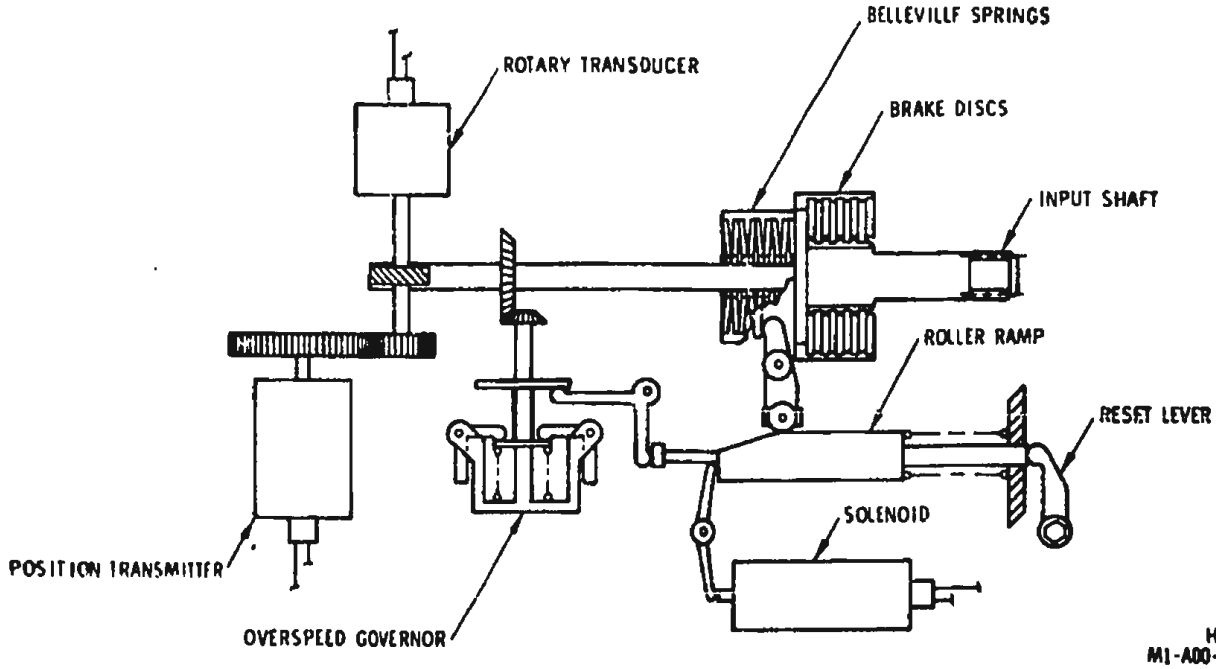
The normal rotational speed of the slat torque tubes is 600 revolutions per minute. If the slats are operating under high air loads and there is a break in the slat drive system, the uncoupled torque tubes can accelerate to high speeds. The overspeed governor is set to trip and actuate the roller ramp when torque tube speed is 1700 to 2200 revolutions per minute.

15. Slat Asymmetry Transducer

A. Description and Operation

Two rotary bi-directional transducers, identical to those in the flap asymmetry system, are incorporated in the slat asymmetry system. A transducer is mounted on, and driven by the slat asymmetry brake in each wing. The transducers rotate in opposite directions with respect to each other. Three separate switch channels in each transducer provide the input to the asymmetry comparator. Each channel incorporates two brush and commutator type switches. Rotation of the transducer shaft and commutator produces electrical signals that indicate amount and direction of





Asymmetry Brake
Figure 22

shaft rotation. Each switch actuates several times during a complete revolution.

16. Slat PDU Hydraulic System C Isolation Valve

A. Description

An isolation shutoff valve is installed in the hydraulic system C supply line to the slat power drive unit (PDU) located in the leading edge of the left wing. The shutoff valve is installed to protect the hydraulic system C supply from a ruptured hydraulic line when slats are not operating. The shutoff valve is located in the hydraulic service center (Ref. Fig. 23).

The isolation shutoff valve is electrically controlled by a relay in the mid-electrical service center (MESC). The relay is controlled through the slat electrical control system (Ref. Fig. 3).

The isolation shutoff valve is a solenoid-controlled pilot-operated spool valve (Ref. Fig. 23). The valve contains four ports and a popout indicator pin to indicate the position of the spool valve.

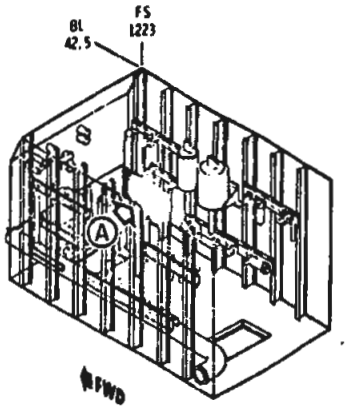
B. Operation

With the slats fully retracted or extended, the slat PDU solenoid shutoff valves are energized. Voltage from one channel of the PDU shutoff valve is directed to the coil of the isolation shutoff valve relay, opening the relay circuit and deenergizing the isolation shutoff valve.

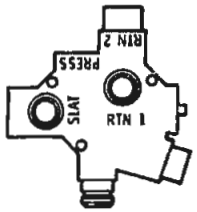
With the isolation shutoff valve deenergized, the spool valve is positioned (Ref. Fig. 23). In this condition, hydraulic pressure is blocked at the pilot valve from entering the actuation piston chamber; the return spring moves the main spool to the right, thus blocking system pressure from entering the slat PDU pressure manifold. In this condition, the slat PDU manifold and slat PDU return are open (through the check valve) to hydraulic system C return.

When the slats are operating, the PDU solenoid shutoff valves are deenergized by the limit switches and start-up switches. The same circuit deenergizes the isolation shutoff valve relay, which allows the relay contacts to close. Voltage from the No. 1 ASYM BRAKE circuit breaker is then directed by the closed contacts of the relay to the isolation shutoff valve solenoid.

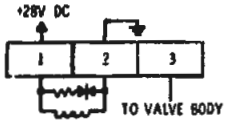
Actuation of the isolation shutoff valve solenoid allows system pressure to force the pilot valve ball off the seat and pressurize the actuation piston. The actuation piston then moves the main spool to the left which opens hydraulic system C pressure to the slat PDU pressure manifold.



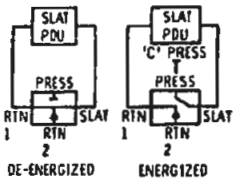
HYDRAULIC SERVICE CENTER



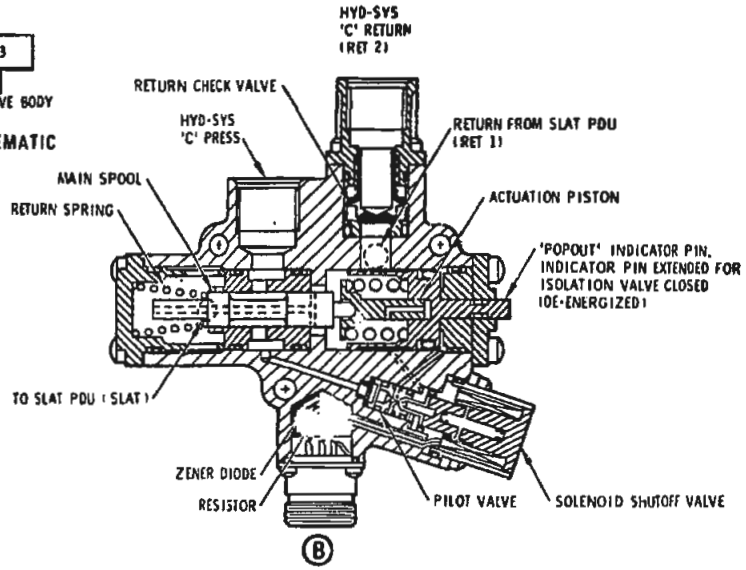
ISOLATION VALVE



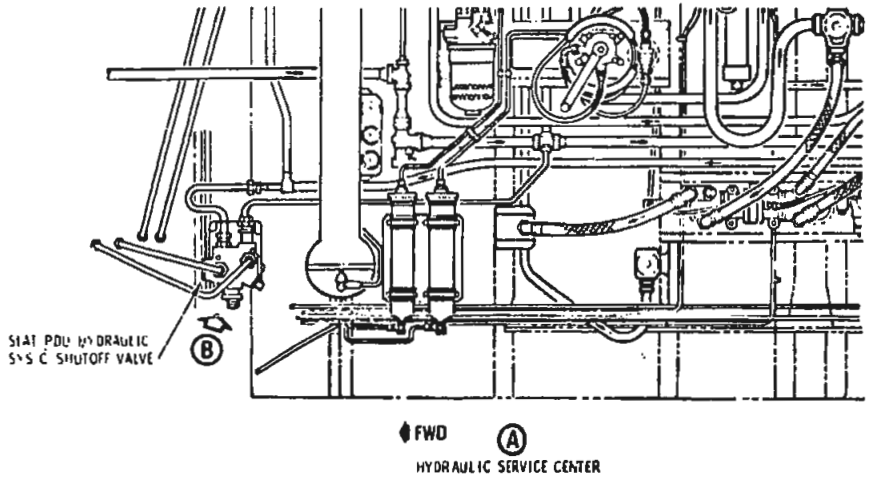
ELECTRICAL SCHEMATIC



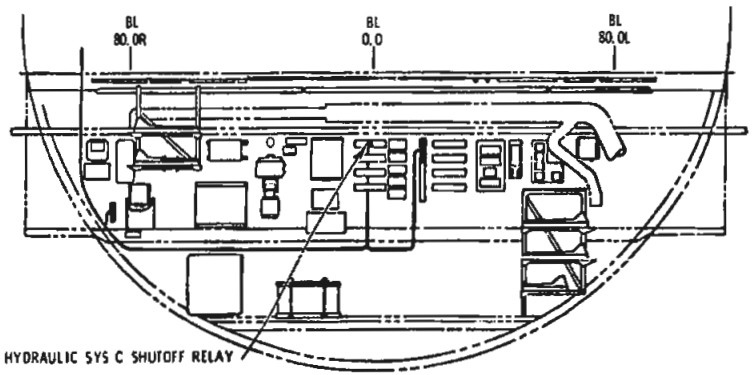
FLOW SCHEMATIC



LE SLAT PDU ISOLATION VALVE
(SHOWN DE-ENERGIZED)



HYDRAULIC SERVICE CENTER



MESC COMPONENT LOCATIONS
VIEW LOOKING AFT AT FS 983

AM-0100-27-389

Slat PDU Hydraulic System C Isolation Valve
Figure 23

SLAT CONTROL SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

Slat Control System Fault Isolation
Table 101

FIGURE	TITLE
101	Slat Control System Location Index
102	Slat Control System Locator Diagram
103	Slats Inoperative, FLAP/SLAT LOCK Light On (On FE/SO Annunciator Panel)
104	SLAT ASYM DET FAULT Light On (FE/SO Annunciation Panel)
105	Slats Inoperative, FLAP/SLAT LOCK Light Off
106	PDU Inoperative on one Hydraulic System
107	Jam or Binding in Slat Drive System

R Slat Control System Fault Isolation (Cont)
R Table 101

FIGURE	TITLE
108	Asymmetry Brake Tripped
109	FLAP/SLAT LOCK Light On, Slats Operative
110	SLAT MONITOR Panel Slat Extend (Segment) Light(s) Does Not Come On
111	Slat Extend (Segment) Light on SLAT MONITOR Panel Stays On
112	Slats Will Not Extend In Flight, OK On Ground
SCHEM 1	LE Slat Control System Electrical Schematic
SCHEM 2	LE Slat Asymmetry System Electrical Schematic
SCHEM 3	LE Slat Position Monitoring (Proximity) System Electrical Schematic

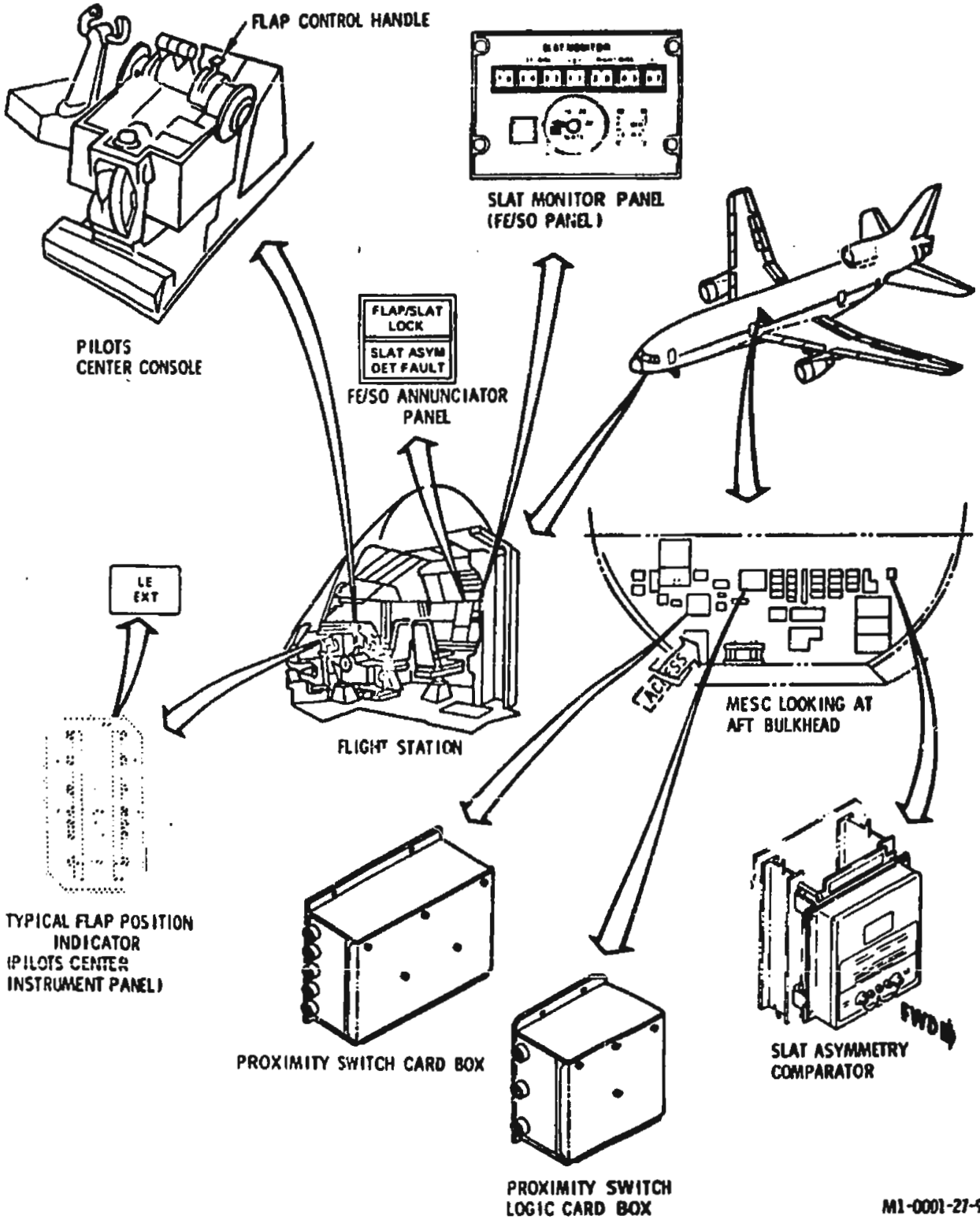
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACTUATOR – BALLSCREW, INBD	6	WINGS/511CB, FB, HB 611CB, FB, HB	27-81-21
ACTUATOR – BALLSCREW, OUTBD	8	WINGS/511CB, JB, NB, SB 612CB, JB, NB, SB	27-81-22
BOX – INDICATOR LIGHTS CONTROL (ILCB)	1	FESC/112AB, 211CB	33-17-04
BOX – PROXIMITY LOGIC	1	MESC/192K, 192EA	31-22-02
BOX – PROXIMITY SWITCH CARD	1	MESC/192K, 192EA	31-22-01
BRAKE – ASYMMETRY, SLAT	2	WINGS/521TB, 621TB	27-81-37
CIRCUIT BREAKERS:			
LE SLAT EXTEND LT 2782-CB2	1	FLT STA/CB3-K18	
LOCK LIGHT LE SLAT 2781-CB1	1	FLT STA/CB1-J12	
NO. 1 ASYM BRAKE LE SLAT 2780-CB2	1	FLT STA/CB2-H22	
NO. 2 ASYM BRAKE LE SLAT 2780-CB1	1	FLT STA/CB1-J10	
POSN IND LE SLAT 2782-CB1	1	FLT STA/CB3-K17	
PROX SW PWR NO. 1 3318-CB1	1	FLT STA/CB1-L10	
PROXIMITY SWITCH 2 3318-CB3	1	FLT STA/CB3-H3	
PROXIMITY SWITCH 3 3318-CB2	1	FLT STA/CB3-H4	
COMPARATOR – SLAT ASYMMETRY	1	MESC/192K, 192EA	27-81-36
MOTOR – HYDRAULIC, PDU	2	HSC/147AB	27-51-14
POWER DRIVE UNIT (PDU)	1	WING BUTT/511BT	27-81-03
SENSOR – PROX SWITCH	14	AT EACH SLAT PNL INBD TRACK	27-82-03
SWITCH – BREAK DETECTOR	2	MESC/192K, 192EA	27-51-04
SWITCHPACK – COMMAND SIGNAL REG	1	ON PDU/511BT	27-81-09
SWITCHPACK – SLAT PDU	2	ON PDU/511BT	27-81-08
SWITCH – START UP	1	ON PROGRAMMER, MESC/ 192K, 192EA	27-81-42
TRANSDUCER – SLAT ASYM	2	ON ASYM BK/521TB, 621TB	27-81-38
VALVE – SOLENOID S/O, PDU	2	ON PDU/511BT	27-81-05

M1-0000-27-870

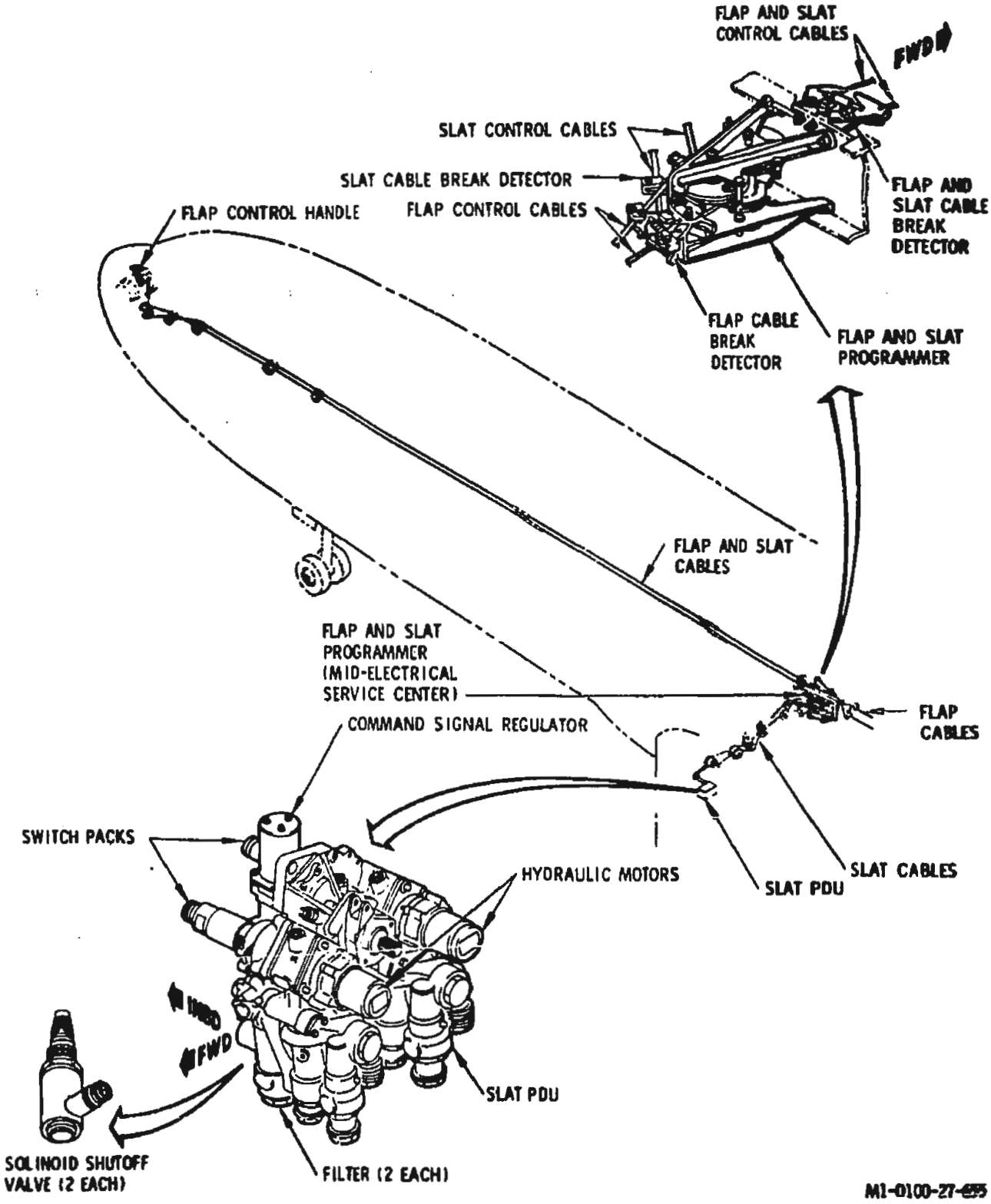
R Slat Control System Component Location Index
R Figure 101

EFFECTIVITY: ALL

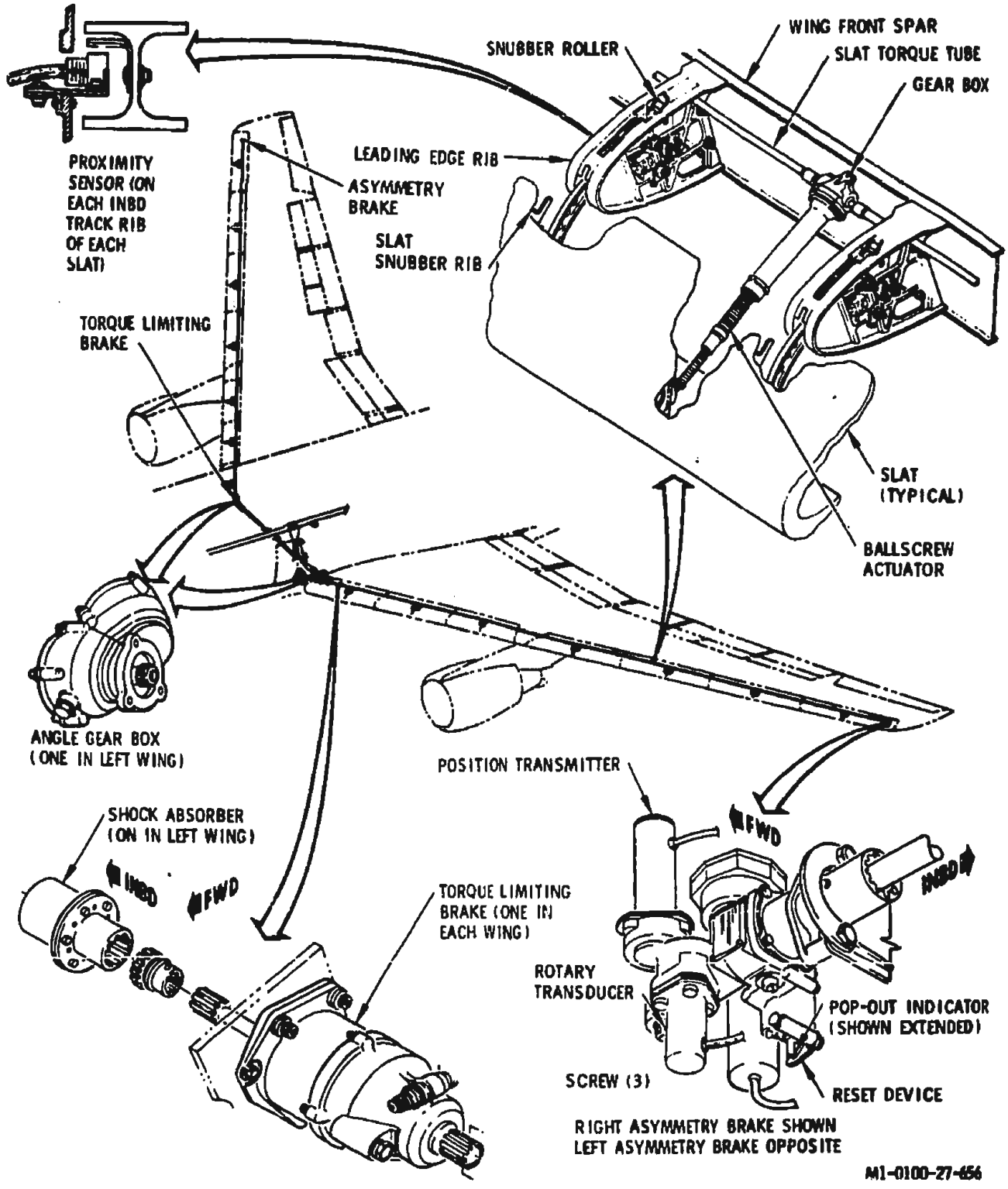
001B



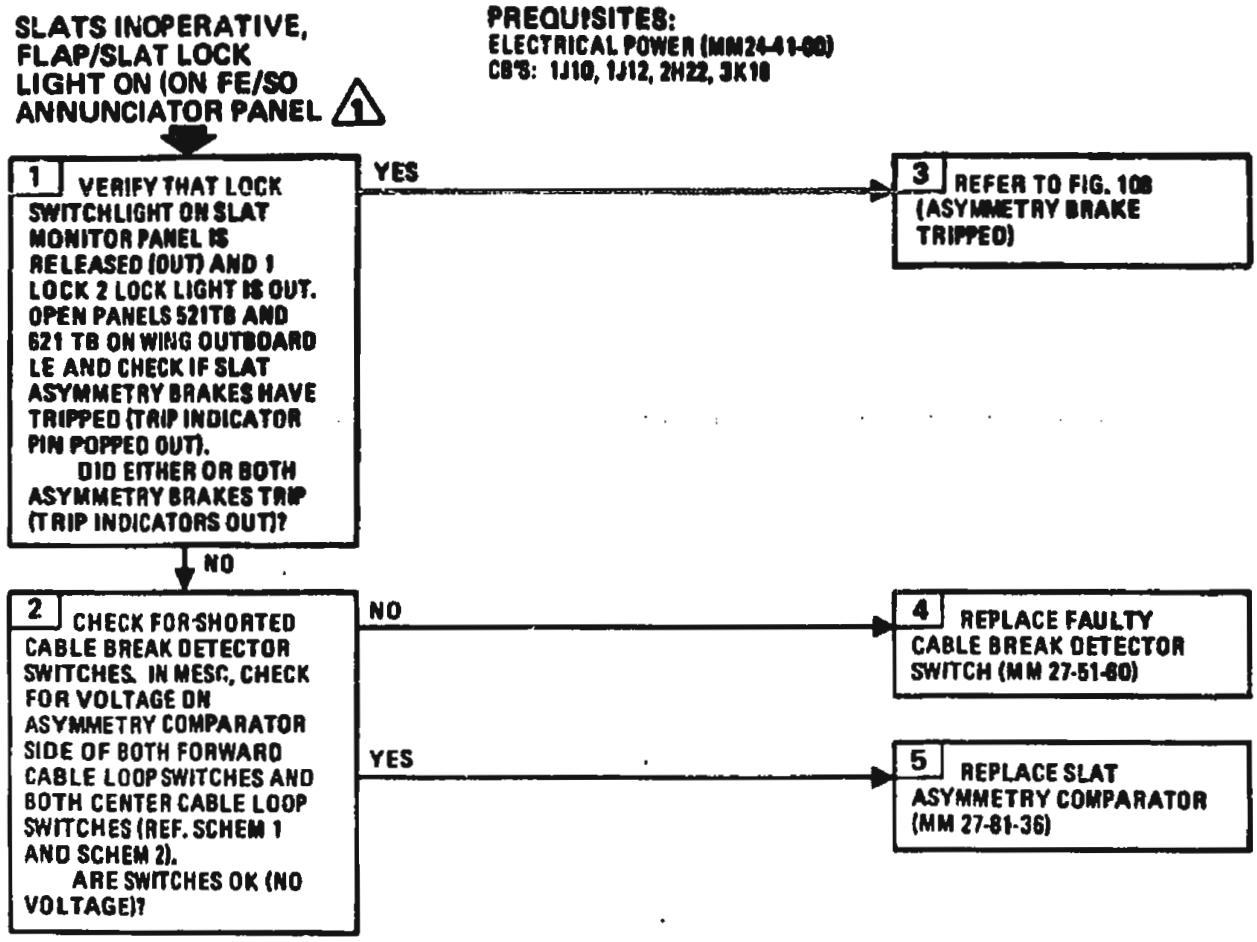
Slat System Component Locator
Figure 102 (Sheet 1)



Slat System Component Locator
Figure 102 (Sheet 2)



Slat System Component Locator
Figure 102 (Sheet 3)


SLATS INOPERATIVE, FLAP/SLAT LOCK LIGHT ON (ON FE/SO ANNUNCIATOR PANEL (1)
PREQUISITES:
ELECTRICAL POWER (MM24-41-00)
CB'S: 1J10, 1J12, 2H22, 3K18
1 VERIFY THAT LOCK SWITCHLIGHT ON SLAT MONITOR PANEL IS RELEASED (OUT) AND 1 LOCK 2 LOCK LIGHT IS OUT. OPEN PANELS 521TB AND 621 TB ON WING OUTBOARD LE AND CHECK IF SLAT ASYMMETRY BRAKES HAVE TRIPPED (TRIP INDICATOR PIN POPPED OUT).
DID EITHER OR BOTH ASYMMETRY BRAKES TRIP (TRIP INDICATORS OUT)?
YES
3 REFER TO FIG. 108 (ASYMMETRY BRAKE TRIPPED)
NO
2 CHECK FOR SHORTED CABLE BREAK DETECTOR SWITCHES. IN MESC, CHECK FOR VOLTAGE ON ASYMMETRY COMPARATOR SIDE OF BOTH FORWARD CABLE LOOP SWITCHES AND BOTH CENTER CABLE LOOP SWITCHES (REF. SCHEM 1 AND SCHEM 2).
ARE SWITCHES OK (NO VOLTAGE)?
NO
4 REPLACE FAULTY CABLE BREAK DETECTOR SWITCH (MM 27-51-60)
YES
5 REPLACE SLAT ASYMMETRY COMPARATOR (MM 27-81-36)

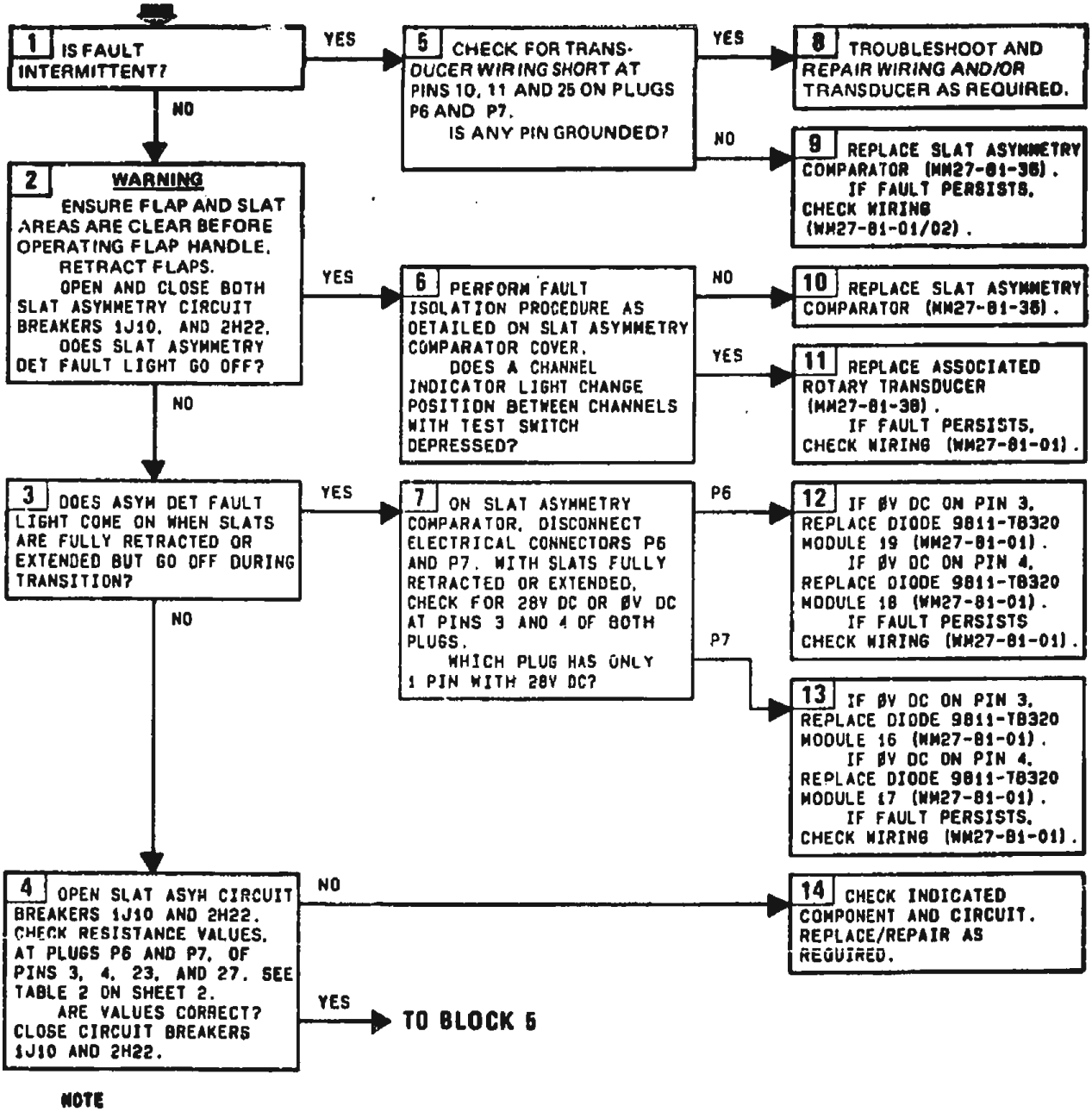
(1) **NOTE**
FLAP/SLAT LOCK LIGHT CAN BE ACTUATED BY ANY OF THE FOLLOWING:
- LOCK SWITCHLIGHT ON FE/SO SLAT MONITOR PANEL.
- SLAT ASYMMETRY SYSTEM
- CABLE BREAK DETECTORS

M1-0001-27-041

Slats Inoperative, FLAP/SLAT LOCK Light On
(FE/SO Annunciator Panel)
Figure 103

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00)
CB'S: 1J10, 1J12, 1J13, 2H22

SLAT ASYM DET FAULT LIGHT ON (FE/SO ANNUNCIATOR PANEL)


1 IS FAULT INTERMITTENT?
YES
NO
5 CHECK FOR TRANSDUCER WIRING SHORT AT PINS 10, 11 AND 25 ON PLUGS P6 AND P7. IS ANY PIN GROUNDED?
YES
8 TROUBLESHOOT AND REPAIR WIRING AND/OR TRANSDUCER AS REQUIRED.
NO
9 REPLACE SLAT ASYMMETRY COMPARATOR (MM27-81-36). IF FAULT PERSISTS, CHECK WIRING (MM27-81-01/02).
2 WARNING ENSURE FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAP HANDLE. RETRACT FLAPS. OPEN AND CLOSE BOTH SLAT ASYMMETRY CIRCUIT BREAKERS 1J10, AND 2H22. DOES SLAT ASYMMETRY DET FAULT LIGHT GO OFF?
YES
6 PERFORM FAULT ISOLATION PROCEDURE AS DETAILED ON SLAT ASYMMETRY COMPARATOR COVER. DOES A CHANNEL INDICATOR LIGHT CHANGE POSITION BETWEEN CHANNELS WITH TEST SWITCH DEPRESSED?
NO
10 REPLACE SLAT ASYMMETRY COMPARATOR (MM27-81-36).
YES
11 REPLACE ASSOCIATED ROTARY TRANSDUCER (MM27-81-36). IF FAULT PERSISTS, CHECK WIRING (MM27-81-01).
NO
3 DOES ASYM DET FAULT LIGHT COME ON WHEN SLATS ARE FULLY RETRACTED OR EXTENDED BUT GO OFF DURING TRANSITION?
YES
7 ON SLAT ASYMMETRY COMPARATOR, DISCONNECT ELECTRICAL CONNECTORS P6 AND P7. WITH SLATS FULLY RETRACTED OR EXTENDED, CHECK FOR 28V DC OR 0V DC AT PINS 3 AND 4 OF BOTH PLUGS. WHICH PLUG HAS ONLY 1 PIN WITH 28V DC?
P6
12 IF 0V DC ON PIN 3, REPLACE DIODE 9811-T8320 MODULE 19 (MM27-81-01). IF 0V DC ON PIN 4, REPLACE DIODE 9811-T8320 MODULE 18 (MM27-81-01). IF FAULT PERSISTS CHECK WIRING (MM27-81-01).
P7
13 IF 0V DC ON PIN 3, REPLACE DIODE 9811-T8320 MODULE 16 (MM27-81-01). IF 0V DC ON PIN 4, REPLACE DIODE 9811-T8320 MODULE 17 (MM27-81-01). IF FAULT PERSISTS, CHECK WIRING (MM27-81-01).
NO
4 OPEN SLAT ASYM CIRCUIT BREAKERS 1J10 AND 2H22. CHECK RESISTANCE VALUES, AT PLUGS P6 AND P7, OF PINS 3, 4, 23, AND 27. SEE TABLE 2 ON SHEET 2. ARE VALUES CORRECT? CLOSE CIRCUIT BREAKERS 1J10 AND 2H22.
14 CHECK INDICATED COMPONENT AND CIRCUIT. REPLACE/REPAIR AS REQUIRED.
YES
TO BLOCK 5

NOTE

1. DUE TO FLEXING OF THE WING IN FLIGHT, WIRING PROBLEMS MAY SHOW UP AS INTERMITTENT. COMMON PLACES FOR PROBLEMS ARE WHEEL WELL, ENGINE PYLONS, AND OUTBOARD WING.

M1-0005-27-943

R SLAT ASYM DET FAULT Light On
R (FE/SO Annunciator Panel)
R Figure 104 (Sheet 1)

TABLE 1

PLUG	PIN	COMPONENT/CIRCUIT	VOLTAGE
2781-P6	15	CIRCUIT BREAKER, CB1J10	28V DC
	3		28V DC OR 0V DC (1)
	4		28V DC OR 0V DC (1)
2781-P7	15	CIRCUIT BREAKER, CB2H22	28V DC
	3		28V DC OR 0V DC (1)
	4		28V DC OR 0V DC (1)

TABLE 2

PLUG	PIN	COMPONENT/CIRCUIT	RESISTANCE	ATA
2781-P6	3	PDU, SHUTOFF VALVE SOLENOID NO. 1 (CH2)	APPROX 55Ω NOT OPEN	27-81-05
	4	PDU, SHUTOFF VALVE SOLENOID NO. 2 (CH2)	APPROX 55Ω NOT OPEN	27-81-05
	10	LH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN (2)	27-81-38
	11	LH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN (2)	27-81-38
	25	LH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN (2)	27-81-38
	23	LH SLAT ASYM. BRAKE SOLENOID	APPROX 22Ω NOT OPEN	27-81-37
	27	LH SLAT ASYM. BRAKE SOLENOID	APPROX 22Ω NOT OPEN	27-81-37
2781-P7	3	PDU, SHUTOFF VALVE SOLENOID NO.1 (CH1)	APPROX 55Ω NOT OPEN	27-81-05
	4	PDU, SHUTOFF VALVE SOLENOID NO. 2 (CH1)	APPROX 55Ω NOT OPEN	27-81-05
	10	RH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN (2)	27-81-38
	11	RH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN (2)	27-81-38
	25	RH ROTARY TRANSDUCER	APPROX 4000Ω OR OPEN (2)	27-81-38
	23	RH SLAT ASYM. BRAKE SOLENOID	APPROX 22Ω NOT OPEN	27-81-37
	27	RH SLAT ASYM. BRAKE SOLENOID	APPROX 22Ω NOT OPEN	27-81-37

NOTE

(1) READINGS FOR PINS 3 AND 4 ON SAME PLUG SHOULD BE IDENTICAL

(2) TRANSDUCER CONTAINS TWO DIODES, ONE FORWARD AND ONE REVERSE BIASED, IN PARALLEL WHICH ARE INDEPENDENTLY ACTIVATED. RESISTANCE READINGS SHOULD BE MADE WITH METER LEADS NEGATIVE TO GND, THEN POSITIVE TO GND. WHILE READINGS MAY DIFFER WITH LEADS TRANSPOSED, ALL READING WITH SAME METER LEAD ORIENTATION SHOULD BE IDENTICAL.

3 VALUES IN TABLE 2 ARE BASED ON THE USE OF SIMPSON MODEL 260 VOM OR EQUIVALENT.

M1-0007-27-911

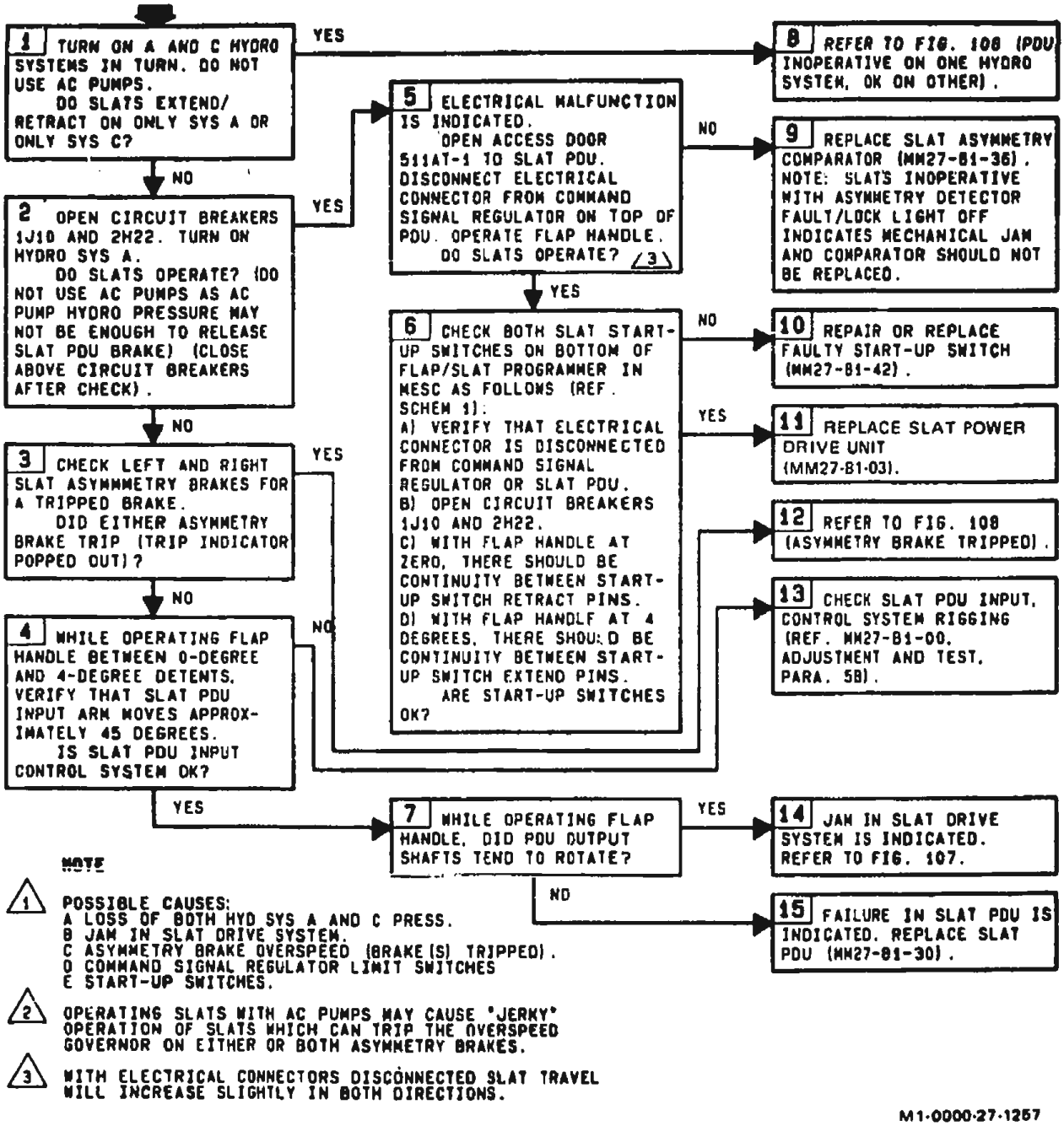
R SLAT ASYM DET FAULT Light On
R (FE/SO Annunciator Panel)
R Figure 104 (Sheet 2)

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00) SYS A AND C
CB'S: 1J10, 1J12, 2H22, 3X18

SLATS INOPERATIVE, FLAPS/SLAT LOCK LIGHT (ON FE/SO ANNUNCIATOR PANEL) OFF /1\ /2\


1 TURN ON A AND C HYDRO SYSTEMS IN TURN. DO NOT USE AC PUMPS.
DO SLATS EXTEND/ RETRACT ON ONLY SYS A OR ONLY SYS C?
YES
8 REFER TO FIG. 108 (PDU INOPERATIVE ON ONE HYDRO SYSTEM, OK ON OTHER).
NO
2 OPEN CIRCUIT BREAKERS 1J10 AND 2H22. TURN ON HYDRO SYS A.
DO SLATS OPERATE? (DO NOT USE AC PUMPS AS AC PUMP HYDRO PRESSURE MAY NOT BE ENOUGH TO RELEASE SLAT PDU BRAKE) (CLOSE ABOVE CIRCUIT BREAKERS AFTER CHECK).
YES
5 ELECTRICAL MALFUNCTION IS INDICATED.
OPEN ACCESS DOOR 511AT-1 TO SLAT PDU. DISCONNECT ELECTRICAL CONNECTOR FROM COMMAND SIGNAL REGULATOR ON TOP OF PDU. OPERATE FLAP HANDLE.
DO SLATS OPERATE? /3\
NO
9 REPLACE SLAT ASYMMETRY COMPARATOR (MM27-81-36). NOTE: SLATS INOPERATIVE WITH ASYMMETRY DETECTOR FAULT/LOCK LIGHT OFF INDICATES MECHANICAL JAM AND COMPARATOR SHOULD NOT BE REPLACED.
YES
6 CHECK BOTH SLAT START-UP SWITCHES ON BOTTOM OF FLAP/SLAT PROGRAMMER IN MESC AS FOLLOWS (REF. SCHEM 1):
A) VERIFY THAT ELECTRICAL CONNECTOR IS DISCONNECTED FROM COMMAND SIGNAL REGULATOR OR SLAT PDU.
B) OPEN CIRCUIT BREAKERS 1J10 AND 2H22.
C) WITH FLAP HANDLE AT ZERO, THERE SHOULD BE CONTINUITY BETWEEN START-UP SWITCH RETRACT PINS.
D) WITH FLAP HANDLE AT 4 DEGREES, THERE SHOULD BE CONTINUITY BETWEEN START-UP SWITCH EXTEND PINS.
ARE START-UP SWITCHES OK?
NO
10 REPAIR OR REPLACE FAULTY START-UP SWITCH (MM27-81-42).
YES
11 REPLACE SLAT POWER DRIVE UNIT (MM27-81-03).
NO
3 CHECK LEFT AND RIGHT SLAT ASYMMETRY BRAKES FOR A TRIPPED BRAKE.
DID EITHER ASYMMETRY BRAKE TRIP (TRIP INDICATOR POPPED OUT)?
YES
12 REFER TO FIG. 108 (ASYMMETRY BRAKE TRIPPED).
NO
4 WHILE OPERATING FLAP HANDLE BETWEEN 0-DEGREE AND 4-DEGREE DETENTS, VERIFY THAT SLAT PDU INPUT ARM MOVES APPROX-IMATELY 45 DEGREES.
IS SLAT PDU INPUT CONTROL SYSTEM OK?
NO
13 CHECK SLAT PDU INPUT, CONTROL SYSTEM RIGGING (REF. MM27-81-00, ADJUSTMENT AND TEST, PARA. 5B).
YES
7 WHILE OPERATING FLAP HANDLE, DID PDU OUTPUT SHAFTS TEND TO ROTATE?
YES
14 JAM IN SLAT DRIVE SYSTEM IS INDICATED. REFER TO FIG. 107.
NO
15 FAILURE IN SLAT PDU IS INDICATED. REPLACE SLAT PDU (MM27-81-30).

NOTE

/1\ POSSIBLE CAUSES:
A LOSS OF BOTH HYD SYS A AND C PRESS.
B JAM IN SLAT DRIVE SYSTEM.
C ASYMMETRY BRAKE OVERSPEED (BRAKE(S) TRIPPED).
D COMMAND SIGNAL REGULATOR LIMIT SWITCHES
E START-UP SWITCHES.

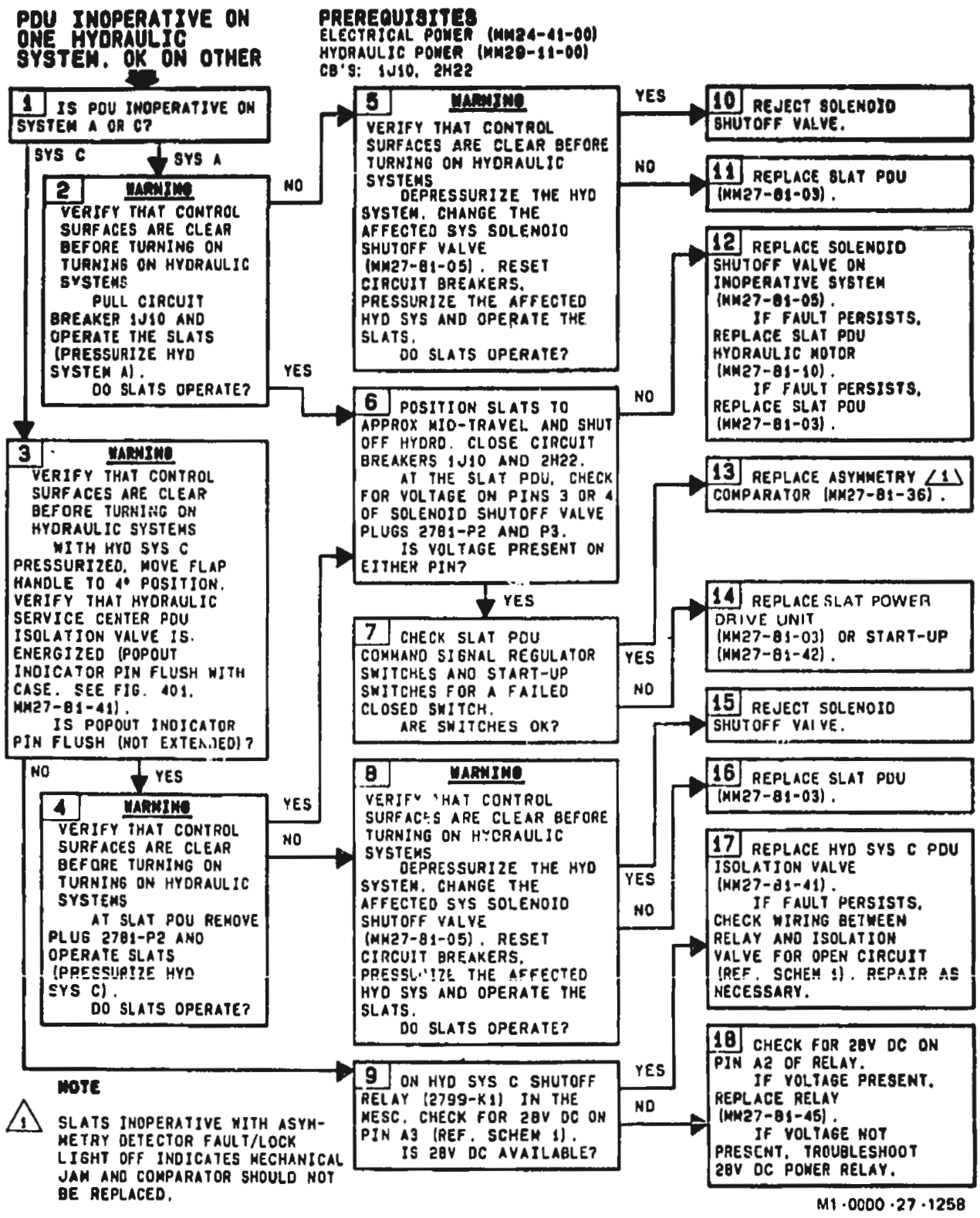
/2\ OPERATING SLATS WITH AC PUMPS MAY CAUSE "JERKY" OPERATION OF SLATS WHICH CAN TRIP THE OVERSPEED GOVERNOR ON EITHER OR BOTH ASYMMETRY BRAKES.

/3\ WITH ELECTRICAL CONNECTORS DISCONNECTED SLAT TRAVEL WILL INCREASE SLIGHTLY IN BOTH DIRECTIONS.

M1-0000-27-1257

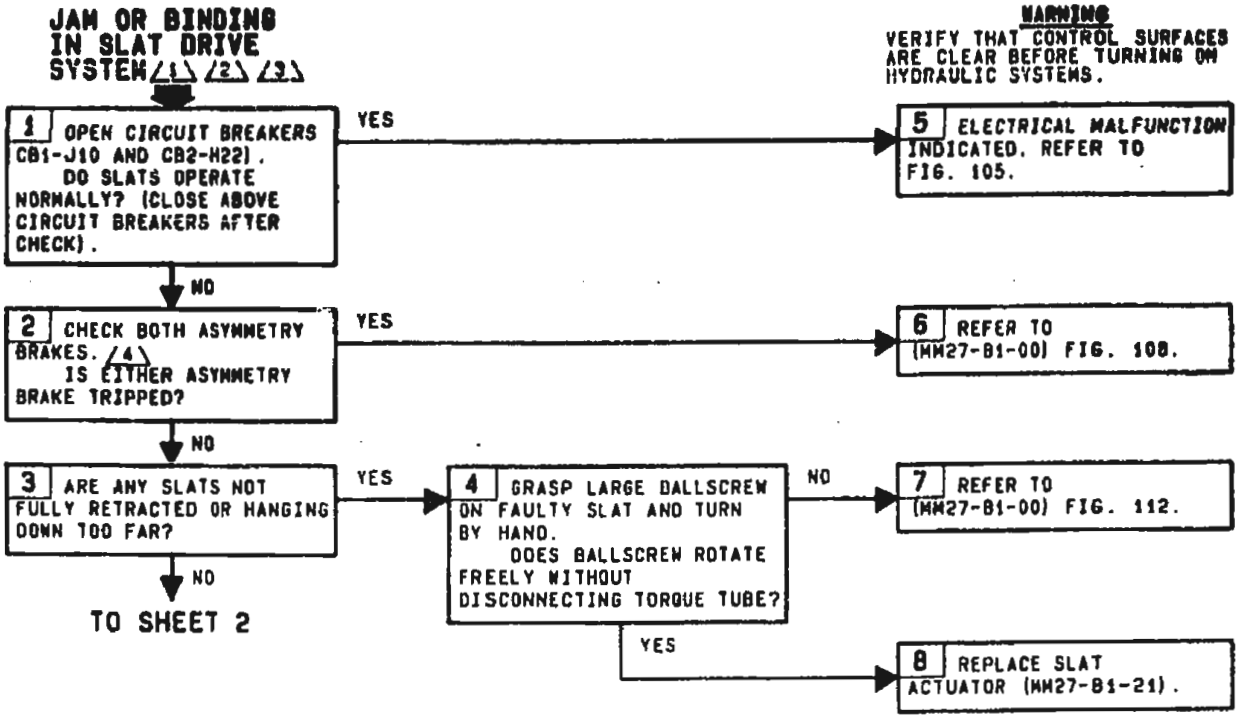
R Slats Inoperative, FLAP/SLAT LOCK Light Off
R Figure 105

EFFECTIVITY: ALL


PDU INOPERATIVE ON ONE HYDRAULIC SYSTEM, OK ON OTHER
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER (MM29-11-00)
CB'S: 1J10, 2H22
1 IS PDU INOPERATIVE ON SYSTEM A OR C?
SYS C
SYS A
2 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON TURNING ON HYDRAULIC SYSTEMS
PULL CIRCUIT BREAKER 1J10 AND OPERATE THE SLATS (PRESSURIZE HYD SYSTEM A).
DO SLATS OPERATE?
NO
YES
3 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS
WITH HYD SYS C PRESSURIZED, MOVE FLAP HANDLE TO 4° POSITION. VERIFY THAT HYDRAULIC SERVICE CENTER PDU ISOLATION VALVE IS ENERGIZED (POPOUT INDICATOR PIN FLUSH WITH CASE. SEE FIG. 401, MM27-81-41).
IS POPOUT INDICATOR PIN FLUSH (NOT EXTENDED)?
NO
YES
4 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON TURNING ON HYDRAULIC SYSTEMS
AT SLAT PDU REMOVE PLUG 2781-P2 AND OPERATE SLATS (PRESSURIZE HYD SYS C).
DO SLATS OPERATE?
YES
NO
5 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS
DEPRESSURIZE THE HYD SYSTEM. CHANGE THE AFFECTED SYS SOLENOID SHUTOFF VALVE (MM27-81-05). RESET CIRCUIT BREAKERS, PRESSURIZE THE AFFECTED HYD SYS AND OPERATE THE SLATS.
DO SLATS OPERATE?
YES
NO
6 POSITION SLATS TO APPROX MID-TRAVEL AND SHUT OFF HYDRO. CLOSE CIRCUIT BREAKERS 1J10 AND 2H22.
AT THE SLAT PDU, CHECK FOR VOLTAGE ON PINS 3 OR 4 OF SOLENOID SHUTOFF VALVE PLUGS 2781-P2 AND P3.
IS VOLTAGE PRESENT ON EITHER PIN?
YES
7 CHECK SLAT PDU COMMAND SIGNAL REGULATOR SWITCHES AND START-UP SWITCHES FOR A FAILED CLOSED SWITCH.
ARE SWITCHES OK?
YES
NO
8 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS
DEPRESSURIZE THE HYD SYSTEM. CHANGE THE AFFECTED SYS SOLENOID SHUTOFF VALVE (MM27-81-05). RESET CIRCUIT BREAKERS, PRESSURIZE THE AFFECTED HYD SYS AND OPERATE THE SLATS.
DO SLATS OPERATE?
YES
NO
9 ON HYD SYS C SHUTOFF RELAY (2799-K1) IN THE MESC, CHECK FOR 28V DC ON PIN A3 (REF. SCHEM 1).
IS 28V DC AVAILABLE?
YES
NO
10 REJECT SOLENOID SHUTOFF VALVE.
11 REPLACE SLAT PDU (MM27-81-03).
12 REPLACE SOLENOID SHUTOFF VALVE ON INOPERATIVE SYSTEM (MM27-81-05).
IF FAULT PERSISTS, REPLACE SLAT PDU HYDRAULIC MOTOR (MM27-81-10).
IF FAULT PERSISTS, REPLACE SLAT PDU (MM27-81-03).
13 REPLACE ASYMMETRY /1\ COMPARATOR (MM27-81-36).
14 REPLACE SLAT POWER DRIVE UNIT (MM27-81-03) OR START-UP (MM27-81-42).
15 REJECT SOLENOID SHUTOFF VALVE.
16 REPLACE SLAT PDU (MM27-81-03).
17 REPLACE HYD SYS C PDU ISOLATION VALVE (MM27-81-41).
IF FAULT PERSISTS, CHECK WIRING BETWEEN RELAY AND ISOLATION VALVE FOR OPEN CIRCUIT (REF. SCHEM 1). REPAIR AS NECESSARY.
18 CHECK FOR 28V DC ON PIN A2 OF RELAY.
IF VOLTAGE PRESENT, REPLACE RELAY (MM27-81-45).
IF VOLTAGE NOT PRESENT, TROUBLESHOOT 28V DC POWER RELAY.
NOTE
/1\ SLATS INOPERATIVE WITH ASYMMETRY DETECTOR FAULT/LOCK LIGHT OFF INDICATES MECHANICAL JAM AND COMPARATOR SHOULD NOT BE REPLACED.
M1-0000-27-1258

R PDU Inoperative On One Hydraulic System, OK On Other
R Figure 106

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER SYS. A AND C (MM29-11-00)
CB'S: CB1-J10, J12, CB2-H22


JAM OR BINDING IN SLAT DRIVE SYSTEM (1) (2) (3)
WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS.
1 OPEN CIRCUIT BREAKERS CB1-J10 AND CB2-H22). DO SLATS OPERATE NORMALLY? (CLOSE ABOVE CIRCUIT BREAKERS AFTER CHECK).
YES
5 ELECTRICAL MALFUNCTION INDICATED. REFER TO FIG. 105.
NO
2 CHECK BOTH ASYMMETRY BRAKES. (4) IS EITHER ASYMMETRY BRAKE TRIPPED?
YES
6 REFER TO (MM27-81-00) FIG. 108.
NO
3 ARE ANY SLATS NOT FULLY RETRACTED OR HANGING DOWN TOO FAR?
YES
4 GRASP LARGE BALLSCREW ON FAULTY SLAT AND TURN BY HAND. DOES BALLSCREW ROTATE FREELY WITHOUT DISCONNECTING TORQUE TUBE?
NO
7 REFER TO (MM27-81-00) FIG. 112.
YES
8 REPLACE SLAT ACTUATOR (MM27-81-21).
NO
TO SHEET 2

NOTE

(1) SLAT ACTUATOR OVERTORQUE INDICATORS ARE PROVIDED TO HELP LOCATE FAULTY COMPONENTS WHEN JAM OR BINDING OCCURES IN SLAT SYSTEM. IF INDICATORS ARE TRIPPED IN ABSENCE OF OTHER FAULT INDICATIONS, RESET TRIPPED INDICATORS AND CYCLE SLATS. IF INDICATORS DO NOT RETRIP, CONSIDER SLAT SYSTEM OPERATIONAL.

(2) SLAT ACTUATOR TORQUE LIMITER INDICATOR SPRINGS WILL NOT RELATCH UNLESS ACTUATOR TORQUE LIMITER BRAKE IS RELEASED. TO RELEASE BRAKE, BACK OFF LOAD AND ROTATE ACTUATOR BALLSCREW INPUT SHAFT OR THE ROTATING NUT IN REVERSE THE DIRECTION THE ACTUATOR WAS TURNING WHEN SYSTEM JAMMED.

(3) IF AIRCRAFT ENCOUNTERED FREEZING CONDITIONS, THE BALLSCREW ACTUATOR MAY HAVE BEEN FROZEN FROM WATER ACCUMULATION DUE TO EXTENSION TUBE HOLES BEING PLUGGED. VERIFY EXTENSION TUBE DRAIN HOLES ARE UNOBSTRUCTED.

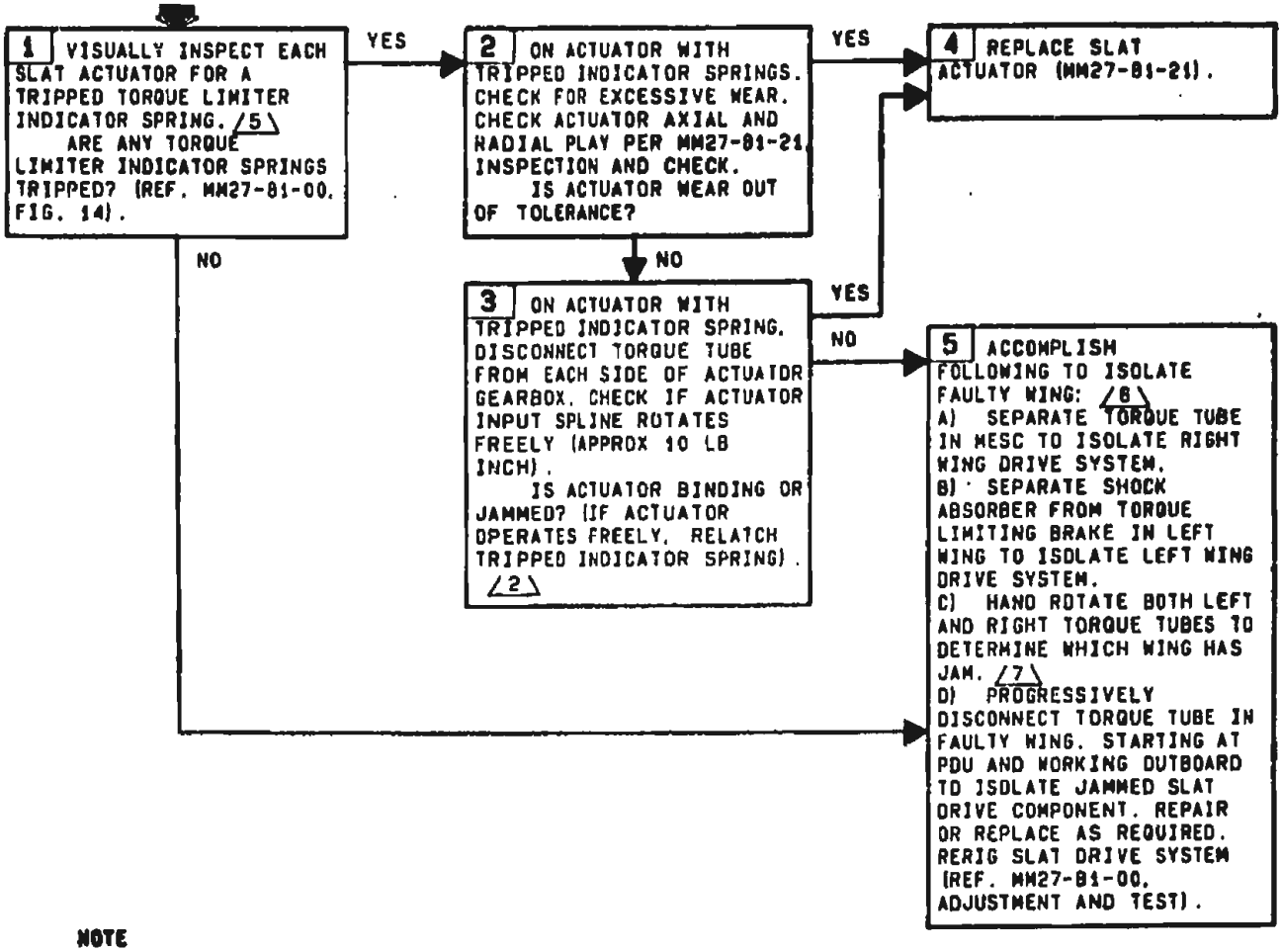
(4) A JAMMED OR BINDING SLAT DRIVE SYSTEM WILL NORMALLY NOT ACTIVATE ASYMMETRY SYSTEM. HOWEVER, OPERATING THE FLAP/SLAT SYSTEMS WITH THE AC PUMPS, WHICH CAUSES 'JERKY' FLAP/SLAT OPERATION, MAY TRIP THE OVERSPEED GOVERNOR IN EITHER OR BOTH ASYMMETRY BRAKES.

M1-0068-27-848

R Jam or Binding In Slat Drive System
R Figure 107 (Sheet 1)

PREREQUISITES
SEE SHEET 1

FROM SHEET 1


1 VISUALLY INSPECT EACH SLAT ACTUATOR FOR A TRIPPED TORQUE LIMITER INDICATOR SPRING. /5\ ARE ANY TORQUE LIMITER INDICATOR SPRINGS TRIPPED? (REF. MM27-81-00, FIG. 14).
YES
2 ON ACTUATOR WITH TRIPPED INDICATOR SPRINGS. CHECK FOR EXCESSIVE WEAR. CHECK ACTUATOR AXIAL AND RADIAL PLAY PER MM27-81-21, INSPECTION AND CHECK. IS ACTUATOR WEAR OUT OF TOLERANCE?
YES
4 REPLACE SLAT ACTUATOR (MM27-81-21).
NO
3 ON ACTUATOR WITH TRIPPED INDICATOR SPRING, DISCONNECT TORQUE TUBE FROM EACH SIDE OF ACTUATOR GEARBOX. CHECK IF ACTUATOR INPUT SPLINE ROTATES FREELY (APPROX 10 LB INCH). IS ACTUATOR BINDING OR JAMMED? (IF ACTUATOR OPERATES FREELY, RELATCH TRIPPED INDICATOR SPRING). /2\
YES
NO
5 ACCOMPLISH FOLLOWING TO ISOLATE FAULTY WING: /6\
A) SEPARATE TORQUE TUBE IN MESC TO ISOLATE RIGHT WING DRIVE SYSTEM.
B) SEPARATE SHOCK ABSORBER FROM TORQUE LIMITING BRAKE IN LEFT WING TO ISOLATE LEFT WING DRIVE SYSTEM.
C) HAND ROTATE BOTH LEFT AND RIGHT TORQUE TUBES TO DETERMINE WHICH WING HAS JAM. /7\
D) PROGRESSIVELY DISCONNECT TORQUE TUBE IN FAULTY WING. STARTING AT PDU AND WORKING OUTBOARD TO ISOLATE JAMMED SLAT DRIVE COMPONENT. REPAIR OR REPLACE AS REQUIRED. RERIG SLAT DRIVE SYSTEM (REF. MM27-81-00, ADJUSTMENT AND TEST).

NOTE

/2\ SLAT ACTUATOR TORQUE LIMITER INDICATOR SPRINGS WILL NOT RELATCH UNLESS ACTUATOR TORQUE LIMITER BRAKE IS RELEASED. TO RELEASE BRAKE, BACK OFF LOAD AND ROTATE ACTUATOR BALLSCREW INPUT SHAFT OR THE ROTATING NUT IN REVERSE OF THE DIRECTION THE ACTUATOR WAS TURNING WHEN SYSTEM JAMMED.

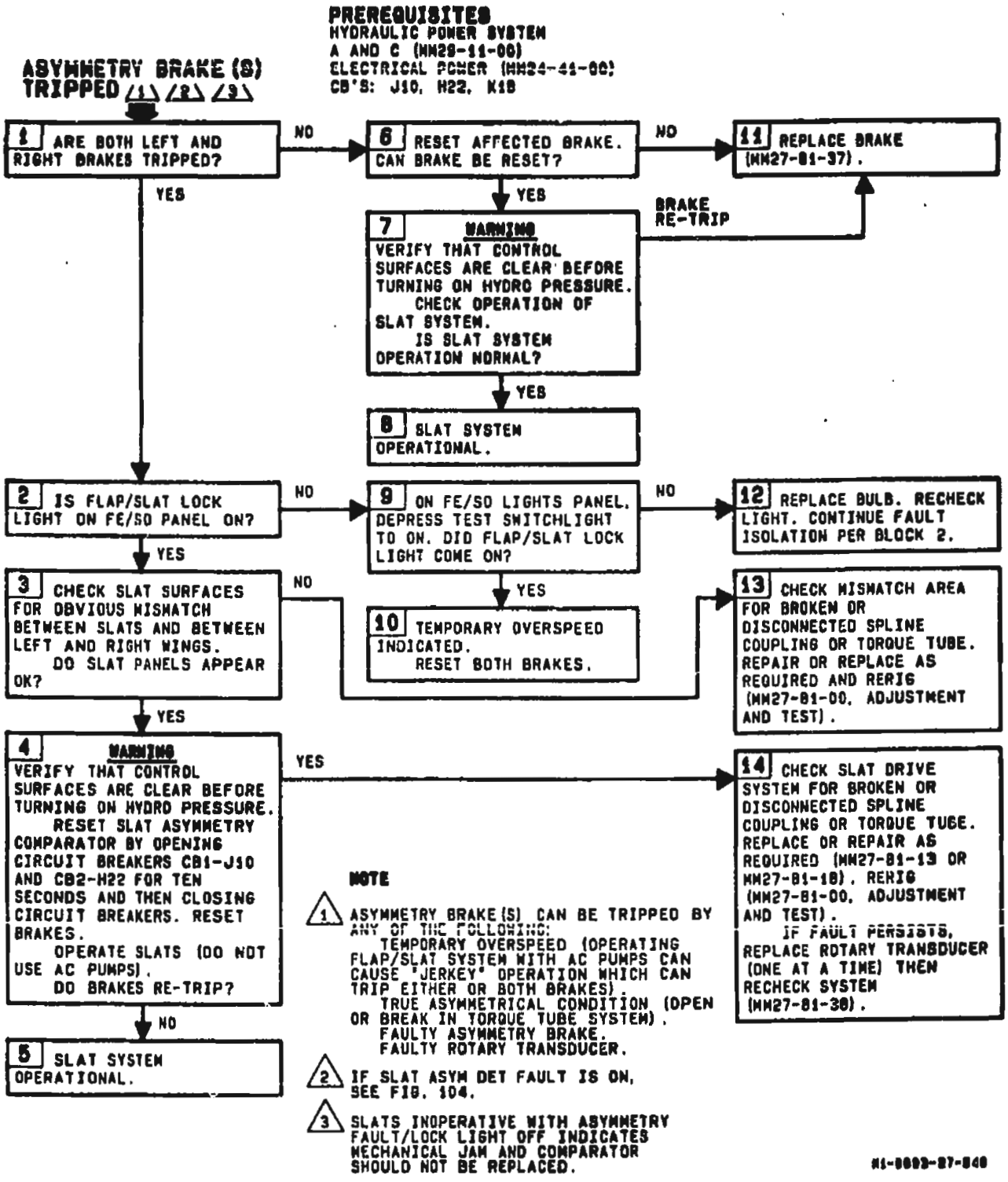
/5\ SLAT ACTUATOR TORQUE LIMITER INDICATOR SPRINGS ARE LOCATED ON ACTUATOR GEARBOX (INBOARD SIDE, LEFT WING; OUTBOARD SIDE, RIGHT WING). INDICATOR CAN BE VIEWED THROUGH SLOT IN WING LEADING EDGE IF SLATS ARE EXTENDED. IF SLATS ARE RETRACTED, OPEN LOWER LE ACCESS DOORS.

/6\ TO PRECLUDE AN UNEXPECTED SLAT EXTENSION UPON DISCONNECTION OF SLAT TORQUE TUBES FROM THE GEAR BOX, SLAT ASYMMETRY BRAKES MUST BE TRIPPED PRIOR TO DISCONNECTING THE TORQUE SHAFT (REF. MM27-81-37, 501).

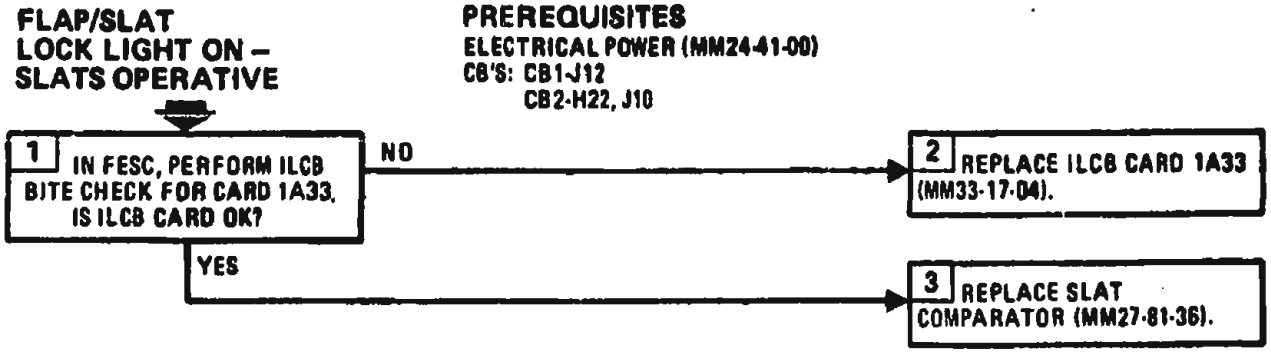
/7\ A JAM IN THE SLAT DRIVE SYSTEM WILL CAUSE WING TORQUE LIMITING BRAKE IN JAMMED WING TO LOCK. TO RELEASE, REMOVE LOAD AND REVERSE TORQUE TUBE ROTATION.

M1-0000-27-1114

R Jam or Binding in Slat Drive System
R Figure 107 (Sheet 2)


PREREQUISITES
HYDRAULIC POWER SYSTEM
A AND C (MM29-11-00)
ELECTRICAL POWER (MM24-41-00)
CB'S: J10, H22, K18
ASYMMETRY BRAKE (S) TRIPPED /1\ /2\ /3\
1 ARE BOTH LEFT AND RIGHT BRAKES TRIPPED?
NO
6 RESET AFFECTED BRAKE. CAN BRAKE BE RESET?
NO
11 REPLACE BRAKE (MM27-81-37).
YES
YES
BRAKE RE-TRIP
7 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE.
CHECK OPERATION OF SLAT SYSTEM.
IS SLAT SYSTEM OPERATION NORMAL?
YES
8 SLAT SYSTEM OPERATIONAL.
2 IS FLAP/SLAT LOCK LIGHT ON FE/SO PANEL ON?
NO
9 ON FE/SO LIGHTS PANEL, DEPRESS TEST SWITCHLIGHT TO ON. DID FLAP/SLAT LOCK LIGHT COME ON?
NO
12 REPLACE BULB. RECHECK LIGHT. CONTINUE FAULT ISOLATION PER BLOCK 2.
YES
YES
3 CHECK SLAT SURFACES FOR OBVIOUS MISMATCH BETWEEN SLATS AND BETWEEN LEFT AND RIGHT WINGS.
DO SLAT PANELS APPEAR OK?
NO
10 TEMPORARY OVERSPEED INDICATED.
RESET BOTH BRAKES.
13 CHECK MISMATCH AREA FOR BROKEN OR DISCONNECTED SPLINE COUPLING OR TORQUE TUBE. REPAIR OR REPLACE AS REQUIRED AND RERIG (MM27-81-00, ADJUSTMENT AND TEST).
YES
4 WARNING
VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRO PRESSURE.
RESET SLAT ASYMMETRY COMPARATOR BY OPENING CIRCUIT BREAKERS CB1-J10 AND CB2-H22 FOR TEN SECONDS AND THEN CLOSING CIRCUIT BREAKERS. RESET BRAKES.
OPERATE SLATS (DO NOT USE AC PUMPS).
DO BRAKES RE-TRIP?
YES
14 CHECK SLAT DRIVE SYSTEM FOR BROKEN OR DISCONNECTED SPLINE COUPLING OR TORQUE TUBE. REPLACE OR REPAIR AS REQUIRED (MM27-81-13 OR MM27-81-18). RERIG (MM27-81-00, ADJUSTMENT AND TEST).
IF FAULT PERSISTS, REPLACE ROTARY TRANSDUCER (ONE AT A TIME) THEN RECHECK SYSTEM (MM27-81-30).
NO
5 SLAT SYSTEM OPERATIONAL.
NOTE
1 ASYMMETRY BRAKE(S) CAN BE TRIPPED BY ANY OF THE FOLLOWING:
TEMPORARY OVERSPEED (OPERATING FLAP/SLAT SYSTEM WITH AC PUMPS CAN CAUSE "JERKEY" OPERATION WHICH CAN TRIP EITHER OR BOTH BRAKES).
TRUE ASYMMETRICAL CONDITION (OPEN OR BREAK IN TORQUE TUBE SYSTEM).
FAULTY ASYMMETRY BRAKE.
FAULTY ROTARY TRANSDUCER.
2 IF SLAT ASYM DET FAULT IS ON, SEE FIG. 104.
3 SLATS INOPERATIVE WITH ASYMMETRY FAULT/LOCK LIGHT OFF INDICATES MECHANICAL JAM AND COMPARATOR SHOULD NOT BE REPLACED.

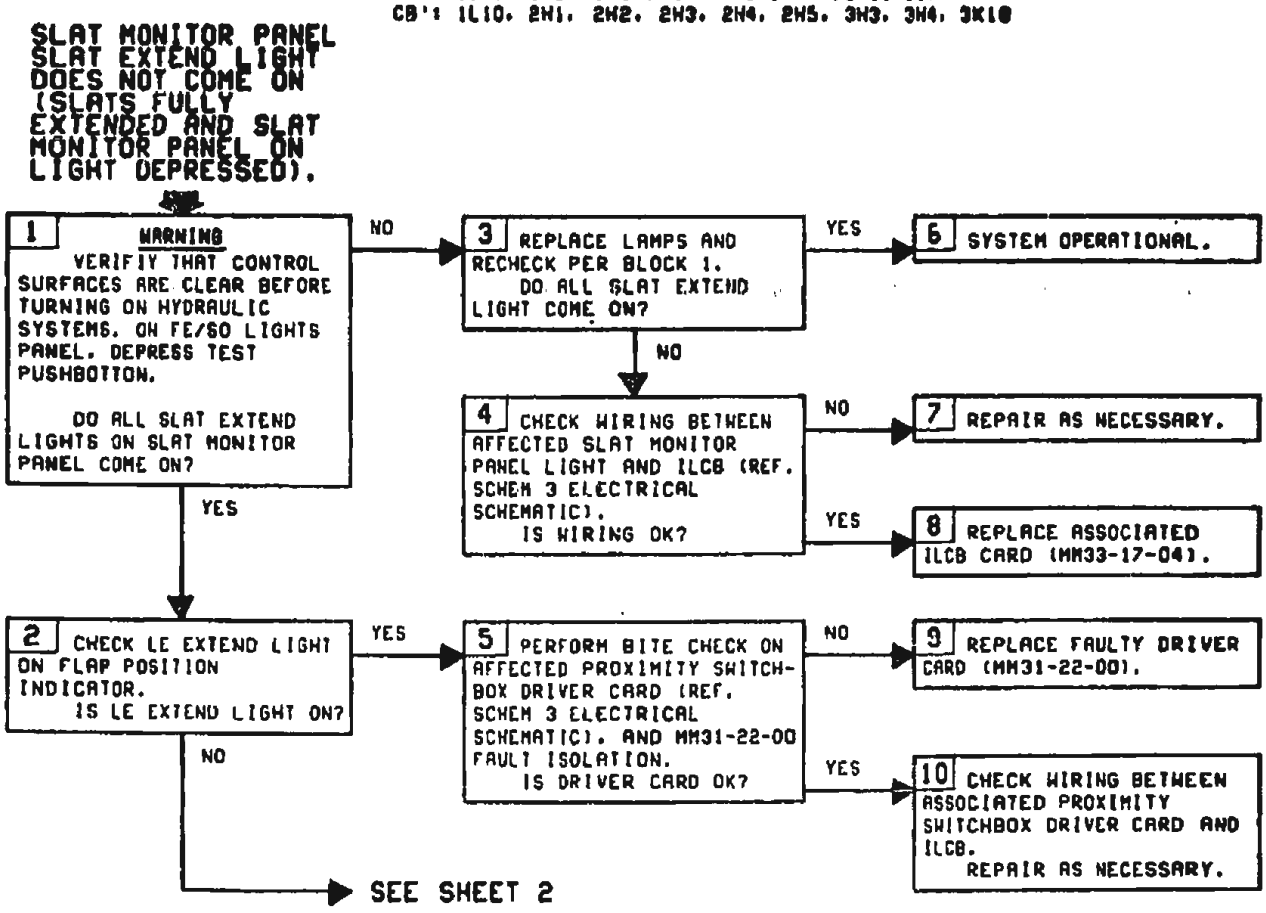
Asymmetry Brake Tripped
Figure 108



M1-0002-27-949

FLAP/SLAT LOCK Light On - Slats Operative
Figure 109

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER SYSTEMS A AND C (MM29-11-00)
CB's 1L10, 2H1, 2H2, 2H3, 2H4, 2H5, 3H3, 3H4, 3K10


SLAT MONITOR PANEL SLAT EXTEND LIGHT DOES NOT COME ON (SLATS FULLY EXTENDED AND SLAT MONITOR PANEL ON LIGHT DEPRESSED).
1 WARNING VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS. ON FE/SO LIGHTS PANEL, DEPRESS TEST PUSHBOTTON. DO ALL SLAT EXTEND LIGHTS ON SLAT MONITOR PANEL COME ON?
NO
3 REPLACE LAMPS AND RECHECK PER BLOCK 1. DO ALL SLAT EXTEND LIGHT COME ON?
YES
6 SYSTEM OPERATIONAL.
NO
4 CHECK WIRING BETWEEN AFFECTED SLAT MONITOR PANEL LIGHT AND ILCB (REF. SCHEM 3 ELECTRICAL SCHEMATIC). IS WIRING OK?
NO
7 REPAIR AS NECESSARY.
YES
8 REPLACE ASSOCIATED ILCB CARD (MM33-17-04).
YES
2 CHECK LE EXTEND LIGHT ON FLAP POSITION INDICATOR. IS LE EXTEND LIGHT ON?
YES
5 PERFORM BITE CHECK ON AFFECTED PROXIMITY SWITCH-BOX DRIVER CARD (REF. SCHEM 3 ELECTRICAL SCHEMATIC), AND MM31-22-00 FAULT ISOLATION. IS DRIVER CARD OK?
NO
9 REPLACE FAULTY DRIVER CARD (MM31-22-00).
YES
10 CHECK WIRING BETWEEN ASSOCIATED PROXIMITY SWITCHBOX DRIVER CARD AND ILCB. REPAIR AS NECESSARY.
NO
SEE SHEET 2

NOTE

INTERMITTENT FAULTS OR FAULTS NOT CORRECTED BY NORMAL PROCEDURES MAY BE CORRECTED BY ONE OR ALL OF THE FOLLOWING STEPS.

1 INSTALL A JUMPER WIRE FORM SENSOR GROUND STUD TO ADJACENT SENSOR GROUND STUD.

2 RESET ALL PROXIMITY SWITCH CARD BOX SWITCH CARDS AND DRIVER CARDS.

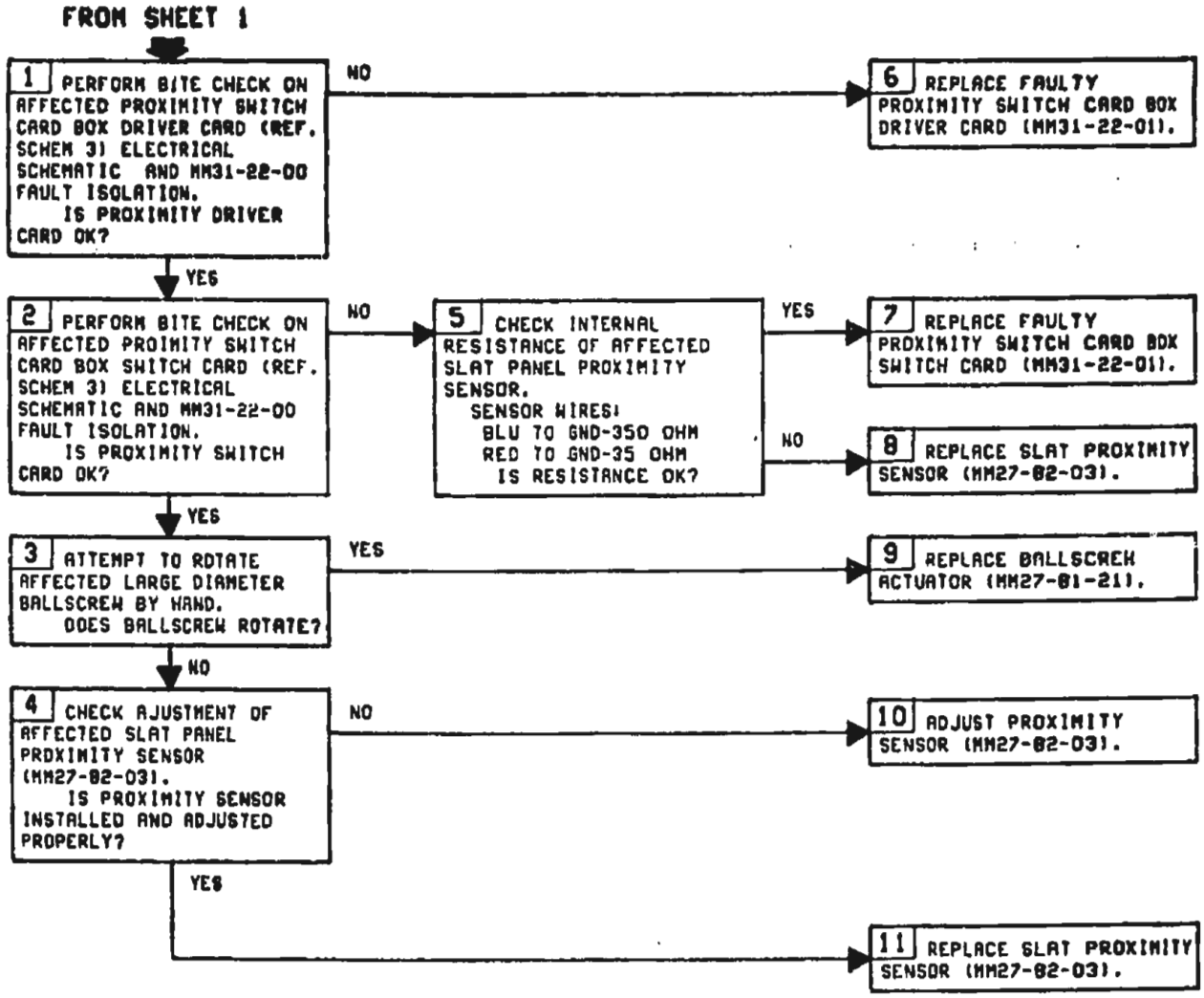
3 PLACE A STRIP OF ADHESIVE MYLAR TAPE ON TARGET FACE.

4 VERIFY TARGET IS MADE OF HI-MU 80 MATERIAL.

HI-0006-27-293

SLAT MONITOR Panel Slat Extend (Segment) Light(s) Does Not Come ON
Figure 110 (Sheet 1)

PREREQUISITES
SEE SHEET 1


FROM SHEET 1
1 PERFORM BITE CHECK ON AFFECTED PROXIMITY SWITCH CARD BOX DRIVER CARD (REF. SCHEM 3) ELECTRICAL SCHEMATIC AND MM31-22-00 FAULT ISOLATION. IS PROXIMITY DRIVER CARD OK?
NO
6 REPLACE FAULTY PROXIMITY SWITCH CARD BOX DRIVER CARD (MM31-22-01).
YES
2 PERFORM BITE CHECK ON AFFECTED PROIMITY SWITCH CARD BOX SWITCH CARD (REF. SCHEM 3) ELECTRICAL SCHEMATIC AND MM31-22-00 FAULT ISOLATION. IS PROXIMITY SWITCH CARD OK?
NO
5 CHECK INTERNAL RESISTANCE OF AFFECTED SLAT PANEL PROXIMITY SENSOR. SENSOR WIRES: BLU TO GND-350 OHM RED TO GND-35 OHM IS RESISTANCE OK?
YES
7 REPLACE FAULTY PROXIMITY SWITCH CARD BOX SWITCH CARD (MM31-22-01).
NO
8 REPLACE SLAT PROXIMITY SENSOR (MM27-82-03).
YES
3 ATTEMPT TO ROTATE AFFECTED LARGE DIAMETER BALLSCREW BY HAND. DOES BALLSCREW ROTATE?
YES
9 REPLACE BALLSCREW ACTUATOR (MM27-81-21).
NO
4 CHECK AJUSTMENT OF AFFECTED SLAT PANEL PROXIMITY SENSOR (MM27-82-03). IS PROXIMITY SENSOR INSTALLED AND ADJUSTED PROPERLY?
NO
10 ADJUST PROXIMITY SENSOR (MM27-82-03).
YES
11 REPLACE SLAT PROXIMITY SENSOR (MM27-82-03).

M1-0001-87-1010

SLAT MONITOR Panel Slat Extend (Segment) Light(s)
Does Not Come ON
Figure 110 (Sheet 2)

ONE OR MORE SLAT SEGMENT EXTEND LIGHTS ON SLAT MONITOR PANEL STAY ON WITH SLATS RETRACTED

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: 1L10, 3H3, 3K18

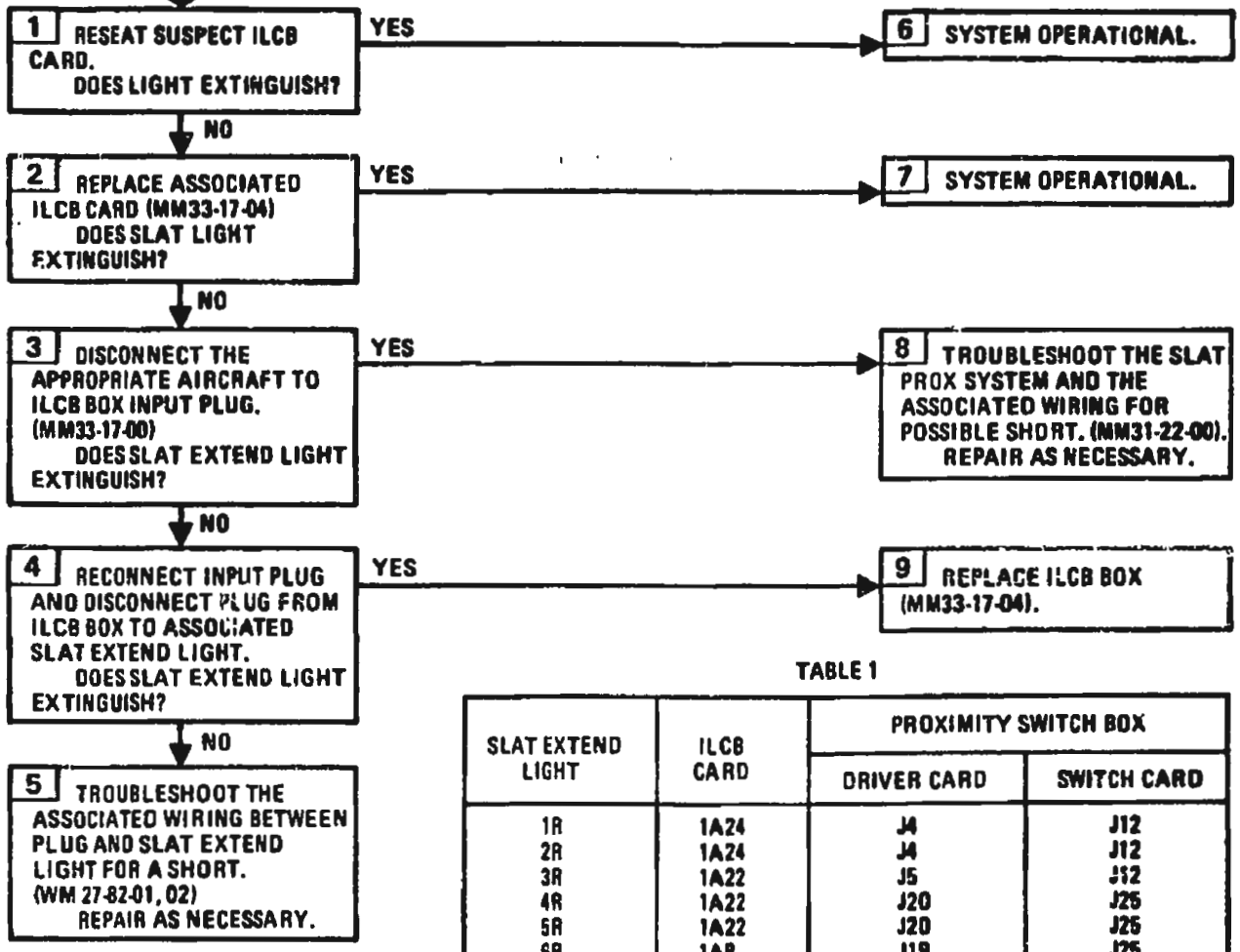
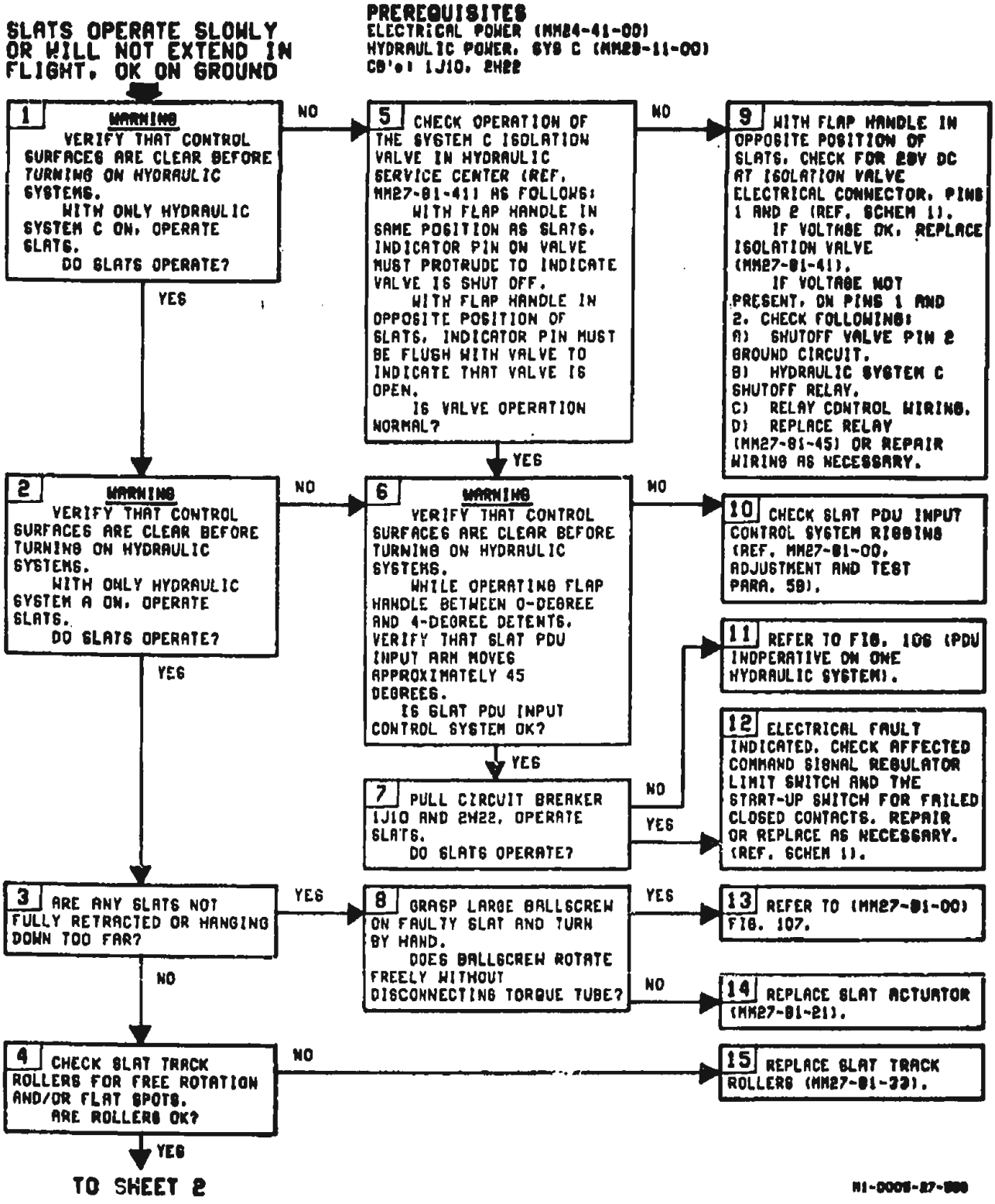

1 RESEAT SUSPECT ILCB CARD. DOES LIGHT EXTINGUISH?
YES
6 SYSTEM OPERATIONAL.
NO
2 REPLACE ASSOCIATED ILCB CARD (MM33-17-04) DOES SLAT LIGHT EXTINGUISH?
YES
7 SYSTEM OPERATIONAL.
NO
3 DISCONNECT THE APPROPRIATE AIRCRAFT TO ILCB BOX INPUT PLUG. (MM33-17-00) DOES SLAT EXTEND LIGHT EXTINGUISH?
YES
8 TROUBLESHOOT THE SLAT PROX SYSTEM AND THE ASSOCIATED WIRING FOR POSSIBLE SHORT. (MM31-22-00). REPAIR AS NECESSARY.
NO
4 RECONNECT INPUT PLUG AND DISCONNECT PLUG FROM ILCB BOX TO ASSOCIATED SLAT EXTEND LIGHT. DOES SLAT EXTEND LIGHT EXTINGUISH?
YES
9 REPLACE ILCB BOX (MM33-17-04).
NO
5 TROUBLESHOOT THE ASSOCIATED WIRING BETWEEN PLUG AND SLAT EXTEND LIGHT FOR A SHORT. (WM 27-82-01, 02) REPAIR AS NECESSARY.

TABLE 1

SLAT EXTEND LIGHT	ILCB CARD	PROXIMITY SWITCH BOX	
		DRIVER CARD	SWITCH CARD
1R	1A24	J4	J12
2R	1A24	J4	J12
3R	1A22	J5	J12
4R	1A22	J20	J25
5R	1A22	J20	J25
6R	1A8	J19	J25
7R	1A8	J20	J25
1L	1A28	J5	J14
2L	1A28	J5	J14
3L	1A28	J5	J14
4L	1A28	J5	J14
5L	1A31	J17	J22
6L	1A31	J17	J22
7L	1A31	J17	J22

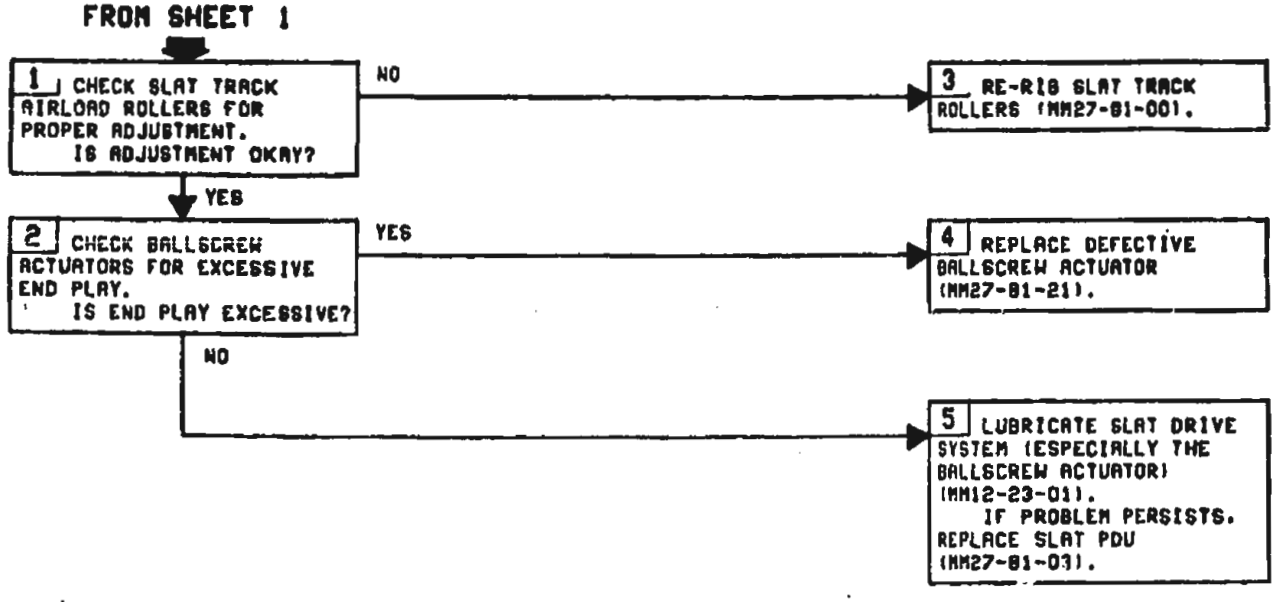
M1-0103-27-480

Slat Extend (Segment) Light on Slat Monitor Panel Stays On
Figure 111


SLATS OPERATE SLOWLY OR WILL NOT EXTEND IN FLIGHT, OK ON GROUND
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER, SYS C (MM29-11-00)
CB's: 1J10, 2H22
1 WARNING VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS. WITH ONLY HYDRAULIC SYSTEM C ON, OPERATE SLATS. DO SLATS OPERATE?
NO
YES
2 WARNING VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS. WITH ONLY HYDRAULIC SYSTEM A ON, OPERATE SLATS. DO SLATS OPERATE?
NO
YES
3 ARE ANY SLATS NOT FULLY RETRACTED OR HANGING DOWN TOO FAR?
YES
NO
4 CHECK SLAT TRACK ROLLERS FOR FREE ROTATION AND/OR FLAT SPOTS. ARE ROLLERS OK?
NO
YES
TO SHEET 2
5 CHECK OPERATION OF THE SYSTEM C ISOLATION VALVE IN HYDRAULIC SERVICE CENTER (REF. MM27-81-41) AS FOLLOWS: WITH FLAP HANDLE IN SAME POSITION AS SLATS, INDICATOR PIN ON VALVE MUST PROTRUDE TO INDICATE VALVE IS SHUT OFF. WITH FLAP HANDLE IN OPPOSITE POSITION OF SLATS, INDICATOR PIN MUST BE FLUSH WITH VALVE TO INDICATE THAT VALVE IS OPEN. IS VALVE OPERATION NORMAL?
NO
YES
6 WARNING VERIFY THAT CONTROL SURFACES ARE CLEAR BEFORE TURNING ON HYDRAULIC SYSTEMS. WHILE OPERATING FLAP HANDLE BETWEEN 0-DEGREE AND 4-DEGREE DETENTS, VERIFY THAT SLAT PDU INPUT ARM MOVES APPROXIMATELY 45 DEGREES. IS SLAT PDU INPUT CONTROL SYSTEM OK?
NO
YES
7 PULL CIRCUIT BREAKER 1J10 AND 2H22, OPERATE SLATS. DO SLATS OPERATE?
NO
YES
8 GRASP LARGE BALLSCREW ON FAULTY SLAT AND TURN BY HAND. DOES BALLSCREW ROTATE FREELY WITHOUT DISCONNECTING TORQUE TUBE?
YES
NO
9 WITH FLAP HANDLE IN OPPOSITE POSITION OF SLATS, CHECK FOR 28V DC AT ISOLATION VALVE ELECTRICAL CONNECTOR, PINS 1 AND 2 (REF. SCHEM 1). IF VOLTAGE OK, REPLACE ISOLATION VALVE (MM27-81-41). IF VOLTAGE NOT PRESENT, ON PINS 1 AND 2, CHECK FOLLOWING: A) SHUTOFF VALVE PIN 2 GROUND CIRCUIT. B) HYDRAULIC SYSTEM C SHUTOFF RELAY. C) RELAY CONTROL WIRING. D) REPLACE RELAY (MM27-81-45) OR REPAIR WIRING AS NECESSARY.
10 CHECK SLAT PDU INPUT CONTROL SYSTEM RIGGING (REF. MM27-81-00, ADJUSTMENT AND TEST PARA. 50).
11 REFER TO FIG. 106 (PDU INOPERATIVE ON ONE HYDRAULIC SYSTEM).
12 ELECTRICAL FAULT INDICATED, CHECK AFFECTED COMMAND SIGNAL REGULATOR LIMIT SWITCH AND THE START-UP SWITCH FOR FAILED CLOSED CONTACTS. REPAIR OR REPLACE AS NECESSARY. (REF. SCHEM 1).
13 REFER TO (MM27-81-00) FIG. 107.
14 REPLACE SLAT ACTUATOR (MM27-81-21).
15 REPLACE SLAT TRACK ROLLERS (MM27-81-33).

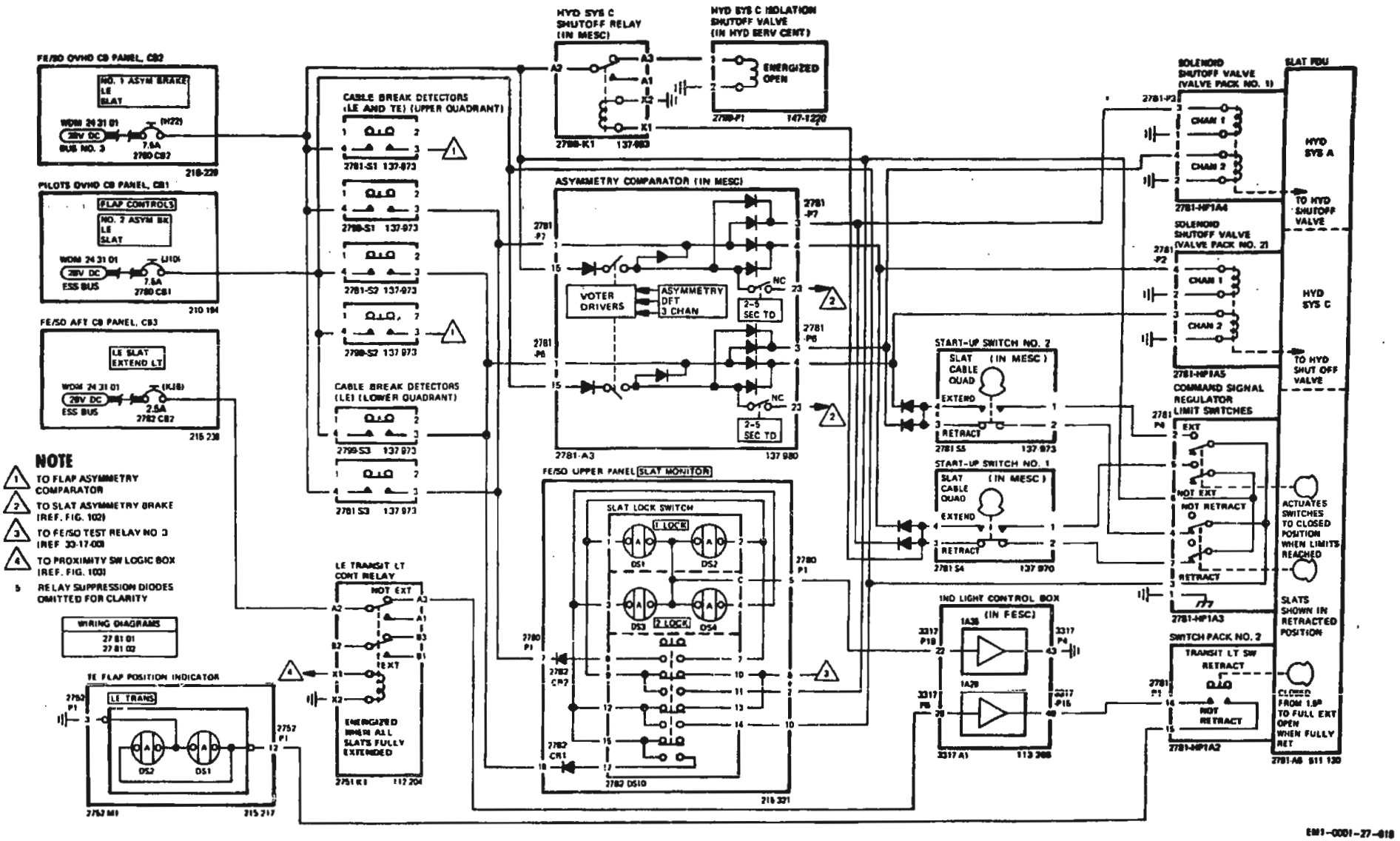
Slats Operate Slowly or Will Not Extend in Flight, OK on Ground
Figure 112 (Sheet 1)

PREREQUISITES
(SEE SHEET 1)


FROM SHEET 1
1 CHECK SLAT TRACK AIRLOAD ROLLERS FOR PROPER ADJUSTMENT. IS ADJUSTMENT OKAY?
NO
3 RE-RIG SLAT TRACK ROLLERS (MM27-81-001).
YES
2 CHECK BALLSCREW ACTUATORS FOR EXCESSIVE END PLAY. IS END PLAY EXCESSIVE?
YES
4 REPLACE DEFECTIVE BALLSCREW ACTUATOR (MM27-81-21).
NO
5 LUBRICATE SLAT DRIVE SYSTEM (ESPECIALLY THE BALLSCREW ACTUATOR) (MM12-23-01). IF PROBLEM PERSISTS, REPLACE SLAT PDU (MM27-81-03).

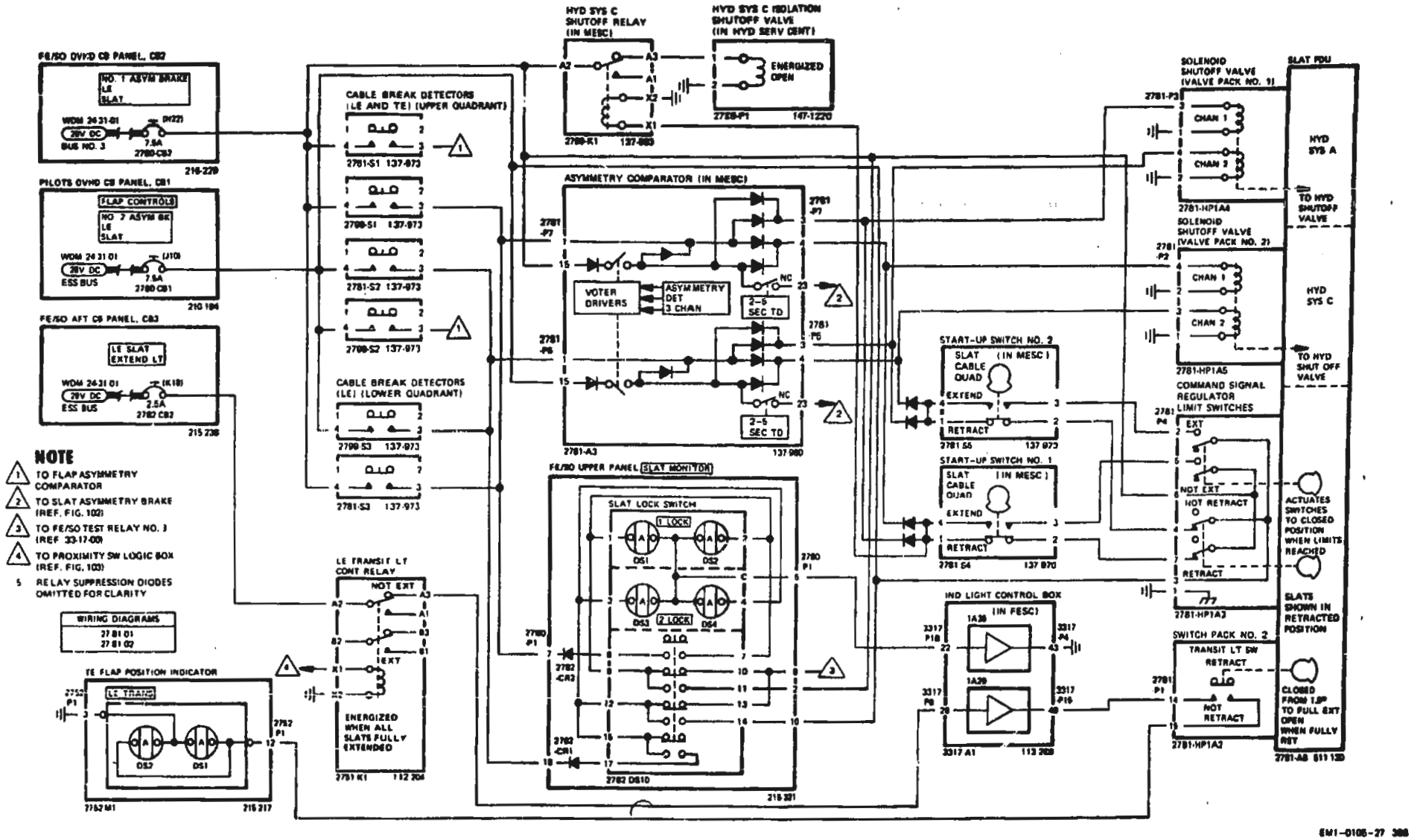
M1-0001-27-007

Slats Operate Slowly or Will Not Extend in Flight, or on Ground
Figure 112 (Sheet 2)


HYD SYS C SHUTOFF RELAY (IN MESC)
HYD SYS C ISOLATION SHUTOFF VALVE (IN HYD SERV CENT)
ENERGIZED OPEN
FE/SO OVHD CB PANEL, CB2
NO. 1 ASYM BRAKE LE SLAT
PILOTS OVHD CB PANEL, CB1
FLAP CONTROLS
NO. 2 ASYM BK LE SLAT
FE/SO AFT CB PANEL, CB3
LE SLAT EXTEND LT
CABLE BREAK DETECTORS (LE AND TE) (UPPER QUADRANT)
CABLE BREAK DETECTORS (LE) (LOWER QUADRANT)
ASYMMETRY COMPARATOR (IN MESC)
VOTER DRIVERS
ASYMMETRY DFT 3 CHAN
2-5 SEC TD
FE/SO UPPER PANEL SLAT MONITOR
SLAT LOCK SWITCH
1 LOCK
2 LOCK
LE TRANSIT LT CONT RELAY
NOT EXT
EXT
ENERGIZED WHEN ALL SLATS FULLY EXTENDED
TE FLAP POSITION INDICATOR
LE TRANS
START-UP SWITCH NO. 2
START-UP SWITCH NO. 1
SLAT CABLE QUAD
EXTEND
RETRACT
IND LIGHT CONTROL BOX (IN FESC)
SOLENOID SHUTOFF VALVE (VALVE PACK NO. 1)
SOLENOID SHUTOFF VALVE (VALVE PACK NO. 2)
CHAN 1
CHAN 2
SLAT PDU
HYD SYS A
HYD SYS C
TO HYD SHUTOFF VALVE
COMMAND SIGNAL REGULATOR
LIMIT SWITCHES
NOT RETRACT
ACTUATES SWITCHES TO CLOSED POSITION WHEN LIMITS REACHED
SLATS SHOWN IN RETRACTED POSITION
SWITCH PACK NO. 2
TRANSIT LT SW RETRACT
CLOSED FROM 1.8° TO FULL EXT OPEN WHEN FULLY RET
NOTE
1 TO FLAP ASYMMETRY COMPARATOR
2 TO SLAT ASYMMETRY BRAKE (REF. FIG. 102)
3 TO FE/SO TEST RELAY NO 3 (REF 30-17-00)
4 TO PROXIMITY SW LOGIC BOX (REF. FIG. 103)
5 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
WIRING DIAGRAMS
27 81 01
27 81 02

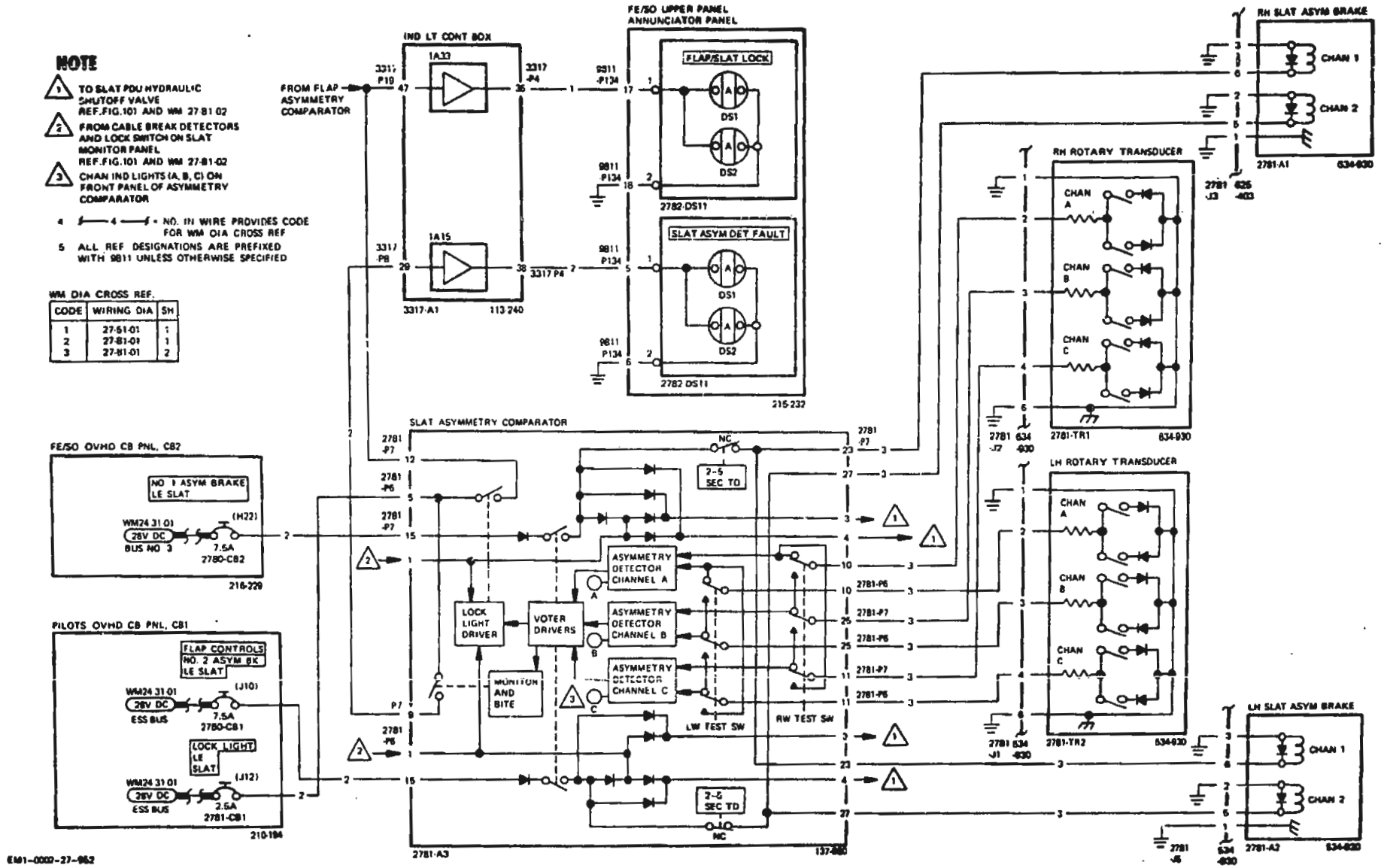
LE Slat Control System Electrical Schematic
SCHEM 1

R EFFECTIVITY: 001-023
R
001B


HYD SYS C SHUTOFF RELAY (IN MESC)
HYD SYS C ISOLATION SHUTOFF VALVE (IN HYD SERV CENT)
ENERGIZED OPEN
FE/SO OVHD CB PANEL, CB2
NO. 1 ASYM BRAKE LE SLAT
PILOTS OVHD CB PANEL, CB1
FLAP CONTROLS
NO. 2 ASYM BK LE SLAT
FE/SO AFT CB PANEL, CB3
LE SLAT EXTEND LT
CABLE BREAK DETECTORS (LE AND TE) (UPPER QUADRANT)
CABLE BREAK DETECTORS (LE) (LOWER QUADRANT)
ASYMMETRY COMPARATOR (IN MESC)
VOTER DRIVERS
ASYMMETRY DET 3 CHAN
2-5 SEC TD
FE/SO UPPER PANEL SLAT MONITOR
SLAT LOCK SWITCH
1 LOCK
2 LOCK
LE TRANSIT LT CONT RELAY
NOT EXT
EXT
ENERGIZED WHEN ALL SLATS FULLY EXTENDED
TE FLAP POSITION INDICATOR
LE TRANS
START-UP SWITCH NO. 2
START-UP SWITCH NO. 1
SLAT CABLE QUAD
EXTEND
RETRACT
IND LIGHT CONTROL BOX (IN FESC)
SOLENOID SHUTOFF VALVE (VALVE PACK NO. 1)
SOLENOID SHUTOFF VALVE (VALVE PACK NO. 2)
CHAN 1
CHAN 2
COMMAND SIGNAL REGULATOR LIMIT SWITCHES
EXT
NOT EXT
NOT RETRACT
RETRACT
SWITCH PACK NO. 2
TRANSIT LT SW RETRACT
NOT RETRACT
SLAT PDU
HYD SYS A
HYD SYS C
TO HYD SHUTOFF VALVE
TO HYD SHUT OFF VALVE
ACTUATES SWITCHES TO CLOSED POSITION WHEN LIMITS REACHED
SLATS SHOWN IN RETRACTED POSITION
CLOSED FROM 1.5P TO FULL EXT OPEN WHEN FULLY RET
NOTE
1 TO FLAP ASYMMETRY COMPARATOR
2 TO SLAT ASYMMETRY BRAKE (REF. FIG. 102)
3 TO FE/SO TEST RELAY NO. 3 (REF. 33-17-00)
4 TO PROXIMITY SW LOGIC BOX (REF. FIG. 103)
5 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
WIRING DIAGRAMS
27 81 01
27 81 02

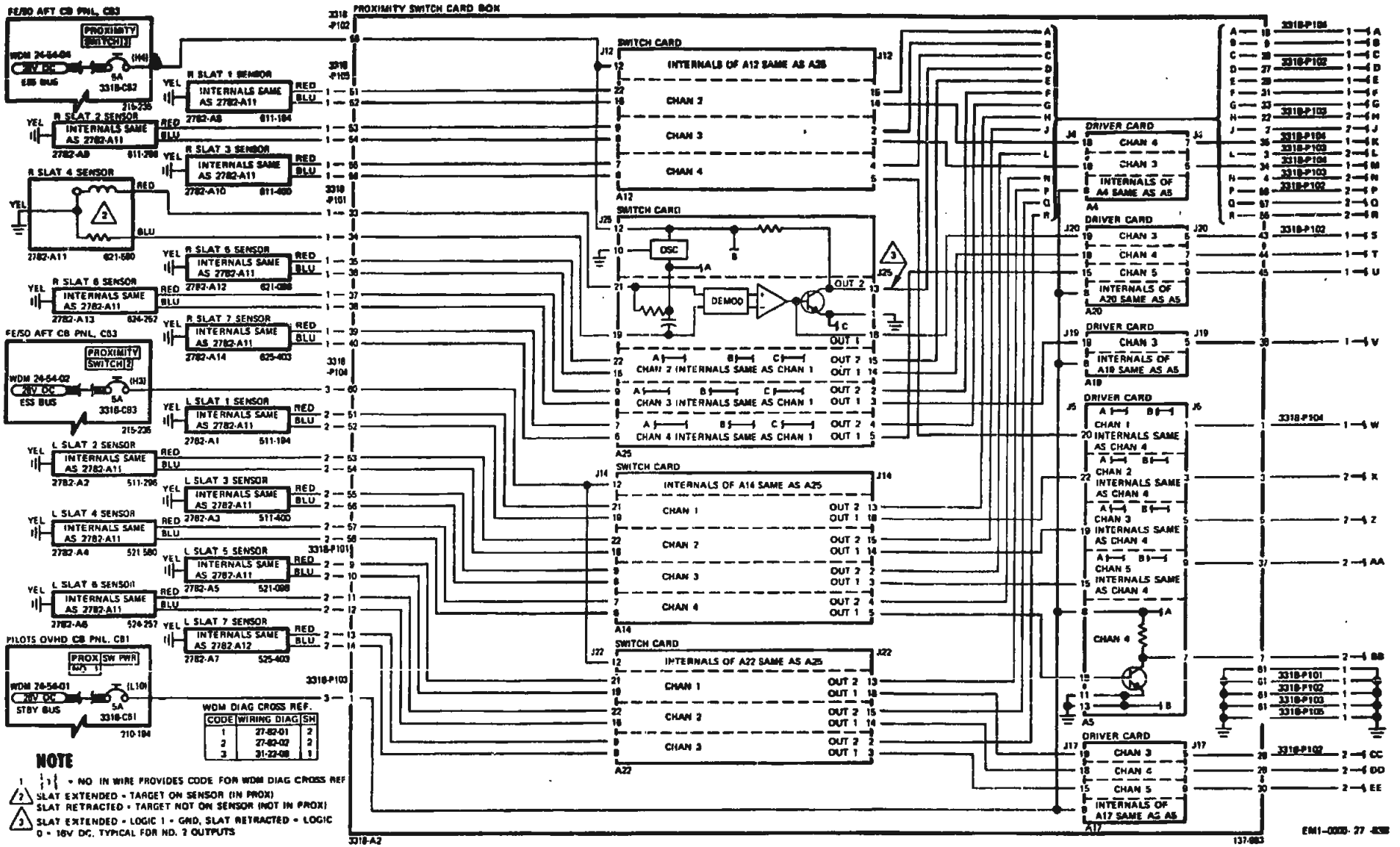
LE Slat Control System Electrical Schematic
SCHEM 1

R EFFECTIVITY: 024-999
R
001B



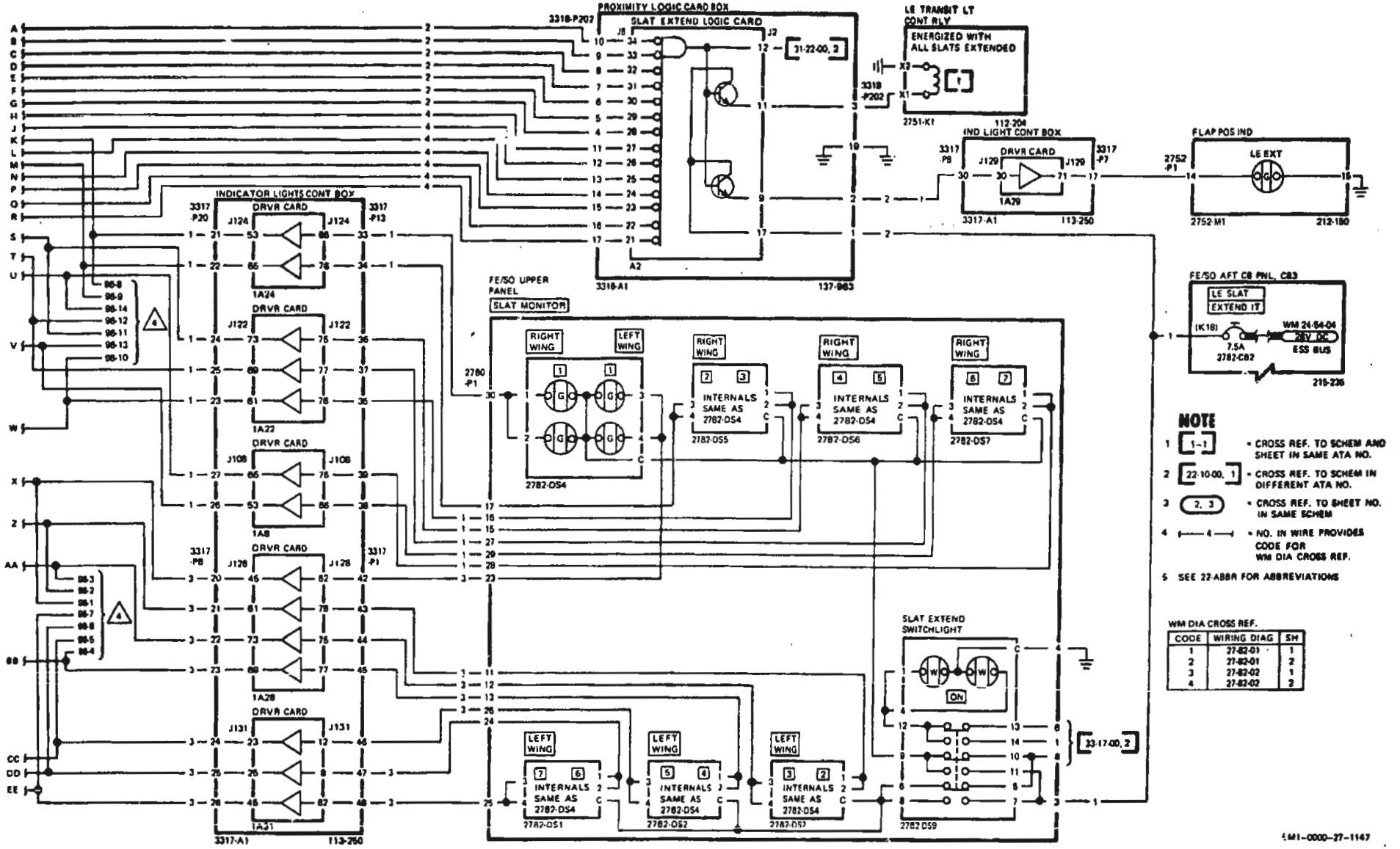
LE Slat Asymmetry System Electrical Schematic
SCHEM 2

R EFFECTIVITY: ALL
R
001B


PROXIMITY SWITCH CARD BOX
SWITCH CARD
DRIVER CARD
R SLAT 1 SENSOR
R SLAT 2 SENSOR
R SLAT 3 SENSOR
R SLAT 4 SENSOR
R SLAT 6 SENSOR
R SLAT 7 SENSOR
L SLAT 1 SENSOR
L SLAT 2 SENSOR
L SLAT 3 SENSOR
L SLAT 4 SENSOR
L SLAT 5 SENSOR
L SLAT 6 SENSOR
L SLAT 7 SENSOR
INTERNALS SAME AS 2782-A11
WDM DIAG CROSS REF.
NOTE
SLAT EXTENDED = TARGET ON SENSOR (IN PROX)
SLAT RETRACTED = TARGET NOT ON SENSOR (NOT IN PROX)
SLAT EXTENDED = LOGIC 1 = GND, SLAT RETRACTED = LOGIC 0 = 16V DC, TYPICAL FOR NO. 2 OUTPUTS

Position Monitoring (Proximity) System Electrical Schematic
SCHEM 3 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



R Position Monitoring (Proximity) System Electrical Schematic
R SCHEM 3 (Sheet 2)

EFFECTIVITY: ALL

0018

WING LEADING EDGE SLAT CONTROL SYSTEM - ADJUSTMENT AND TEST

1. General

This section provides the procedures to perform operational tests (Ref. Para. 4) and a rigging check and adjustment (Ref. Para. 5) of the wing leading edge slat control system.

2. Equipment and Materials

Rig pins: 5/16-inch diameter, 2-inches long (R2, Red), and 3-inches long (R3, Green), or equivalent (Part of Rig Pin Kit, PN B735).

Cable Tensiometer, Pacific Scientific Co., PN T5-2002-101-00, or equivalent

Lock-wire 0.032 inch diameter, Fed Spec QQ-W-390, Temp A, or equivalent

Lock-wire 0.040 inch diameter, Fed Spec QQ-W-423, Form 1, Cond A, or equivalent

Cotter Pin, MS24665-153

Cotter Pin, MS24665-302

Slat Downstop Gage, G/ITEL 27-81-93, or equivalent

Wrench Set, Leading Edge Slat, BC48, or equivalent (For adjusting track rollers)

Pull-Strips, stainless steel .016-inch thick, 6.0 inches wide and approximately 12 inches long (3 each). (Used to check slat upper trailing edge to wing leading edge contact).

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
6-50-00	Interior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-51-00	Trailing Edge Flap System - Fault Isolation
27-51-00	Trailing Edge Flap System - Adjustment and Test

	27-81-23	Inboard Slats - Removal and Installation
	27-81-26	Outboard Slats - Removal and Installation
	27-81-36	Slat Asymmetry Comparator - Removal and Installation
R	27-81-37	Slat Asymmetry Brake - Adjustment and Test
	27-81-38	Slat Asymmetry Rotary Transducer - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices
	30-13-06	Wing Anti-Ice Telescoping Duct - Removal and Installation

4. Adjustment/Test

The following procedures are provided in this section:

Slat Asymmetry Comparator BITE Test (Ref. Para. 4A)

Slat Control System Verification Test (Ref. Para. 4B)

Slat Asymmetry Detector System Operational Test (Ref. Para. 4C)

Slat Control System Operational Test (Ref. Para. 4D)

CAUTION: PRIOR TO GROUND OPERATION OF WING FLAPS/SLATS, OBSERVE THE FOLLOWING TO PREVENT SPOILER SELECTOR ACTUATOR STALL:

AILERONS FAIRED ±10 DEGREES

SPEED BRAKE LEVER WITHIN 2 INCHES OF FULL FORWARD

A. Slat Asymmetry Comparator BITE Test

NOTE: The SLAT ASYM DET FAULT light on the FE/SO panel will come on anytime a fault is sensed in the asymmetry detector and control system. The SLAT ASYM DET FAULT annunciator light may go out after resetting the comparator (opening CB1-J10 and CB2-H22 for ten seconds and the closing circuit breakers) but will come on again when the slats are operating and a fault still exists in the asymmetry detector system. When a fault exists in the asymmetry detector system, the CHAN IND lights on the asymmetry comparator will flash on and off while slats are operating.

Accomplish the comparator BITE test only if the CHAN IND lights on the asymmetry comparator flash on and off while slats are operating. The comparator BITE test isolates the problem to the comparator or the rotary transducer. If the SLAT ASYM DET FAULT annunciator light is on, and the CHAN IND lights do not come on refer to 27-51-00 Fault Isolation.

(1) Verify the following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

NO. 2 ASYM BK

LE SLAT (J10)

LOCK LIGHT

LE SLAT (J12)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE

LE SLAT (H22)

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Normal operation of the flaps and slats requires system A and C with each system supplying 25 gpm at 3000 psi. Section 29-11-00 (Maintenance Practices) details the various hydraulic supply capabilities.

Operating flaps and slats with electric pumps can cause "jerky" operation and trip the overspeed governor in the asymmetry brakes. Therefore, when operating with electric pumps only, turn on B and C electric pumps (B system is needed to permit shutting off the stabilizer C servo) and shut off all servos using C system: STABILIZER C, AILERON L INBD and R INBD, SPOILERS L5&6, L&R3, and R5&6.

(4) Enter mid-electrical service center and locate slat asymmetry comparator mounted on the rear bulkhead on the left side (BL 70L).

(5) Remove covers from left and right trouble test switches.

(6) Position flap handle to 4 degree detent.

(7) If PN 672835-109 comparator is installed: with slats moving, depress the LEFT WING TROUBLE TEST SW and hold for at least five seconds then release. Repeat with the RIGHT WING TROUBLE TEST SW.

(7) If PN 672835-111 comparator is installed: with slats moving, depress the LEFT WING TROUBLE TEST SW, while CHAN IND light is off, and hold for at least five seconds. Release only when CHAN IND light is off. Repeat with the RIGHT WING TROUBLE TEST SW.

CAUTION: ON 672835-111 COMPARATOR, DEPRESSING OR RELEASING EITHER TROUBLE TEST SWITCH WHILE CHANNEL LIGHT IS ON WILL CAUSE ASYMMETRY LOCK-UP.

NOTE: If extending slats is not enough time to accomplish test, complete test while slats are retracting.

(8) If the channel indicator lights change position between channels while wing test switch is depressed, replace rotary transducer associated with switch causing change (Ref. 27-81-38).

(9) If the channel indicator light does not change position during test, replace comparator (Ref. 27-81-36).

(10) R If the channel indicator lights do not come on during test but the SLAT ASYM DET FAULT light on the FE/SO annunciator panel is on, replace the comparator.

(11) Replace covers on left and right trouble test switches.

(12) Retract flaps and slats.

(13) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(14) Turn off electrical power if no longer required (Ref. 24-41-00).

B. Slat Control System Verification Test

R (1) Verify the following circuit breakers are closed:

R (a) On Pilots overhead circuit breaker panel CB1, zone R 210:

R FLAP CONTROLS - NO. 2 ASYM BK

R LE SLAT (J10)

R TE FLAP (J11)

R FLAP CONTROLS - LOCK LIGHT

R LE SLAT (J13)

R TE FLAP (J14)

R (b) On Flight Engineer/Second Officers overhead R circuit breaker panel CB2, zone 215:

R NO. 1 ASYM BRAKE

R TE FLAP (H21)

R LE SLAT (H22)

R (c) On Flight Engineer/Second Officers aft circuit R breaker panel CB3, zone 215:

R POSN IND

R LE SLAT (K17)

R LE SLAT

R EXTEND LT (K18)

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic system A only (Ref. 29-11-00).

R NOTE: Normal operation of flaps and slats requires
R pressurization of hydraulic systems A and/or C
R with that system supplying 25 gpm at 3000 psi.
R Section 29-11-00 (Maintenance Practices) details
R the various hydraulic supply capabilities.

R Operation of the flap/slat system with electric
R pumps may cause "jerky" motion and may trip the overspeed governor in either or both asymmetry brakes.

(4) Depress the finger-latch release under the forward edge of the flap control knob (right side of pilots center console) and move flap control handle to the 4-degree position. The slats (and flaps) must start to extend.

(5) During transit, verify that the amber LE TRANS (leading edge transit) light on pilots center instrument panel, zone 210, comes on.

(6) When movement stops, verify that LE TRANS light goes out and that the green LE EXT (leading edge extend) light, on the pilots center instrument panel, comes on.

(7) Verify that all slats (left and right wings) are fully extended.

(8) On the slat monitor panel on Flight Engineer/Second Officers console, verify that the two pointers of the slat position indicator move when slats move and continuously indicate actual position of slats.

(9) Turn off hydraulic system A and turn on hydraulic system C (Ref. 29-11-00).

(10) Return flap control handle to 0-degree detent position. Slats (and flaps) must start to retract.

(11) Verify that green LE EXT light goes out and amber LE TRANS light is on during retraction cycle.

(12) Verify that slats (and flaps) fully retract and LE TRANS light goes out.

C (13) On aircraft with MO 96836 accomplished (Installation of
C Hyd System C Slat Isolation Valve), check operation of
C slat hydraulic system C isolation valve as follows.

(a) Turn off hydraulic system A (leave only system C on).

(b) Cycle slats from full up to full down and back to full up by positioning flap handle between zero and the 4-degree detent. Normal operation of the slat system verifies that the isolation valve has opened when commanded to. (Isolation valve opens for slat operation, closes when slats reach full up or full down position).

(c) On FE/SO overhead circuit breaker panel CB2, zone 215, open circuit breaker CB2-H22 (NO. 1 ASYM BRAKE - LE SLAT) to prevent the isolation valve from being energized open.

(d) Position flap handle from zero detent to 4-degree detent and back to zero. Verify that slats do not operate (use slat position indicator).

(e) Close circuit breaker CB2-H22.

(14) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(15) Turn off electrical power if no longer required (Ref. 24-41-00).

C. Slat Asymmetry Detector System Operational Test

NOTE: During the following test, it is possible for the torque limiting brakes to actuate and lock the slat drive system. This can be caused by late slat PDU brake application during an asymmetry system shutdown of the slats. If the slat system does not operate after resetting the slat asymmetry comparator, release the torque limiting brake by momentarily reversing the slats (by repositioning the flap

handle) or by cycling the hydraulic power systems off then on.

(1) Remove wing access panels 521TB and 621TB to gain access to slat asymmetry brakes (Ref. 6-40-00).

(2) Disconnect the electrical connector from either the left wing or right wing rotary transducer mounted on bottom of asymmetry brake; (do not disconnect both rotary transducers).

(3) Verify that the following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

NO. 2 ASYM BK

LE SLAT (J10) and TE FLAP (J11)

LOCK LIGHT

LE SLAT (J12) and TE FLAP (J13)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE

LE SLAT (H22) and TE FLAP (H21)

(4) Turn on electrical power (Ref. 24-41-00).

(5) Verify that slats are fully retracted (flap handle in 0-degree detent).

(6) Open circuit breaker CB1-J10; the SLAT ASYM DET FAULT light on FE/SO annunciator panel must come on.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test, pressurize the B and C hydraulic system using ATM pump and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(8) Move flap control handle to the 4-degree detent position; verify following:

(a) The slats (and flaps) start to extend.

(b) The slat asymmetry system actuates to lock both slat asymmetry brakes before the slats have extended four degrees (the pop-out indicator rod, on both asymmetry brakes, protrudes from unit when brakes are locked).

NOTE: Slat lock-up may be immediate with no noticeable slat movement.

(c) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out on the FE/SO annunciator panel.

NOTE: The hydraulic shutoff valve solenoids on the slat power drive unit (PDU) are energized to block hydraulic pressure.

The flaps will continue to move to the 4-degree extended position.

R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE
R RESET DEVICE.

(9) Reset both slat asymmetry brakes by applying wrench torque to reset device hex on the brake (the pop-out indicator rods on the brakes must be retracted).

(10) Open circuit breakers CB2-H22 and CB1-J12; the FLAP/SLAT LOCK Light must go out and slats fully extended [if not, refer to note before Step 4C(1)].

NOTE: The Slat PDU System C Hydraulic Isolation Valve will be closed at this time and slats will be opperated by system A hydraulic power only.

C C C C (11) Reset slat asymmetry comparator by closing circuit breakers CB1-J10 and CB1-J12. The SLAT ASYM DET FAULT light will come on. Position flap handle to zero degrees; verify following:

C (a) Deleted.

(b) The slats start to retract and then lock up.

(c) Both right and left slat asymmetry brakes have tripped.

(d) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out.

R R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(12) Reset both slat asymmetry brakes.

(13) Open circuit breakers CB1-J10 and CB1-J12; the FLAP/SLAT LOCK light must go out and slats fully retract [if not, refer to note before Step 4C(1)].

C C C C (14) Reset the slat asymmetry comparator by closing circuit breakers CB1-J12 and CB1-J10. The SLAT ASYM DET FAULT light comes on. Position flap handle to 4 degrees; verify following:

C (a) Deleted.

(b) The slats start to extend and then lock up.

(c) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out.

R R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(15) Reset both asymmetry brakes.

(16) Open circuit breakers CB1-J10 and CB1-J12; the FLAP/SLAT LOCK light must go out and slats fully extend [if not, refer to note before Step 4C(1)]

(17) Reset the slat comparator by closing circuit breaker CB1-J12 and CB2-H22. Verify SLAT ASYM DET FAULT light comes on.

(18) Position flap handle to zero degrees; verify following:

(a) The slats start to retract and then lock up.

(b) Both right and left slat asymmetry brakes have tripped.

(c) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out.

CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(19) Reset both slat asymmetry brakes.

(20) Open circuit breaker CB1-J12 and CB2-H22; the FLAP/SLAT LOCK light must go out. Slats start retracting towards full-up.

(21) Reconnect electrical connector to rotary transducer disconnected in Step 4C (2).

(22) Reset comparator by closing circuit breakers CB2-H22, CB1-J10, and CB1-J12.

(23) Position flap handle to 4 degree position and back to full up position. Verify following:

(a) Slats fully extend and then fully retract.

(b) FLAP/SLAT LOCK and SLAT ASYM DET FAULT lights on FE/SO annunciator panel remain off.

(24) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(25) Turn off electrical power if no longer required (Ref. 24-41-00).

(26) Install access panels under both wing asymmetry brakes.

D. Slat Control System Operational Test

(1) Verify the following circuit breakers are closed:

(a) On Pilots overhead circuit breaker panel CB1, zone 210:

NO. 2 ASYM BK

LE SLAT (J10)

TE FLAP (J11)

LOCK LIGHT

LE SLAT (J12)

TE FLAP (J13)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE

TE FLAP (H21)

LE SLAT (H22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

POSN IND

LE SLAT (K17)

LE SLAT EXTEND LT (K18)

(2) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed

governor in either or both brakes and give invalid results. To perform a valid test, pressurize the B and C hydraulic system using ATM pump and the A hydraulic system using the PTU. Alternately, two ground sources, each capable of 25 GPM at 3000 psi, may be used to pressurize the A and C hydraulic systems.

(4) Depress the finger-latch release under the forward edge of the flap control knob (right side of pilots center console) and move flap control handle to the 4-degree position; the slats (and flaps) must start to extend.

(5) During transit, verify that the amber LE TRANS light on the flap position indicator comes on. When movement stops, verify that LE TRANS light goes out and that the green LE EXT light on flap position indicator comes on.

(6) Verify that all slats (left and right wings) are fully extended.

(7) On the slat monitor panel on Flight Engineer/Second Officers console, verify that the two pointers of the slat position indicator move when slats move and continuously indicate actual position of slats. Depress (in) the ON switchlight on the slat monitor panel and verify that all fourteen green extend lights are on. Depress and release (out) the ON switchlight after check; all fourteen extend lights should go out.

(8) Return flap control handle to 0-degree detent position; slats (and flaps) must start to retract.

(9) Verify that green LE EXT light goes out and amber LE TRANS light is on during retraction cycle.

(10) Verify that slats (and flaps) fully retract and amber LE TRANS light goes out.

(11) Check operation of hydraulic system C isolation valve as follows:

(a) Turn off hydraulic system A (leave only system C on).

(b) Cycle flap handle from zero degrees to 4 degrees and back to zero degrees. Normal operation of slats verifies that the isolation valve has opened when commanded to (isolation valve opens for slat operation and closes when slats reach full-up or full-down position).

(c) Open circuit breaker CB2-H22 (NO. 1 ASYM BRAKE - LE SLAT) to prevent the isolation valve from being energized open.

(d) Position flap handle from zero detent to 4-degree detent and back to zero; verify that slats do not operate (use slat position indicator).

(e) Close circuit breaker CB2-H22.

(f) Turn on hydraulic system A.

NOTE: The following steps 4D(12) through 4D(29) check the slat asymmetry detector system. During the following test, it is possible for the torque limiting brakes to actuate and lock the slat drive system; this can be caused by late slat PDU brake application during an asymmetry system shutdown of the slats. If the slat system does not operate after resetting the slat asymmetry comparator, release the torque limiting brakes by momentarily reversing the slats (by repositioning the flap handle) or by cycling the hydraulic power systems off then on.

(12) Remove wing access panels 521TB and 621TB to gain access to slat asymmetry brakes (Ref. 6-40-00).

(13) Verify that slats are fully retracted (flap handle in 0-degree detent).

(14) Disconnect the electrical connector from either the left wing or right wing rotary transducer mounted on bottom of asymmetry brake (do not disconnect both rotary transducers).

(15) Open circuit breaker CB1-J10. The SLAT ASYM DET FAULT light on the FE/SO annunciator panel must come on.

(16) Move flap control handle to the 4-degree detent position; verify following:

(a) The slats (and flaps) start to extend.

(b) The slat asymmetry system actuates to lock both slat asymmetry brakes before the slats have extended four degrees (the pop-out indicator rod on both asymmetry brakes protrudes from unit when brakes are locked).

NOTE: Slat lock-up may be immediate with no noticeable slat movement.

R (c) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out on the FE/SO annunciator panel.

NOTE: The hydraulic shutoff valve solenoids on the slat power drive unit (PDU) are energized to block hydraulic pressure. The flaps will continue to move to the 4-degree extended position.

CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(17) Reset both slat asymmetry brakes by applying wrench torque to reset device hex on the brake (the pop-out indicator rods on the brakes must be retracted).

(18) Open circuit breakers CB2-H22 and CB1-J12; the FLAP/SLAT LOCK light must go out and slats fully extend [if not, refer to note following Step (11)(f)].

NOTE: The Slat PDU System C Hydraulic Isolation Valve will be closed at this time and slats will be operated by system A hydraulic power only.

C (19) Reset slat asymmetry comparator by closing circuit
C breakers CB1-J10 and CB1-J12. The SLAT ASYM DET FAULT
C light will come on. Position flap handle to zero
C degrees; verify following:

C (a) Deleted.

(b) The slats start to retract and then lock up.

(c) Both right and left slat asymmetry brakes have tripped.

(d) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out.

CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(20) Reset both slat asymmetry brakes.

(21) Open circuit breakers CB1-J10 and CB1-J12; the FLAP/SLAT LOCK light must go out and slats fully retract [if not, refer to note following Step (11)(f)]

C (22) Reset the slat asymmetry comparator by closing CB1-J12
C and CB1-J10. The SLAT ASYM DET FAULT light will come

C on. Position flat handle to 4 degrees; verify
C following:

C (a) Deleted.

(b) The slats start to extend and then lock up.

(c) Both right and left slat asymmetry brakes have tripped.

(d) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out.

R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE
R RESET DEVICE.

(23) Reset both asymmetry brakes.

(24) Open circuit breakers CB1-J10 and CB1-J12; the FLAP/SLAT LOCK light must go out and the slats fully extend [if not, refer to note following Step (11)(f)].

C (25) Reset the slat asymmetry comparator by closing circuit
C breakers CB1-J12 and CB2-H22. The ASYM DET FAULT light
C will come on. Position the flap handle to zero
C degrees; verify following:

C (a) Deleted.

(b) The slats start to retract and then lock up.

(c) Both(b) right and left slat asymmetry brakes have tripped.

(d) The FLAP/SLAT LOCK light comes on and the SLAT ASYM DET FAULT light goes out.

R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE
R RESET DEVICE.

(26) Reset both slat asymmetry brakes.

(27) Open circuit breaker CB1-J12 and CB2-H22; the FLAP/SLAT LOCK light must go out. Slats start retracting towards full-up.

(28) Reconnect electrical connector to rotary transducer disconnected in Step (14).

(29) Reset comparator by closing circuit breakers CB2-H22, CB1-J10, and CB1-J12.

(30) Position flap handle to 4 degrees; verify that slats extend.

(31) Position flap handle to zero degrees; verify that slats retract.

(32) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(33) Turn off electrical power if no longer required (Ref. 24-41-00).

(34) Install access panels under both wing asymmetry brakes (Ref. 6-40-00).

5. Rigging Check and Adjustment

Rigging check and adjustment procedures are presented separately for each part of the slat system. Each part may be rigged separately without disturbing the remainder of the system. The preparation and completion check procedures must be performed before and after any rigging check and adjustment. The separate rigging check and adjustment procedures are listed below.

	PARAGRAPH	PROCEDURE
	5A	Preparation
	5B	Flap-and-Slat Programmer to Slat PDU (Center Cable Loop) Rigging Check and Adjustment
	5C	Slat Panels Rigging Check and Adjustment
R	5D	Slat Panels Quick Rigging Check
R	5E	Completion Check

NOTE: Aircraft structure and cable temperatures must be stabilized when adjusting cable tension. Do not operate air conditioning equipment immediately before or during cable rigging and/or adjustment.

After making a turnbuckle adjustment, check for minimum thread engagement by verifying that no more than three threads are exposed on cable terminal. Also verify that cable terminals are not threaded more than maximum 0.25 of an inch into the turnbarrel and prevent proper engagement of locking clips.

To measure the maximum thread engagement, insert a small

piece of 0.020 inch safety wire between cable and inside surface of turnbarrel and mark where safety wire and outside surface contacts.

Remove safety wire and measure distance of mark (Ref. Fig. 501).

After making push rod adjustment, check for minimum thread engagement by verifying that rod end thread is visible at inspection hole.

A. Preparation

(1) Shut off all four hydraulic systems (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on the hydraulic service panel, zone 147.

B. Flap-and-Slat Programer to slat PDU (Center Cable Loop) Rigging Check and Adjustment

NOTE: The flap/slat cable system consists of the forward (flap/slat) cable loop, the aft (flap) cable loop, and the center (slat) cable loop. The slat system is controlled by the forward and center cable loops. The forward cable loop rigging is covered in 27-51-00, Adjustment and Test.

(1) Remove access panel 511AB to slat PDU (Ref. 6-40-00).

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

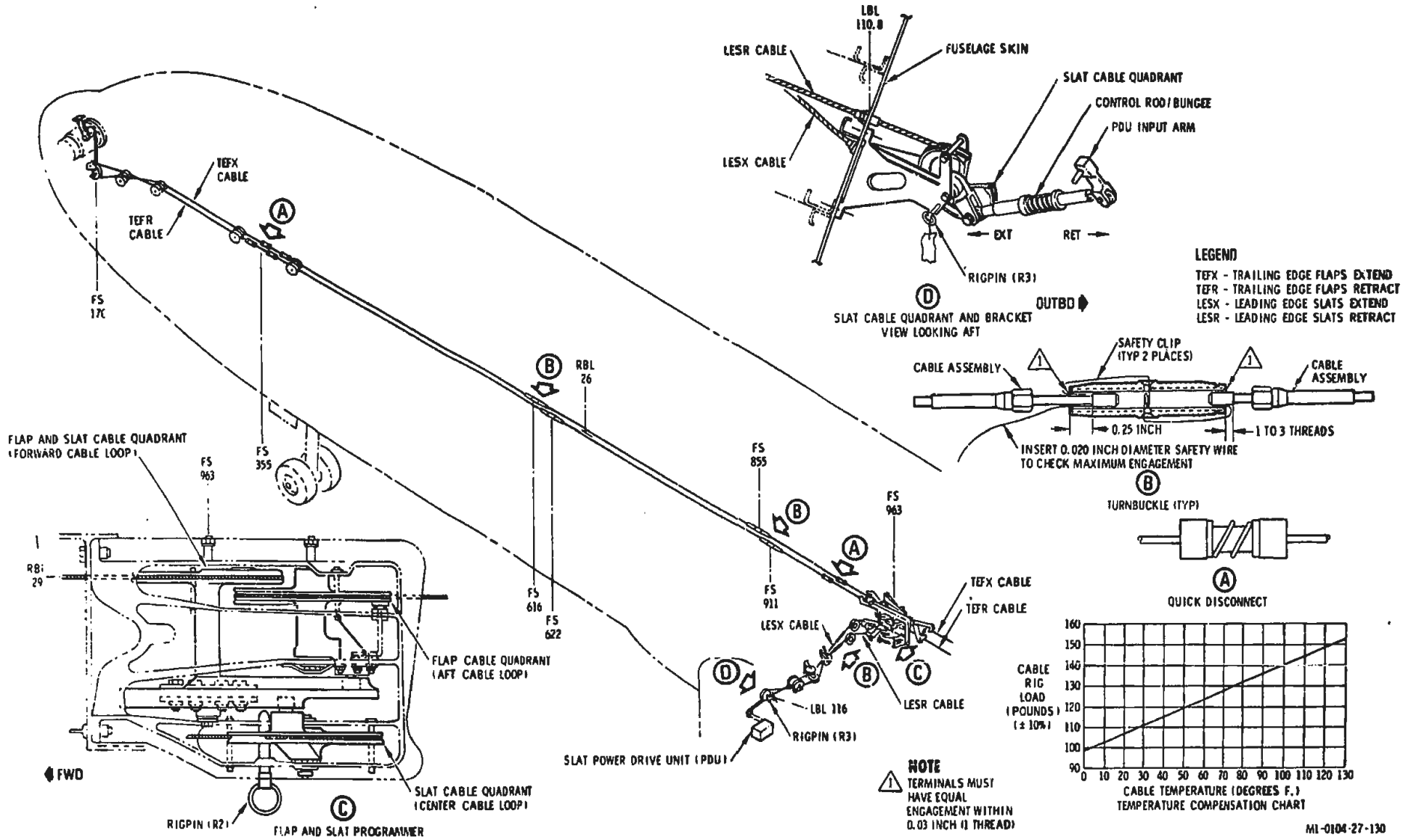
(2) Check center (slat) cable loop rigging as follows:

(a) Verify that forward (flap/slat) cable loop is rigged (Ref. 27-51-00, Adjustment and Test).

(b) Verify that center cable loop tension conforms to temperature compensation chart (Ref. Fig. 501).

(c) Position flap handle to 0-degree detent. Verify that slat PDU input lever is contacting the PDU (internal) retract stop with slight compression of control rod/bungee.

(d) Position flap handle to 4-degree detent. Verify that PDU input lever is contacting the PDU (internal) extend stop with slight compression of control rod/bungee.



Slat Input Control System Rigging
Figure 501

R
R
0018 EFFECTIVITY: ALL

NOTE: Observe slat PDU input lever and slat cable quadrant during check and verify that slat PDU input arm stops moving (contacts stop) before cable quadrant stops moving.

(e) If requirements of Step 5B(c) or 5B(d) cannot be met, rig the center cable loop.

(3) Rig center (slat) cable loop as follows:

(a) Verify that forward cable loop is rigged (Ref. 27-51-00).

(b) Position flap handle to 0-degree detent.

(c) Disconnect control rod/bungee from PDU input arm.

(d) If possible, install rig pin (R2) through support bracket and lower cable quadrant of the flap-and-slat programmer.

NOTE: Installation of rig pin (R2) is desirable but not necessary. Rigging of the forward cable loop may have caused the rig pin holes in the support bracket and lower cable quadrant of programmer to be slightly out of alignment.

(e) With the forward cable loop rigged, and the flap handle in the 0-degree detent (rig pin in programmer may or may not be installed), verify that rig pin (R3) can be inserted in slat cable quadrant and that the center cable loop tension conforms to temperature compensation chart. If not, adjust turnbuckles in center cable loop (Ref. Fig. 501).

NOTE: Turnbuckles are located on the left side overhead of the mid-electrical service center.

(f) If cables are adjusted, remove all rig pins, cycle flap control handle to stabilize cables and recheck cable rigging (Ref. Step 5B(e).

(g) Install turnbuckle safety clips.

C (h) With the T.E. flap handle in the four unit detent,
C accomplish the following:

C NOTE: It is extremely important that the
C following steps be accomplished accurately.

CR A. Position the L.E. PDU input arm solidly against its slats extend internal stop using hand pressure on the lever in an inboard direction.

CR B. Adjust the L.E. PDU input rod and bungee assembly so that the rod and attach bolt at the PDU input arm can be inserted with the arm held as in previous step A.

CR C. Shorten the previously adjusted rod end by one full turn to give a slight preload on the PDU input arm in an inboard direction.

CR D. Verify that PDU input arm is against PDU internal extend stop.

NOTE: PDU input arm moves outboard to contact retract stop and inboard to contact extend stop.

CR (i) Move the T.E. flap handle (NO HYD. PRESS ON) to the "0" detent (FULL UP) and accomplish the following:

CR A. Position the L.E. PDU input arm solidly against its RETRACT internal stop using hand pressure on the lever in an outboard direction.

CR B. Assure that there is a slight prload in the slats retracted direction on the L.E. PDU input arm (input rod and bungee assembly should be 1/2 to 2 turns longer than would be required to install the input arm to rod end bolt).

CR C. If adjustments are required to meet (i)B, you must recheck step (h) to assure correct final adjustment of L.E. PDU input rod and bungee assembly.

CR D. Lock-wire adjustment (QQ-W-390, 0.032 diameter, or equivalent).

(j) Connect control rod/bungee to PDU input arm. Make sure that adjustable side of rod/bungee is connected to cable quadrant. Install bolt, washer, nut and cotter pin (MS24665-153).

(k) Remove all rig pins from flap and slat control systems.

R (l) Position flap handle to 4-degree detent. Verify PDU input lever is contacting the PDU (internal)

extend stop with slight compression of control rod/bungee.

NOTE: Observe slat PDU input lever and slat cable quadrant during check and verify that slat PDU input arm stops moving (contacts stop) before cable quadrant stops moving.

(4) Replace access panel 511AB (Ref. 6-40-00).

NOTE: If no further rigging of slat system is required, perform completion check (Ref. Para. 5E).

R

C. Slat Panels Rigging Check and Adjustment

NOTE: Rigging of the inboard slats (panels 1, 2, and 3) and outboard slats (panels 4, 5, 6, and 7) are similar unless noted.

If outboard slat panel No. 4 is rerigged or adjusted, check adjustment of the anti-ice telescoping duct (Ref. 30-13-06).

(1) On Pilots overhead circuit breaker panel CB1, zone 210, verify NO. 2 ASYM BK - LE SLAT (J10) circuit breaker is closed.

(2) On FE/SO overhead circuit breaker panel CB2, zone 215, verify NO. 1 ASYM BRAKE - LE SLAT (H22) circuit breaker is closed.

(3) Verify slat PDU shut off is by electrical actuation of PDU shutoff valves as follows:

(a) Unlock leading edge slats if locked out.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(b) Pressurize hydraulic system A (Ref. 29-11-00).

(c) Verify hydraulic system C is off.

(d) Cycle the slat PDU three times by placing the flap handle alternately in the zero degree and four degree detents. Verify the PDU shaft stops abruptly at the extend and retract positions.

(e) Turn off hydraulic system A and pressurize hydraulic system C (Ref. 29-11-00).

(f) Cycle the slat PDU three times by placing the flap handle alternately in the zero degree and four degree detents. Verify the PDU shaft stops abruptly at the extend and retract positions.

.4) Turn off hydraulic system C (Ref. 29-11-00).

(5) Remove the following slat drive system access panels (Ref. 6-40-00):

(a) Left wing, zones 510 and 520, slat drive system access panels:

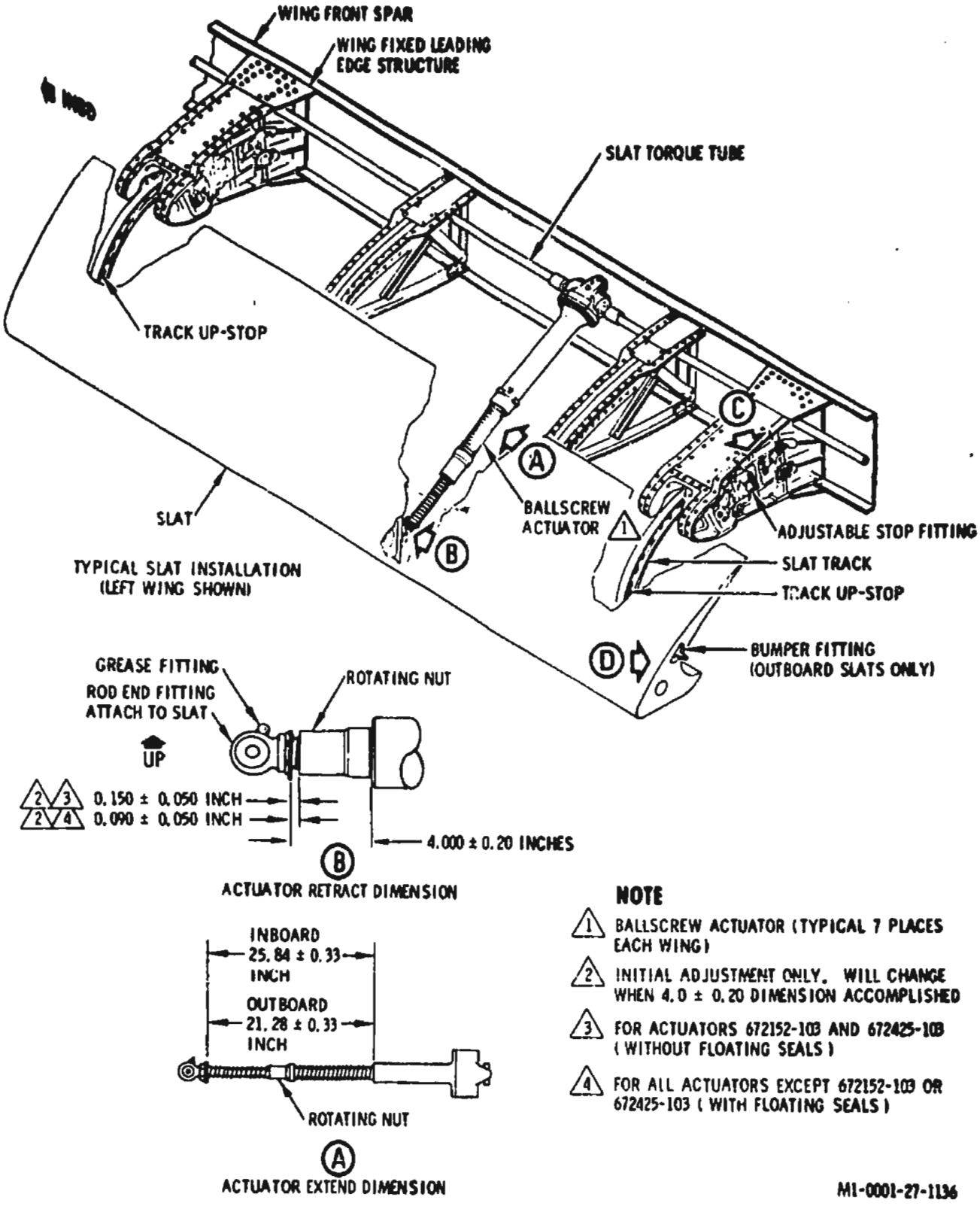
511AB, inner wing	521FB, outer wing
511DB, inner wing	521HB, outer wing
511GB, inner wing	521LB, outer wing
511KB, inner wing	521NB, outer wing
	521QB, outer wing
	521SB, outer wing
	521TB, outer wing

(b) Right wing, zones 610 and 620, slat drive system access panels:

611AB, inner wing	621FB, outer wing
611DB, inner wing	621HB, outer wing
611GB, inner wing	621LB, outer wing
611KB, inner wing	621NB, outer wing
	621QB, outer wing
	621SB, outer wing
	621TB, outer wing

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(6) Check the 4.0 (±0.20) inch full-up rig dimension on each ballscrew actuator. If the dimensions are not within tolerance, adjust as follows (Ref. Fig. 502) .



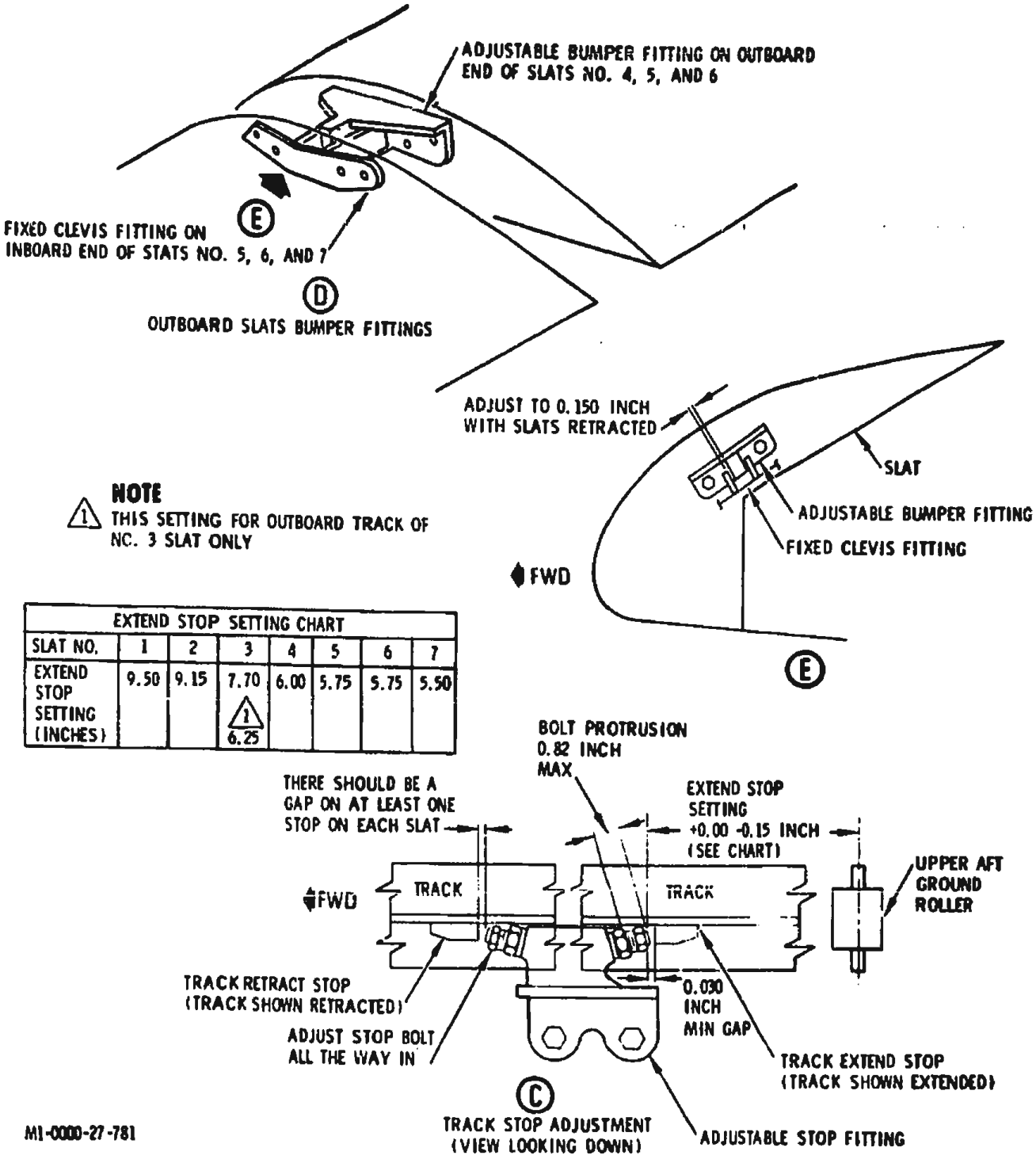
NOTE

1. BALLSCREW ACTUATOR (TYPICAL 7 PLACES EACH WING)
2. INITIAL ADJUSTMENT ONLY. WILL CHANGE WHEN 4.0 ± 0.20 DIMENSION ACCOMPLISHED
3. FOR ACTUATORS 672152-103 AND 672425-103 (WITHOUT FLOATING SEALS)
4. FOR ALL ACTUATORS EXCEPT 672152-103 OR 672425-103 (WITH FLOATING SEALS)

MI-0001-27-1136

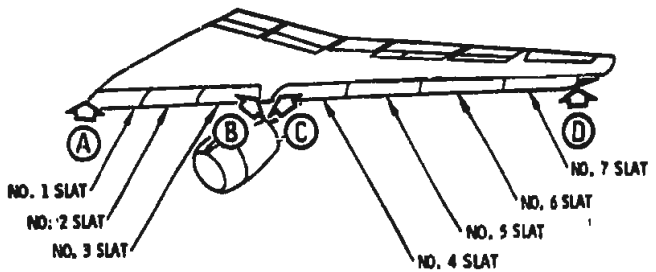
C
C

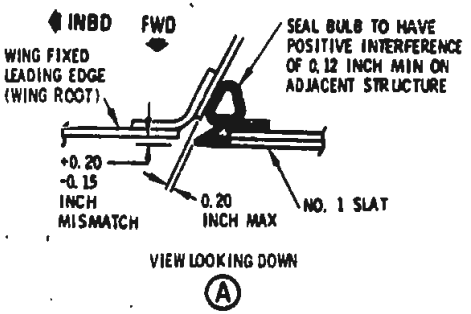
Slat Panel Rigging
Figure 502 (Sheet 1)

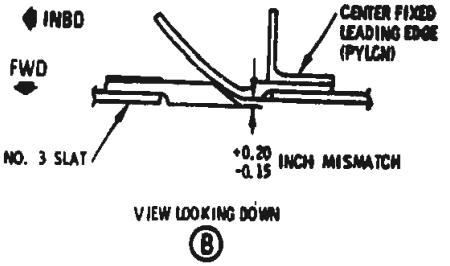

ADJUSTABLE BUMPER FITTING ON OUTBOARD END OF SLATS NO. 4, 5, AND 6
FIXED CLEVIS FITTING ON INBOARD END OF STATS NO. 5, 6, AND 7
E
D
OUTBOARD SLATS BUMPER FITTINGS
ADJUST TO 0.150 INCH WITH SLATS RETRACTED
SLAT
ADJUSTABLE BUMPER FITTING
FIXED CLEVIS FITTING
FWD
E
1 NOTE
1 THIS SETTING FOR OUTBOARD TRACK OF NO. 3 SLAT ONLY
BOLT PROTRUSION 0.82 INCH MAX
THERE SHOULD BE A GAP ON AT LEAST ONE STOP ON EACH SLAT
EXTEND STOP SETTING +0.00 -0.15 INCH (SEE CHART)
FWD
TRACK
TRACK
UPPER AFT GROUND ROLLER
TRACK RETRACT STOP (TRACK SHOWN RETRACTED)
ADJUST STOP BOLT ALL THE WAY IN
0.030 INCH MIN GAP
TRACK EXTEND STOP (TRACK SHOWN EXTENDED)
C
TRACK STOP ADJUSTMENT (VIEW LOOKING DOWN)
ADJUSTABLE STOP FITTING
M1-0000-27-781

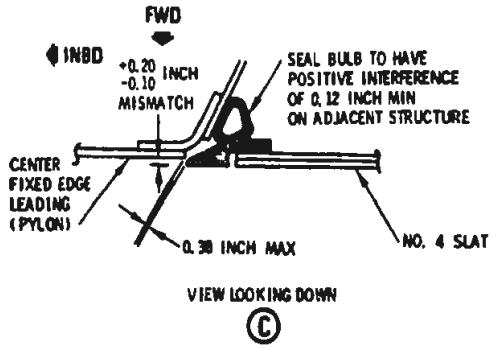
EXTEND STOP SETTING CHART							
SLAT NO.	1	2	3	4	5	6	7
EXTEND STOP SETTING (INCHES)	9.50	9.15	7.70 1 6.25	6.00	5.75	5.75	5.50

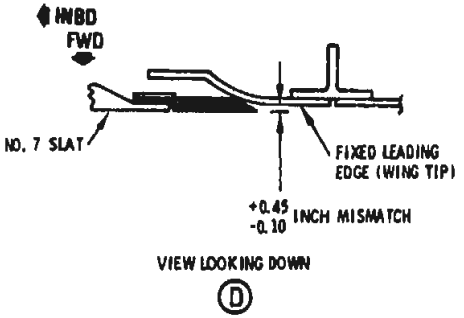
Slat Panels Rigging
Figure 502 (Sheet 2)

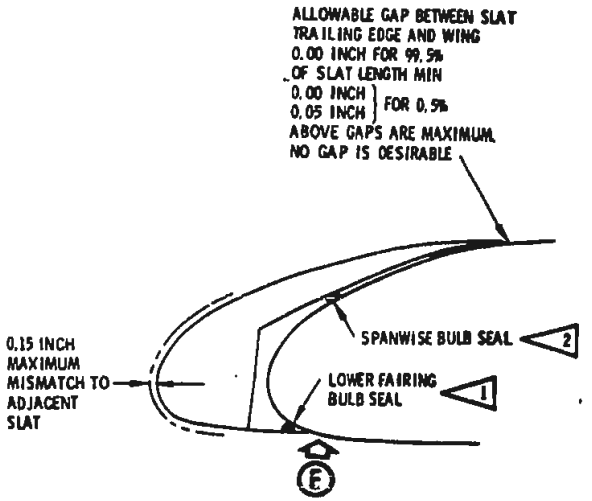


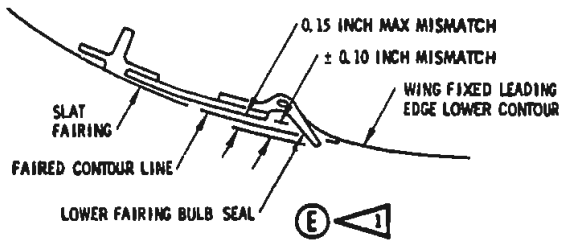


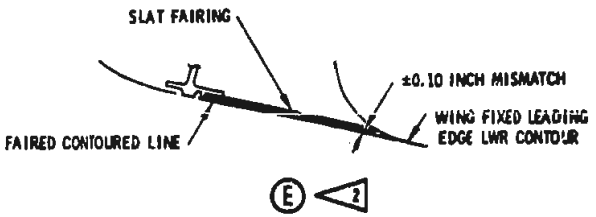












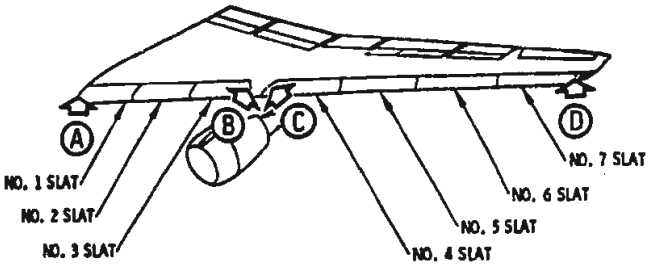
NOTE

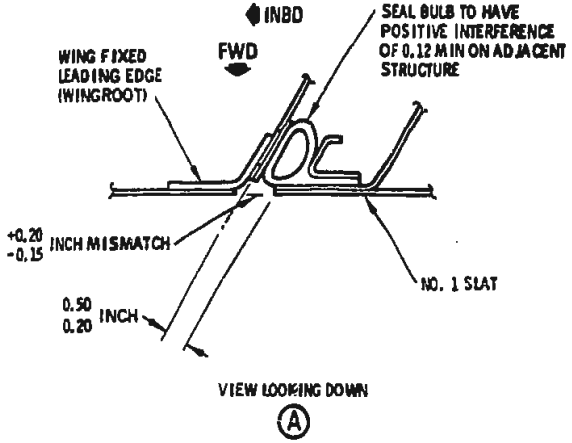
1 WITHOUT SB57-112

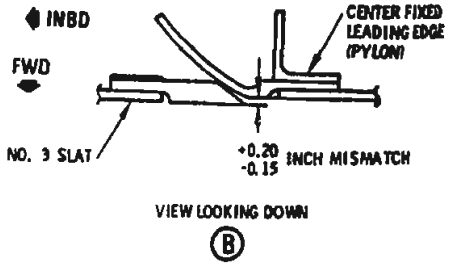
2 WITH SB57-112

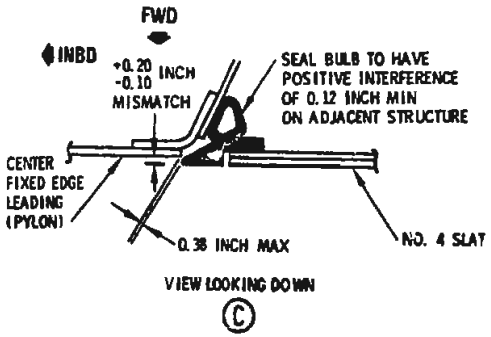
M1-0000-27-1101

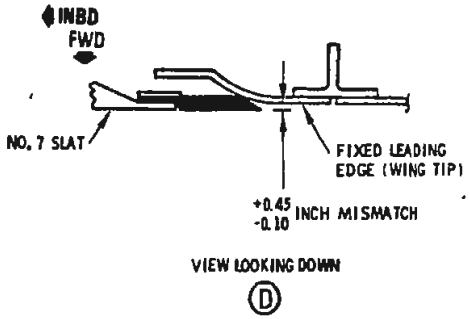
R Slat Panels Contour and Mismatch Tolerances
R Figure 503

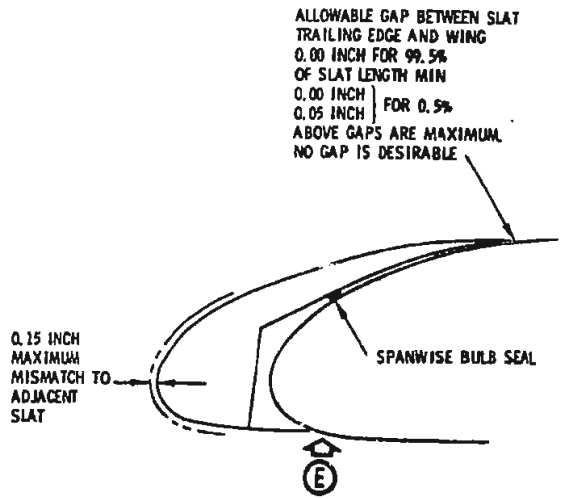


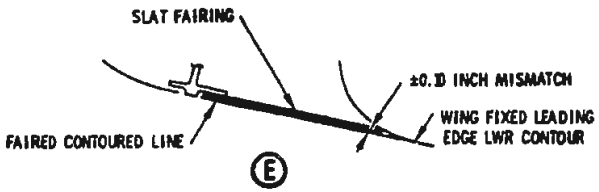






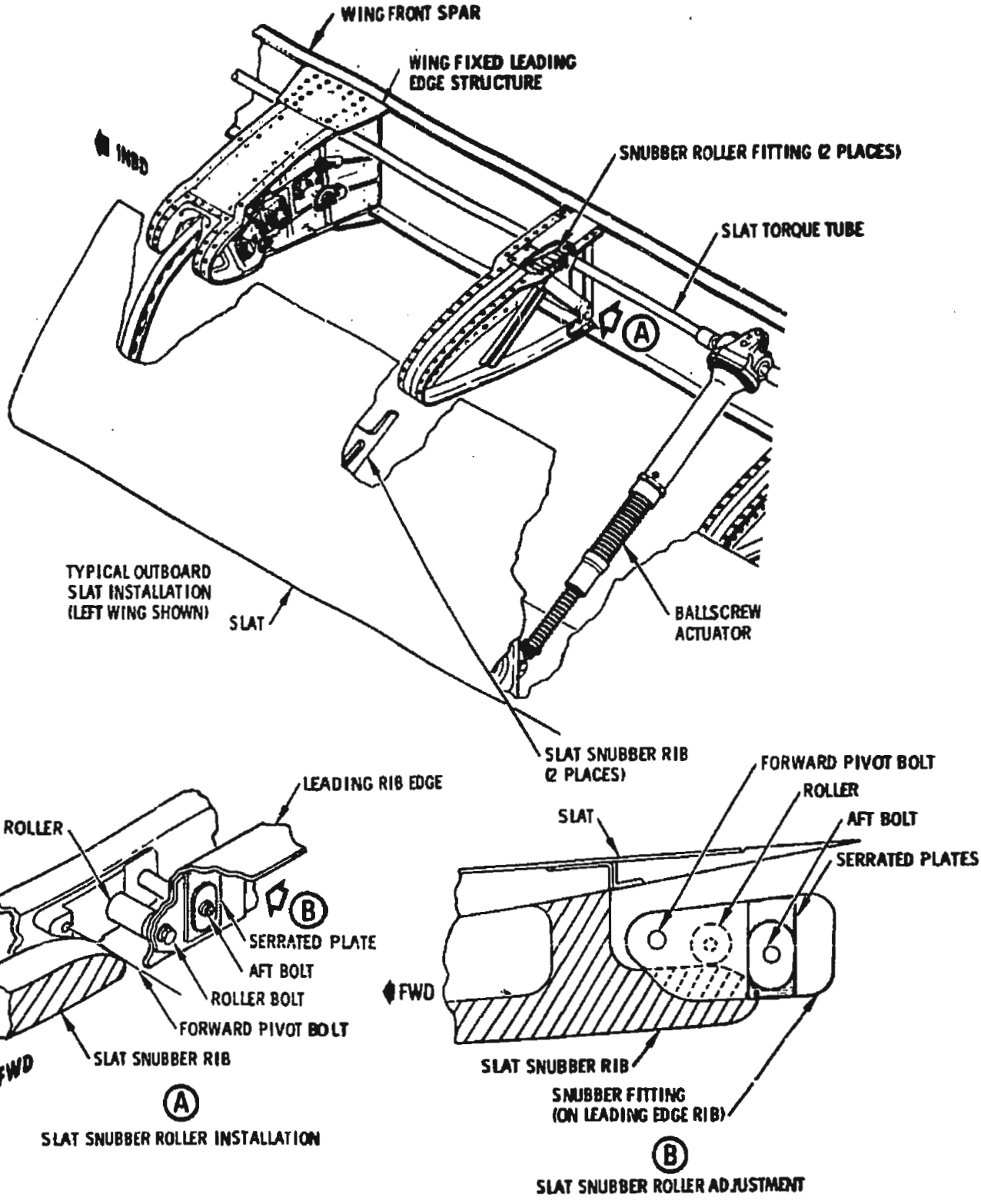



ALLOWABLE GAP BETWEEN SLAT TRAILING EDGE AND WING
0.00 INCH FOR 99.5% OF SLAT LENGTH MIN
0.00 INCH
0.05 INCH
FOR 0.5%
ABOVE GAPS ARE MAXIMUM. NO GAP IS DESIRABLE
0.15 INCH MAXIMUM MISMATCH TO ADJACENT SLAT
SPANWISE BULB SEAL
E

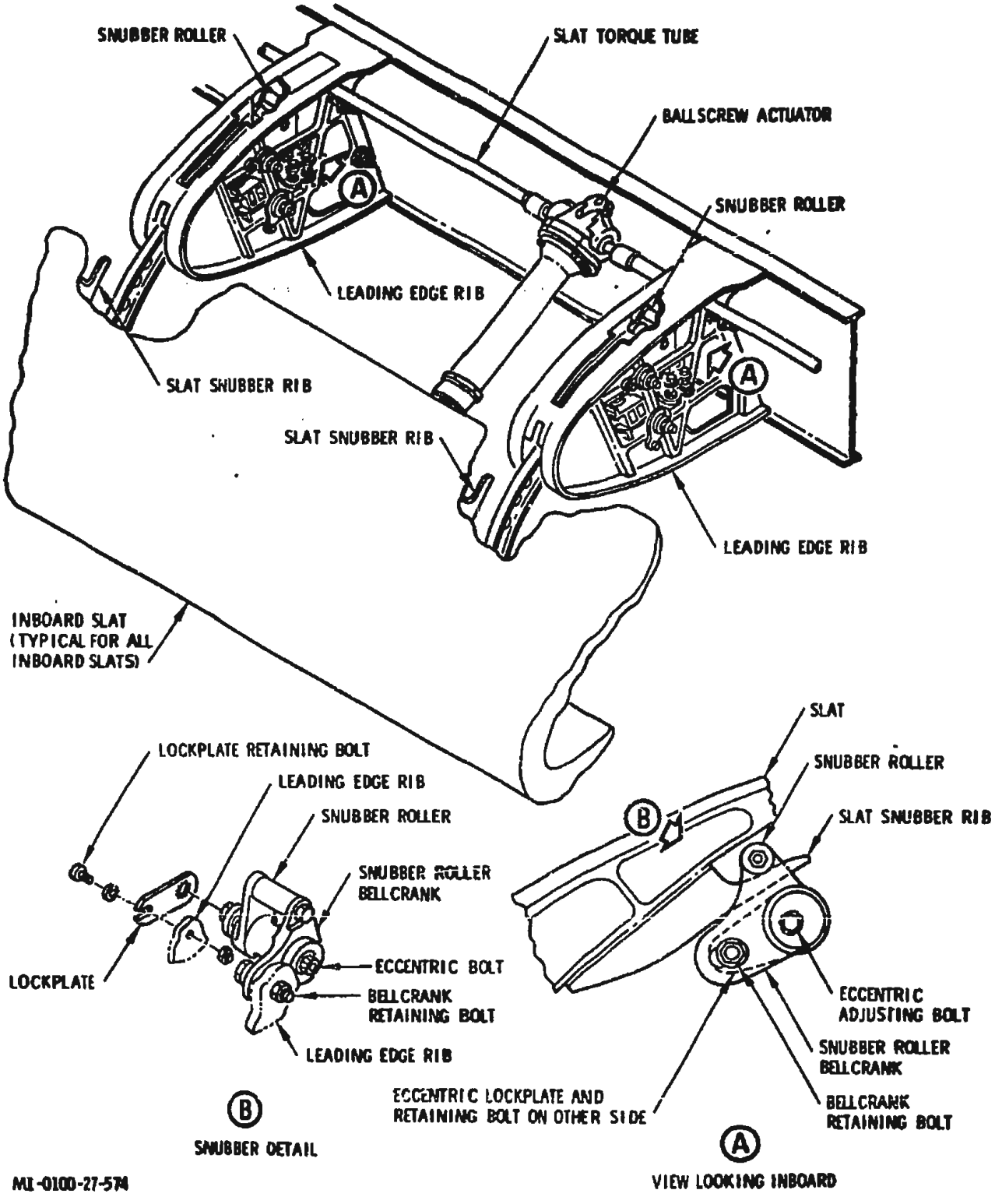


M1-0001-27-064

R Slat Panels Contour and Mismatch Tolerances
R Figure 503



Outboard Slat Panel Snubber Adjustment
Figure 504



Inboard Slat Panel Snubber ADJUSTMENT
Figure 505

(a) Support slat to prevent uncontrolled extension when actuator is disconnected.

(b) Disconnect ballscrew actuator rod end fitting from slat.

(c) On first slat outboard of disconnected actuator, measure and record gap between inboard track and retract stop fitting.

(d) Disconnect drive torque tube from each side of actuator.

(e) Position the screwjack in the full retracted position against the internal stop by rotating the input shaft or the output ballscrew (rotating nut) (Ref. Fig. 502, Sheet 1).

R (f) On aircraft with 672152-103 and/or 672425-103
R actuators,
R with rotating nut against internal stop, rotate
R rod end only to obtain the 0.150 (±0.050) inch
R dimension with grease fitting up, as shown on
R Figure 502. (If the above dimension cannot be
R obtained with the grease fitting pointing up,
R loosen rod-end nut, adjust rod-end, torque nut 80
R to 100 lb ft and lock-wire nut to tab locking
R washer. Verify that locking washer tab is
R properly engaged in ballscrew slot).

R NOTE: On aircraft with 672152-103 and/or
R 672425-103 actuators,
R the 0.150 inch dimension is an initial
R adjustment only and will change when the
R actuator retract dimension (4.0 ±0.20
R inches) is obtained (next step).

R (f) On aircraft with any actuator except 672152-103 or
R 672425-103,
R with rotating nut against internal stop, rotate
R rod end only to obtain the 0.090 (±0.050) inch
R dimension with grease fitting up, as shown on
R Figure 502. (If the above dimension cannot be
R obtained with the grease fitting pointing up,
R loosen rod-end nut, adjust rod-end, torque nut 80
R to 100 lb ft and lock-wire nut to tab locking
R washer. Verify that locking washer tab is
R properly engaged in ballscrew slot).

R NOTE: On aircraft with any actuator except
R 672152-103 or 672425-103,
R the 0.090 inch dimension is an initial

R adjustment only and will change when the
R actuator retract dimension (4.0 ±0.20
R inches) is obtained (next step).

(g) Hold rod end with grease fitting up and turn input shaft to obtain the 4.0 (±0.20) inch actuator retract (slats-up rig) dimension (Ref. Fig. 502).

(h) Connect the drive torque tube to inboard side of actuator.

(i) Verify that slats outboard of disconnected actuator are still in the retract rig position as follows:

Manually rotate slat torque tube to position slat to dimension recorded in Step 5C(6)(c). While maintaining slats in the retract rig position, connect torque tube to outboard side of actuator.

(j) Attach rod end of ballscrew actuator (with grease fitting up) to slat fitting by installing clevis bolt with threads inboard. Secure with nut torqued 175 to 190 lb in. Safety nut with cotter pin (MS24665-302).

(7) Verify that slat retract stop bolts are adjusted full-in to provide maximum retract stop clearance and lock-wire stop bolt (QQ-W-423, 0.040, or equivalent).

(8) Check slat extend stop adjustment. Verify dimension from the center of the upper aft ground roller shaft to the face of the extend stop bolt (Ref. Fig. 502 and the
R Slat Extend Stop Setting Chart). (Use slat downstop gage to check adjustment). Adjust extend stop as required. Lock-wire stop bolt (QQ-W-423, 0.040, or equivalent).

(9) Check slat for proper contact of the upper trailing edge with the wing leading edge as follows:

(a) Extend slats.

(b) Position a pull-strip at each slat track rib and at the actuator rib so that when slats are retracted the pull-strips are between the slat upper trailing edge and the wing leading edge.

(c) Fully retract slats.

(d) Pull load to remove pull-strips should be 10 to 60 pounds. If pull load is not 10 to 60 pounds,

adjust the slat-to-track link eccentrics to meet the pull load requirement.

(10) R Verify that there are no gaps between the slat upper trailing edge and the wing leading edge. If there are, bend the trailing edge as required to remove any gap.

NOTE: If slat upper trailing edge is plastic or the .012-inch steel angle, do not bend.

(11) Verify that the slat lower trailing edge seal seats against the fixed leading edge along the entire length of the slat, and that the track and actuator tabouts seat in the recess provided in the fixed leading edge.

(12) Verify that the slat fairs into the fixed leading edge surfaces and to adjacent slat within contour tolerances (Ref. Fig. 503).

NOTE: If the slat requires adjustment, refer to 27-81-23, Inboard Slats, or 27-81-26, Outboard Slats.

(13) On the inboard slats only (slats 1 through 3), check for minimum clearance between slat track and stop fitting assembly as follows:

(a) With track held against the outboard rollers, verify 0.020 minimum clearance between the slat track and stop fitting assembly (stop body, bolt head, or tab washer).

(b) If clearance is less than minimum, add laminated shim between track stop fitting and rib.

(14) On aircraft 032-999, verify the slat snubber rib is in contact with the slat snubber roller in the fixed leading edge with slats fully retracted (Ref. Fig. 505). If snubber roller requires adjustment, adjust as follows:

(a) Remove the eccentric bolt lock plate retaining bolt. Remove lock plate.

(b) Loosen the bellcrank retaining bolt.

(c) Loosen eccentric bolt nut.

(d) Rotate eccentric bolt so that roller is in the full up position.

(e) Rotate eccentric bolt forward until roller contacts the snubber rib. Rotate eccentric bolt aft until roller contacts the snubber rib. Eccentric bolt should rotate about the same number of degrees forward and aft to verify proper installation of snubber components. Then rotate eccentric bolt forward until roller contacts snubber rib.

(f) Tighten bellcrank retaining bolt and eccentric bolt nut.

(g) Install the eccentric bolt lock plate and lock plate bolt.

(15) On outboard slats (slats 4 through 7), verify that slat snubber rib is in contact with the slat snubber roller in the fixed leading edge with slats fully retracted (Ref. Fig. 504). If snubber roller requires adjustment, adjust as follows:

(a) Loosen the forward snubber fitting pivot bolt and the center roller bolt.

(b) Loosen the aft bolt that clamps the serrated plates.

(c) Move the snubber roller fitting downward until snubber roller contacts snubber rib.

(d) Tighten the aft bolt to lock the serrated plates and the snubber roller in position.

(e) Tighten forward pivot bolt and center roller bolt.

(16) On outboard slats only, with slats fully retracted, verify a gap of 0.150 inch between forward end of bumper fitting and clevis located between outboard slats. Adjust as required (Ref. Fig. 502).

(17) Fully extend slats. Verify actuator extend dimension of 25.840 (±0.330) inches for inboard slats, 21.280 (±0.330) inches for outboard slats (Ref. Fig. 502).

(18) With the slat actuator extend dimension requirement met, verify that clearance at each slat track extend stop is a minimum of 0.030 inch.

NOTE: Slat stop extend clearance is satisfactory if the total of both extend stop clearances on any one slat is a minimum of 0.060 inch. (One stop can be contacting stop screw).

(19) Fully retract slats.

(20) With flaps fully retracted, verify that a gap exists on at least one retract stop on each slat.

NOTE: The slats are rigged so that there is a clearance between the slat retractor stop and the stop fitting at both the inboard and outboard stops. However, during normal operation, the slat may twist about a vertical axis, causing a gap at one stop and none on the other. This condition is normal.

(21) Adjust inboard slat (No. 1, 2, 3) side rollers as follows (Ref. Fig. 506):

R (a) Retract slat to approximately 6 inches short of fully retracted position.

(b) Tighten nuts on two main roller shafts (flight rollers), if necessary, to prevent roller support ribs from spreading.

(c) Check that tracks are resting freely on rollers and no significant load on track to slat-rib attachments exist.

CAUTION: DO NOT APPLY FORCE OR ATTEMPT TO UNTWIST TRACKS IF TRACKS ARE TWISTED.

(d) Adjust and shim outboard roller assemblies to contact either upper or lower side or lower side of inboard track.

NOTE: Simultaneous contact of side rollers with both upper and lower sides of track is not required.

R Do not taper side roller assembly shims.

(e) Adjust and shim inboard roller assemblies to a

R 0.040 (±0.010) inch clearance from same part of track (upper or lower), that is in contact with outboard rollers.

(f) Position inboard track firmly against outboard side rollers.

(g) Adjust shims on outboard rollers assemblies to contact either upper or lower side of outboard track.

NOTE: Simultaneous contact of side rollers with both the upper or lower sides of track is not

R required. Do not taper side roller assembly shims.

(h) Adjust and shim inboard roller assemblies to a
R 0.040 (±0.010) inch clearance from same part of track (upper or lower), that is in contact with outboard rollers.

(22) Adjust outboard slat (No. 4, 5, 6, 7) side rollers as follows:

(a) Retract slat to approximately 6 inches short of fully retracted position.

(b) Tighten nuts on two main roller shafts (flight rollers), if necessary, to prevent roller support ribs from spreading.

(c) Place temporary shims between rib face and outboard surface of inboard track (shim thickness
R for No. 4 slat is 0.340 inch and for No. 5, 6 and
R 7 slats is 0.300 inch).

(d) Position track firmly against temporary shims.

CAUTION: DO NOT APPLY FORCE OR ATTEMPT TO UNTWIST TRACKS IF TRACKS ARE TWISTED.

(e) Adjust and shim outboard roller assemblies to contact either upper or lower side of inboard track.

NOTE: Simultaneous contact of side rollers with both upper or lower sides of track is not
R required. Do not taper side roller
R assembly shims.

(f) Adjust and shim inboard roller assemblies to a
R 0.040 (±0.010) inch clearance from same part of track (upper or lower), that is in contact with outboard rollers.

(g) Remove temporary shims.

(h) Position inboard track firmly against outboard side rollers.

(i) Place temporary shims between rib face and outboard surface of outboard track (shim thickness
R for No. 4 slat is 0.340 inch and for No. 5, 6 and
R 7 slats is 0.300 inch).

(j) Adjust and shim outboard roller assemblies to contact either upper or lower side of outboard track.

NOTE: Simultaneous contact of side rollers with both upper or lower sides of track is not required. Do not taper side roller assembly shims.

(k) Adjust and shim inboard roller assemblies to a 0.040 (±0.010) inch clearance from same part of track (upper or lower), that is in contact with outboard rollers.

(l) Remove temporary shims.

(23) Perform operational check as follows:

(a) Check for smooth operation of slat tracks and side rollers.

NOTE: Side roller clearance will vary as slats are operated.

(b) Check that side rollers do not bottom out in retracted position.

NOTE: Side rollers may bottom out in extended position. This condition is acceptable providing that slat tracks are parallel.

(24) Shut off hydraulic power if no longer required (Ref. 29-11-00).

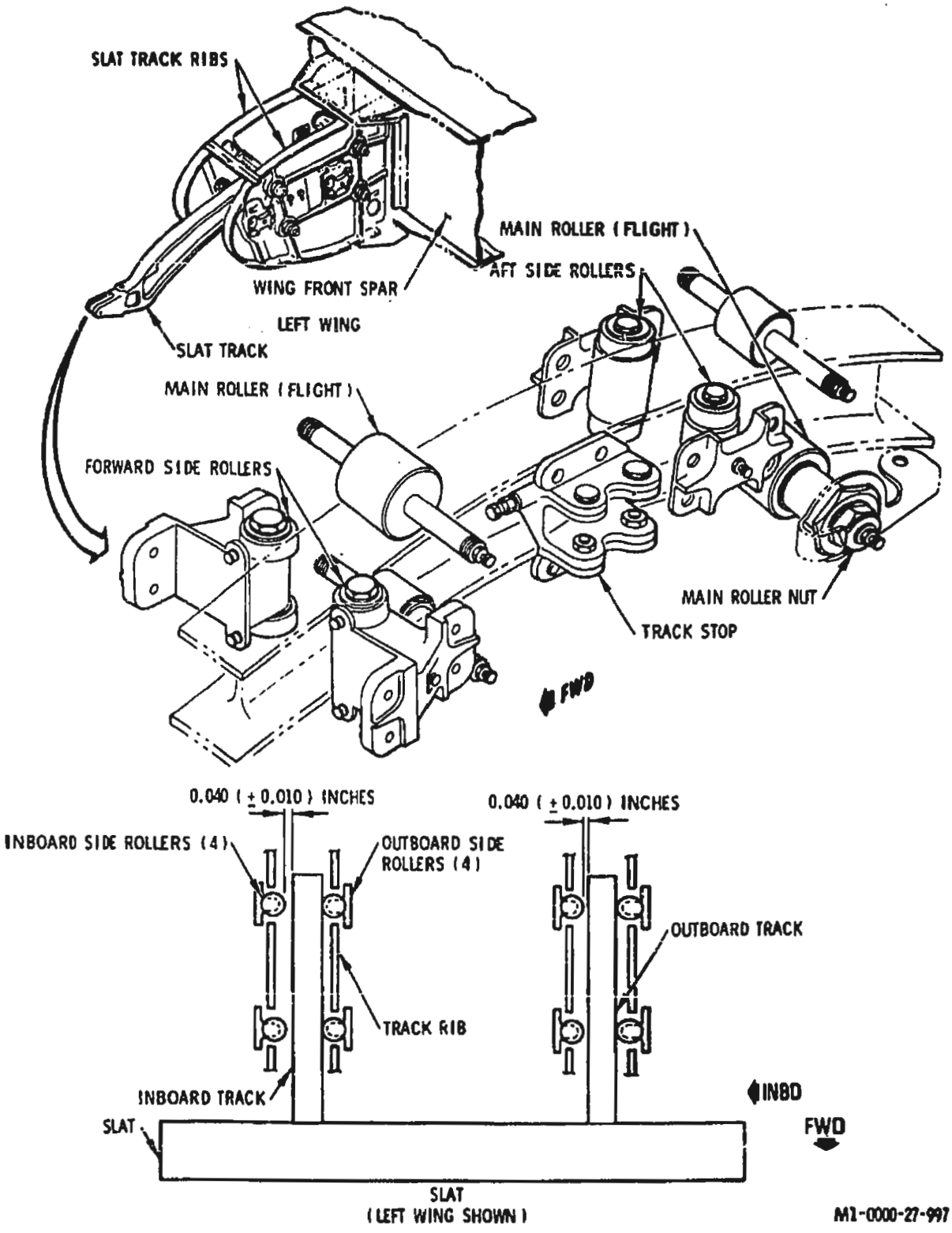
(25) Turn off electrical power if no longer required (Ref. 24-41-00).

NOTE: If no further rigging of the slat system is required, perform completion check (Ref. Para. 5E).

D. Slat Panels Quick Rigging Check

NOTE: This procedure is used to verify the following:

- The leading edge slats are correctly positioned with respect to the wing leading edge.
- The slat track retract and extend stops are correctly adjusted.



Slat Side Roller Adjustment
Figure 506

R • The slat actuators are adjusted to the correct
R retracted dimension.

R (1) Remove the torque tube between the left wing No. 1
R inboard slat actuator and the torque limiting brake.

R (2) Remove the torque tube between the right wing No. 1
R inboard slat actuator and the torque limiting brake.

R (3) Remove the asymmetry transducer from either slat
R asymmetry brake.

R (4) Standard procedure,
R manually retract the left wing slats as follows:

R NOTE: If retracting all seven slats at the same time
R requires an excessive amount of torque, the
R three inboard slats and the four outboard slats
R may be retracted separately in accordance with
R the Step (4) alternate procedure.

R (a) Rotate the torque tube system until the slats fair
R with the landing light rib, the pylon and the wing
R tip.

R (b) While holding slats in the retracted position,
R turn on electrical power and set slat asymmetry
R brake by turning the transducer input shaft (Ref.
R 27-81-37).

R (4) Alternate procedure,
R manually retract the left wing slats as follows:

R (a) Remove slat torque tube just inboard of the No. 1
R outboard slat.

R (b) Rotate the outboard slat torque tube system until
R the outboard slats fair with the pylon and wing
R tip.

R (c) Temporally reinstall the torque tube inboard of
R the No. 1 outboard slat.

R (d) Turn on electrical power and set slat asymmetry
R brake by turning the transducer input shaft (Ref.
R 27-81-37).

R (e) Remove slat torque tube just inboard of the No. 1
R outboard slat.

R (f) Rotate the inboard slat torque tube system until
R the inboard slats fair with the landing light rib
R and the pylon.

R (g) Reinstall the torque tube inboard of the No. 1
R outboard slat.

R (5) Reset the right wing slat asymmetry brake.

R NOTE: The left wing slat asymmetry brake must remain
R locked.

R (6) Repeat Step (4) for the right wing slats.

R (7) Reinstall the asymmetry transducer on the slat
R asymmetry brake.

R (8) Measure the slat actuator retract dimension for each
R slat (Ref. Fig. 502 Sheet 1). Retract dimension must
R be 4.00 (±0.20) inches.

R (9) Reinstall torque tubes between the No. 1 inboard slat
R actuators and the torque limiting brakes.

R NOTE: Do not reset asymmetry brakes until both torque
R tubes are reinstalled.

R (10) Reset both slat asymmetry brakes.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM.

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (11) Remove hydraulic panel warning tags and turn on
R hydraulic system A and C (Ref. 29-11-00).

R (12) Place flap handle in the 4° position to fully extend
R slats.

R (13) Measure the extend stop clearance at each slat track
R (Ref. Fig. 502 Sheet 2). The slat extend stops should

R have a 0.030 inch minimum clearance when the slats are
R fully extended, however, it is permissible for one stop
R to have less than 0.030 inch clearance, if the total
R clearance for both tracks of that slat is 0.060 inch
R minimum.

R (14) Shut off hydraulic power if no longer required (Ref.
R 29-11-00).

R (15) Turn off electrical power if no longer required (Ref.
R 24-41-00).

R NOTE: If no further rigging of the slat system is
R required, perform completion check (Ref. Para.
R 5E).

R E. Completion Check

(1) Verify that hydraulic systems warning tags are removed (Ref. 29-11-00).

(2) Verify that all access areas are closed and that all access panels are installed (Ref. 6-40-00).

(3) Perform slat control system verification test (Ref. Para. 4B).

LEADING EDGE SLAT SYSTEM - INSPECTION AND CHECK

1. General

A Flap/Slat Comparator Test Box (G/ITEL 27-51-167) may be used to check out and fault isolate slat asymmetry detection system. This test box connects in series with the asymmetry comparator.

2. Equipment and Materials

Flap/Slat Comparator Test Box, G/ITEL 27-51-167

3. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Inspection/Check

A. Installation

(1) Remove both electrical connectors from asymmetry comparator.

NOTE: Do not remove asymmetry comparator from aircraft.

(2) Install two electrical connectors from test box to asymmetry comparator and two connectors from test box to aircraft wiring that was disconnected from asymmetry comparator in Step 4A(1).

B. Test

(1) Verify following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel, CB1, zone 210:

NO. 2 ASYM BK - LE SLAT (J10)

LOCK LIGHT - LE SLAT (J12)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel, CB2, zone 215:

R NO. 1 ASYM BRAKE - LE SLAT (H22)

R (2) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY FOLLOWING BEFORE PRESSURING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR
R SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES
R AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL
R AND GROUND EQUIPMENT.

R AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (3) Turn on hydraulic systems A and C (Ref. 29-11-00).

R NOTE: Operating flaps and slats with AC pumps can
R cause "jerky" operation and trip overspeed
R governor in the asymmetry brakes. To provide
R normal flap and slat operation, pressurize B and
R C hydraulic systems using ATM pumps and A system
R using PTU. Alternately, two ground sources,
R each capable of 25 gpm at 3000 psi may be used
R to pressurize A and C systems.

R (4) Press and release LAMP TEST button and verify all
R lights on comparator test box are on (Ref. Fig. 601).

R (5) Press and release LAMP RESET button on comparator test
R box.

R (6) Verify all three POWER REQUIREMENTS lights are on, if
R not trouble-shoot power supply between indicated
R circuit breaker and comparator.

R (7) Verify all four ASYMMETRY BRAKE COILS - OPEN COIL and
R all four PDU SHUT OFF - OPEN COIL lights are off, if
R not replace indicated component.

R (8) Verify COMPARATOR FAULT DETECTION - DIVERGENCE
R COMPARATOR light is off, if not check PDU feedback
R assembly.

R NOTE: COMPARATOR FAULT DETECTION - LOCK light is
R normally on when DIVERGENCE COMPARATOR light is
R on.

R (9) Verify CABLE BREAK DETECTOR OR FLAP DIVERGENCE
R COMPARATOR CHECK lights are off. Three lights on
R indicate a failed cable break detector switch. All six
R lights on indicate a failed cable.

R NOTE: COMPARATOR FAULT DETECTION - LOCK light is
R normally on when CABLE BREAK DETECTOR OR FLAP
R DIVERGENCE COMPARATOR CHECK lights are on.

R (10) Position slats full up.

R (11) Verify PDU switches CH1 and/or CH2 lights are on.

R NOTE: PDU SWITCHES lights on indicate PDU shutoff
R valves are closed.

R (12) Position flap handle to 4-degree position.

R (13) While slats are in transit, verify 2 OUT OF 3 VOTER
R lights remain off. One light on indicates a failed
R channel in indicated rotary transducer or in that
R channel wiring.

R NOTE: A true asymmetry condition will cause following
R lights on test box to come on: COMPARATOR FAULT
R DETECTION-LOCK, PDU SWITCHES - CH-1 and CH-2 and
R multiple 2 OUT OF 3 VOTER lights come on; and
R ASYMMETRY BRAKE COILS - RIGHT WING and LEFT WING
R light come on for 5 seconds and then go off.

R (14) With slats extended, verify PDU SWITCHES CH1 and/or CH2
R lights are on.

R C. Removal

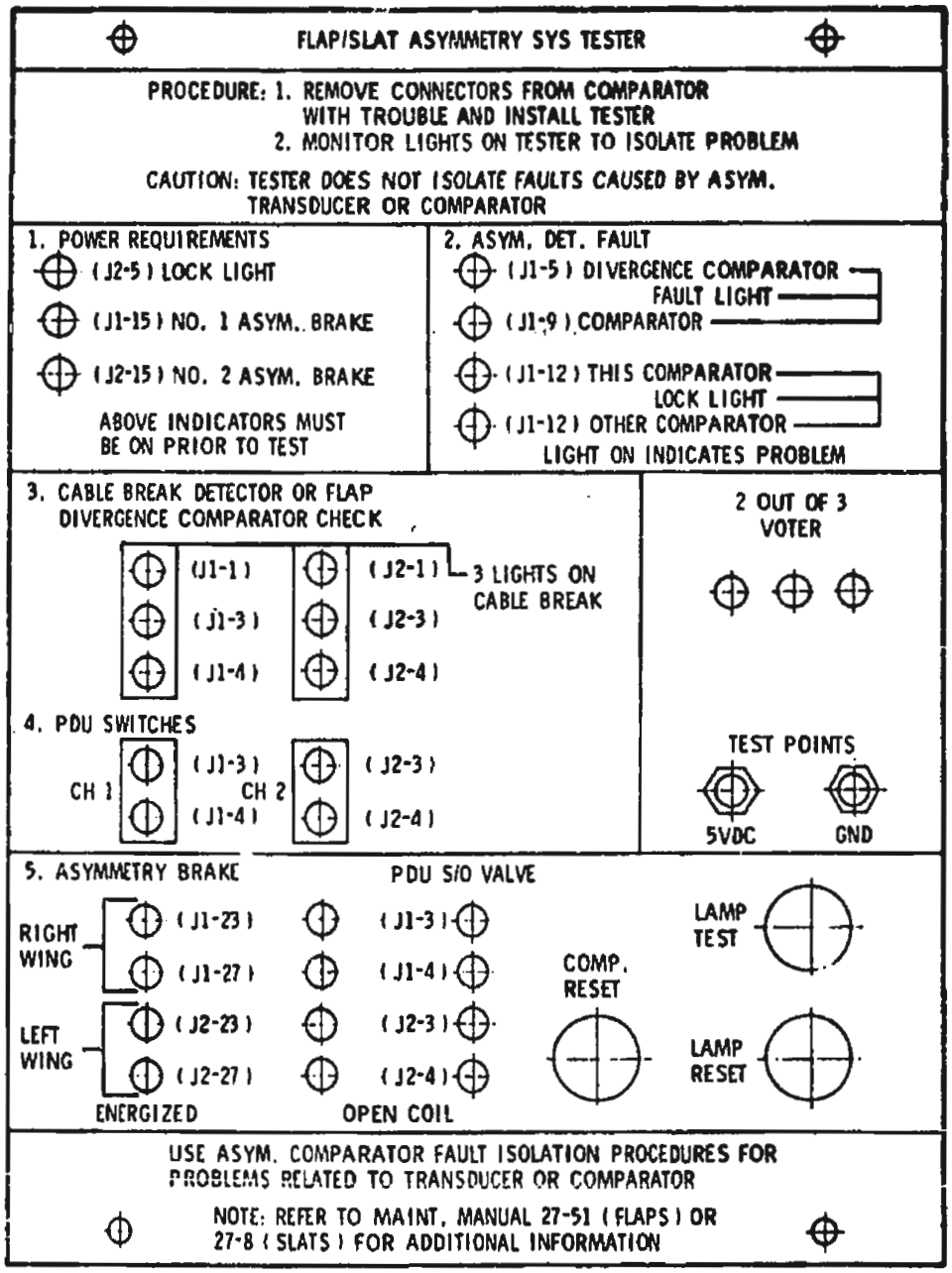
R (1) Disconnect two electrical connectors from test box to
R aircraft wiring and two connectors from test box to
R asymmetry comparator.

R (2) Connect two aircraft wiring electrical connectors to
R asymmetry comparator.

R (3) Operate slats through at least one up-down cycle.
R Verify SLAT ASYM DET FAULT and FLAP/SLAT LOCK lights on
R FE/SO annunciator panel remain off.

R (4) Turn off hydraulic power (Ref. 29-11-00).

R (5) Turn off electrical power (Ref. 24-41-00).



M1-0001-27-1029

R
R

Flap/Slat Comparator Test Set
Figure 601

EFFECTIVITY: ALL

001B

SLAT POWER DRIVE UNIT - REMOVAL AND INSTALLATION

1. General

The following is a list of slat PDU Line Replaceable Units (LRU'S):

R Flow Limiter Valve, 27-81-04

Solenoid Shutoff Valve, 27-81-05

R Free Wheel Valve, 27-81-06

R Brake Valve, 27-81-07

Position Indicator Switch Pack, 27-81-08

Command Signal Regulator, 27-81-09

Hydraulic Motor, 27-81-10

Filter, 27-81-11

2. Equipment and Materials

Container (1 gallon minimum)

Hydraulic fitting

Protective caps

Rig pin, 5/16-inch diameter, 3-inches long (R3) part of Rig Pin Kit, PN 8735, or equivalent

Lubricant, Grease, MIL-G-23827A, or equivalent

Lifting eye, 3/8-16 threads, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
20-29-01	Fluid Lines and Fittings - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

36-14-00 Distribution Manifold System

36-22-04 Left Inboard Wing Area Overheat Sensors, Channel D - Removal and Installation

4. Removal/Installation

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

A. Removal

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on hydraulic systems A and C (Ref. 29-11-00).

CR NOTE: To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources, each capable of 25 gpm at 3000 psi, may be used to pressurize the A and C hydraulic systems. Electric pumps must not be used as they will not meet this requirement.

(3) Position flap control handle to the four degree detent to fully extend leading edge slats. When flaps and slats reach selected position, turn off hydraulic power.

NOTE: Slat PDU can be replaced with slats in any position.

(4) Activate the slat asymmetry system brakes as follows to lock slat drive system.

(a) Open either wing tip access panel 521TB or 621TB.

R (b) Remove either left or right asymmetry rotary
R transducer from brake by removing attaching
R screws.

R (c) Do not disconnect electrical connector. (Rotary
R transducer is mounted on bottom of asymmetry
R brake.)

R (d) Rotate transducer shaft in either direction until
R brake trips (pop-out indicator protrudes from
R brake).

R (e) Reinstall transducer with washers and screws;
R lock-wire screws. No timing is necessary.

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL ZONE 215, AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL, ZONE 147.

(5) Turn off electrical power (Ref. 24-41-00).

(6) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker NO. 2 ASYM BK LE SLAT (J10).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker L.E. SLAT EXTEND LIGHT (K18).

(7) Open the following left wing upper and lower access panels to gain access to slat PDU: 511AB and 511AT-1, (Ref. 6-40-00).

NOTE: The following procedures must be used to remove the torsional shock absorber, in order to disconnect the fuselage left torque tube from angle gearbox, and to remove power drive unit (PDU) with angle gearbox as an assembly.

(8) Disconnect overheat sensor wire from pneumatic duct and from connector at outboard end of compartment.

(a) Move connector towards spar.

WARNING: PLACARD FLIGHT ENGINEER/SECOND OFFICERS (FE/SO) BLEED AIR AND APU CONTROL PANELS AND THE THREE HIGH-PRESSURE GROUND AIR CONNECTIONS TO PREVENT OPERATION UNTIL COMPLETION OF PROCEDURES.

RECENT OPERATION OF AIRCRAFT PNEUMATIC SYSTEM WILL REQUIRE PRECAUTIONS AGAINST DANGEROUSLY HIGH SYSTEM TEMPERATURES. PROTECTIVE GLOVES SHOULD BE USED WHEN REQUIRED.

(9) Remove section of pneumatic manifold ducting below PDU as follows:

(a) Placard Flight Engineer/Second Officers (FE/SO) bleed air and APU control panels and the three high-pressure ground air connections to prevent operation until completion of procedures.

(b) Disconnect required duct clamp covers and clamps (Ref. 36-14-00).

(10) Disconnect five electrical connectors at PDU (Ref. Fig. 401).

(11) Disconnect and cap four hydraulic lines (SYS A and SYS C) at PDU.

(12) On aircraft without SB27-278, disconnect and cap two seal drain lines at PDU.

(12) On aircraft with SB27-278, disconnect and cap three seal drain lines at PDU.

(13) Disconnect PDU input rod/bungee from PDU input arm by removing connecting bolt.

(14) Remove bolts securing fuselage pressure seal assembly to inboard side of angle gearbox.

(15) Loosen fuselage pressure seal clamp bolt and push pressure seal inboard to expose torque tube coupling.

(16) Reinstall four bolts on inboard side of angle gearbox to prevent gearbox from separating.

(17) Remove all three coupling bolts and slide coupling sleeve inboard to disengage coupling from angle gearbox spline coupling.

(18) On the outboard end of PDU, remove coupling spline bolt from outboard end of the torsional shock absorber.

(19) Remove coupling spline bolt from inboard end of shock absorber.

(20) Disengage couplings from shock absorber and remove shock absorber.

(21) Install lifting eye in 3/8-16 tapped hole on top of PDU. Attach rope to lifting eye. Have one man on top of wing to support weight of PDU.

NOTE: PDU with angle gearbox weighs approximately 85 pounds. (If available, use overhead crane or mobile hoist to lower PDU and to raise replacement PDU.)

(22) Remove bolt from upper outboard mount first.

(23) On aircraft with one piece upper outboard mount bushing, remove bushing from mount hole by pulling out with pliers or by drifting bushing out.

NOTE: If bushing is difficult to remove, use "easy-out" and discard bushing. (See Fig. 401 for detail of installation).

(24) Remove two bolts from inboard (upper and lower) mounts.

(a) Lower PDU (with angle gearbox to cart). Remove rope from lifting eye and remove lifting eye from top of PDU.

(25) Remove nuts securing angle gearbox to PDU.

(26) Remove angle gearbox.

B. Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL AND THE HYDRAULIC SERVICE CENTER HYDRAULIC SERVICING PANEL.

(1) Verify circuit breakers opened in Step A(6) are open and tagged.

(2) Butter-lube angle gearbox spline with grease.

(a) Engage angle gearbox to PDU splines and install gearbox on replacement PDU with mounting nuts.

(b) Lock-wire nuts together.

(3) Install lifting eye in threaded hole on top of PDU. Attach rope to lifting eye, and with one man on top of wing, raise PDU into position (position PDU lugs on inboard side of mounting bracket lugs).

NOTE: PDU with angle gearbox weighs approximately 85 pounds.

(4) Install PDU on mounting bracket as follows:

(a) Install bolt, washer, and nut securing PDU to the two inboard mounts (upper and lower) of mounting bracket.

(b) Install bushing in the upper outboard PDU lug and mounting bracket links.

NOTE: Normally, LS 10020-5PP36 bushing engages PDU lug and links. To facilitate PDU removal, replace one long bushing with two short bushings. Use LS 10020-5PP28 in links and use LS 10020-5PP8 in PDU support (Ref. Fig. 401, view C).

(c) Install bolt, washer and nut in upper outboard mount.

(d) Remove rope from lifting eye and remove lifting eye from PDU.

R (5) On aircraft without SB27-278,
R remove caps from lines and connect two seal drain lines
R to PDU.

R (5) On aircraft with SB27-278,
R remove caps from lines and connect three seal drain
R lines to PDU.

(6) Remove caps from lines and connect four hydraulic pressure and return lines to PDU. Torque hydraulic fittings (Ref. 20-29-01).

(7) Connect five electrical connectors to PDU.

(8) Install slat PDU input rod/bungee as follows:

(a) Position flap handle to the 0-degree detent.

(b) Install rig pin in slat cable quadrant just inboard of PDU.

(c) With PDU input arm against the PDU internal up stop (input arm pointing outboard), adjust input
R rod/bungee to fit, then lengthen one-half turn
R (approximately 0.02 in.). Install bolt through
R PDU input arm and input rod/bungee. Install
R washer and nut on bolt and tighten finger tight.

R (d) Remove rig pin from slat cable quadrant.

R (e) Position flap handle to 4-degree detent. Verify
R PDU input lever is contacting the PDU (internal)
R extend stop with slight compression of input
R rod/bungee spring. Verify the bolt through the
R PDU input arm and input rod/bungee will not rotate
R freely.

R (f) Torque nut on bolt through the PDU input arm and
R input rod/bungee and install cotter pin.

NOTE: Observe slat PDU input lever and slat cable quadrant during check and verify that slat PDU input arm stops moving (contacts stop) before cable quadrant stops moving.

(9) Turn on electrical power (Ref. 24-41-00).

(10) Reset slat asymmetry comparator as follows:

WARNING: DO NOT RESET SLAT ASYMMETRY BRAKE.

(a) On pilots overhead circuit breaker panel CB1, open circuit breaker NO. 2 ASYM BK - LE SLAT (J10) and LOCK LITE LE SLAT (J12).

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open circuit breaker NO. 1 ASYM BRAKE - LE SLAT (H22).

(c) After 10 seconds, close circuit breakers opened in Steps (a) and (b). The FLAP/SLAT LOCK light and SLAT ASYM DET FAULT lights on Flight Engineer/Second Officers annunciator panel must go off.

(11) Remove all rig pins from flap and slat control system.

(12) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(13) Turn on hydraulic system A and C.

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap actuation system, pressurize B and C hydraulic systems using ATM pumps and pressurize A hydraulic system using B-A PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize A and C hydraulic systems.

C NOTE: To perform a valid test of the flap actuation
C system, pressurize B and C hydraulic systems
C using ATM pumps and pressurize A hydraulic
C system using B-A PTU. Alternately, two ground
C sources each capable of 25 GPM at 3000 psi may
C be used to pressurize A and C hydraulic systems.
C The electric pumps must not be used as they do
C not meet this requirement.

C (14) Operate the new PDU a number of cycles to purge trapped
C air. Ten to 12 cycles are recommended.

C (a) With the PDU at electrical shutoff in the "slats
C up" position, pull circuit breakers 1J10 and 2H22
C for asymmetry brakes 1 and 2. Observe that the
C PDU output shaft makes additional movement beyond
C electrical shutoff. Reset the circuit breakers.

CR NOTE: If the PDU has a "K" or "M" control lap
CR assembly, there may be little or no
CR additional movement when the two circuit
CR breakers are pulled. The letter
CR vibro-etched after the I.D. part number
CR indicates which lap assembly is installed.

CR Verify that the 'C' system isolation valve
CR shuts off.

C (b) Repeat this procedure at the electrical shutoff
C point for "slats down". Observe that the PDU
C output shaft makes additional movement beyond
C electrical shutoff. Reset the circuit breakers.

CR NOTE: If the PDU has a "K" or "M" control lap
CR assembly, there may be little or no
CR additional movement when the two circuit
CR breakers are pulled. The letter
CR vibro-etched after the I.D. part number
CR indicates which lap assembly is installed.
CR Verify that the 'C' system isolation valve
CR shuts off.

C (c) Prior to connecting the torque tubes, cycle the
C PDU one more time so that the PDU is inside the
C electrical shutoff envelope. Proceed with the
C regular torque tube rig and hookup as indicated in
C the Maintenance Manual.

C (d) If these operating envelopes cannot be
C established, replace the PDU.

NOTE: After bleeding PDU, bleed hydraulic reservoir. See reservoir servicing instruction placard (Ref. 12-13-00).

(15) Inspect slat PDU hydraulic line connections for leakage.

(16) Position flap handle to four-degrees detent. When slat PDU stops operating, (slats extend rig position), shut off hydraulic power.

(17) With slat PDU in a extended rig position, rig left and right torque tube systems before coupling to slat PDU as follows:

CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(a) Gain access to left slat asymmetry brake (access panel 521TB) and reset asymmetry brake.

(b) At outboard end of PDU, rotate torque limiting brake splined shaft so No. 1 left slat actuator is at maximum extended rig length (26.17 inch) (Ref. 27-81-00, Figure 502, Sheet 1, View A and B).

NOTE: Butter-lube all spline surfaces with grease.

(c) With left torque tube system positioned in slat extended rig position, install torsional shock absorber by engaging shock absorber coupling splines to PDU output spline and to torque limiting brake.

(d) Install bolt, washer, nut, and cotter pin through coupling splines and shafts in both ends of shock absorber.

CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(e) Gain access to right slat asymmetry brake (access panel 621TB) and reset asymmetry brake.

(f) At inboard end of PDU, rotate torque tube until the No. 1 right slat actuator is at maximum extended rig length (26.17 inch) (Ref. 27-81-00, Figure 502, Sheet 1, View A and B).

(g) With right torque tube system positioned in slat extended rig position, slide coupling sleeve to engage fixed spline coupling on the angle gearbox.

(h) Install bolts securing coupling sleeve to fixed spline coupling.

(i) Lock-wire bolt heads together.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(18) With electrical and hydraulic power on, position flap handle to zero-degree detent to retract slats.

(19) With slats retracted, verify No. 1 left and right slat actuator retract dimension is 4.00 (±0.20) inches (Ref. 27-81-00, Figure 502, Sheet 1, View B). If slat

retract dimension meets above requirements, slat to PDU rigging is acceptable. If not accomplish the following:

(a) Record slat retract dimension on, No. 1 left or right, slat actuator that does not meet retract requirements.

(b) Position flap handle to 4-degree detent position in order to fully extend slats.

(c) On No. 1 slat actuator that did not meet retract limits, measure and record slat extended dimension.

C
C NOTE: Actuator cannot be shortened to less than 25.5 inches.

(d) Disconnect applicable slat torque tube from PDU and manually rotate torque tube to retract or extend the affected No. 1 actuator the amount required to meet retract dimension [4.0 (±0.2) inches]. For example, if retract dimension was 4.5 inches, manually rotate torque tube to retract slat 0.5 inches. Reconnect torque tube to PDU.

(e) Position flap handle to zero degree detent to retract slats.

(f) Recheck No. 1 slat actuator retract dimension. If dimension is still not 4.0 (±0.2) inches, repeat steps 4B(19)(a) through 4B(19)(f).

(g) Turn off hydraulic power.

(20) Remove bolts from angle gearbox to attach fuselage pressure seal. Pull fuselage pressure seal outboard to mate with angle gearbox and install mounting bolts.

(a) Tighten fuselage pressure seal clamp bolt.

(21) Install section of pneumatic manifold ducting as follows:

(a) Position duct in place and install clamps and clamp covers (Ref. 36-14-00).

(b) Remove placards from Flight Engineer/Second Officers (FE/SO) bleed air and APU control panels and the three high-pressure ground air connections.

(c) Pressure test pneumatic manifold ducting.

(22) Install overheat sensor wire (Ref. 36-22-04).

(23) Verify all rig pins are removed from flap and slat control system.

(24) Verify slat PDU area is clear of all tools and equipment.

(25) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(26) Verify that following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel, CB1, zone 210: PROX SW PWR NO. 1 (H10).

(b) On Flight Engineer/Second Officers aft circuit breaker panel, CB3, zone 215: LE SLAT EXTEND LT (K18), and PROXIMITY SWITCH 2 and 3 (H3 and H4).

(27) Turn on hydraulic systems A and C (Ref. 29-11-00).

(28) Cycle slats from full retract to full extend and back to full retract for several cycles and verify normal slat operation and that the "C" system isolation valve indicator pin extends with slats retracted and slats extended (Ref. 27-81-00 Fig. 23).

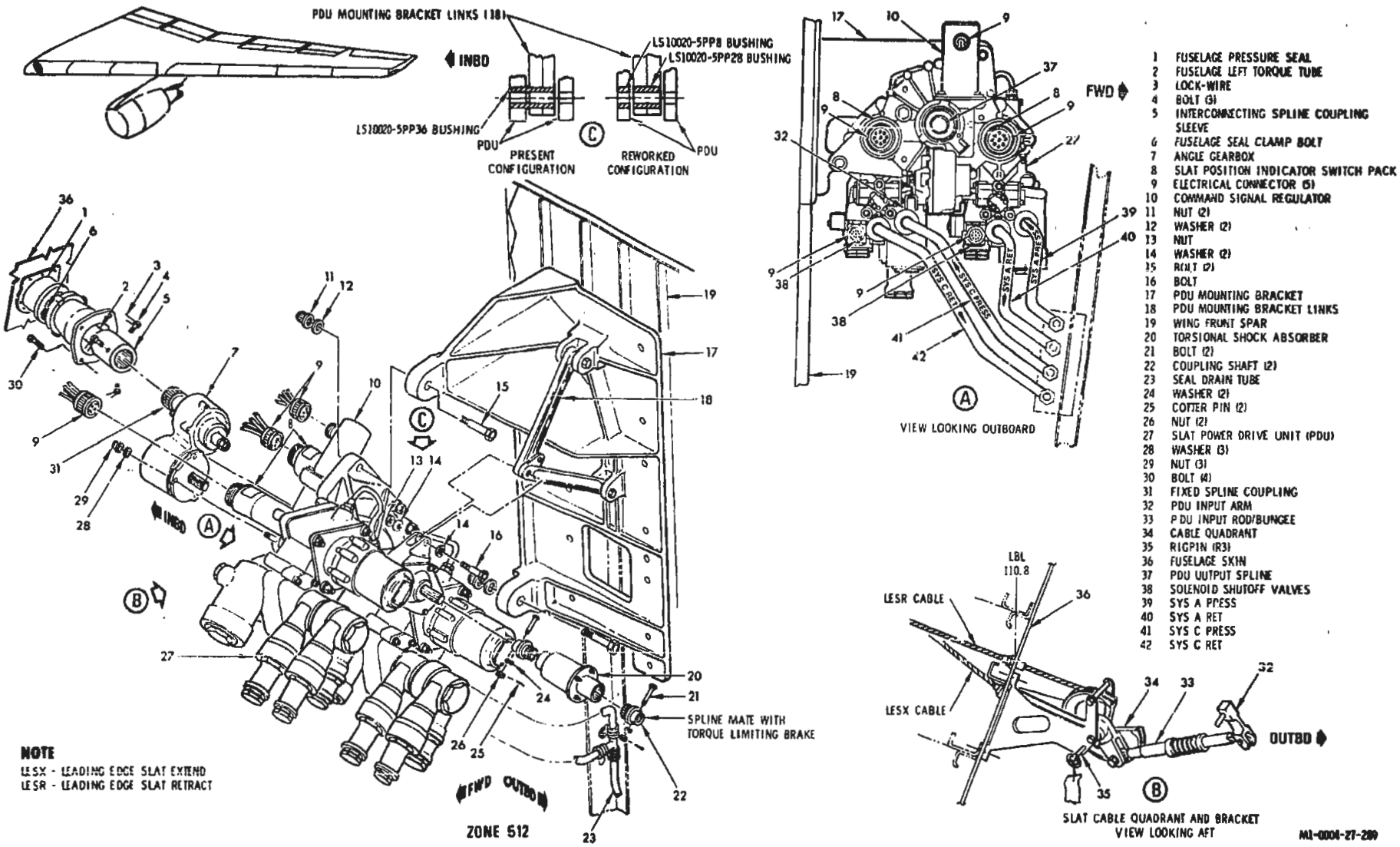
C
C
C

(29) Check operation of position indicating switch packs (Ref. 27-81-08, 2C).

(30) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(31) Turn off electrical power if no longer required (Ref. 24-41-00).

(32) Close all access openings.

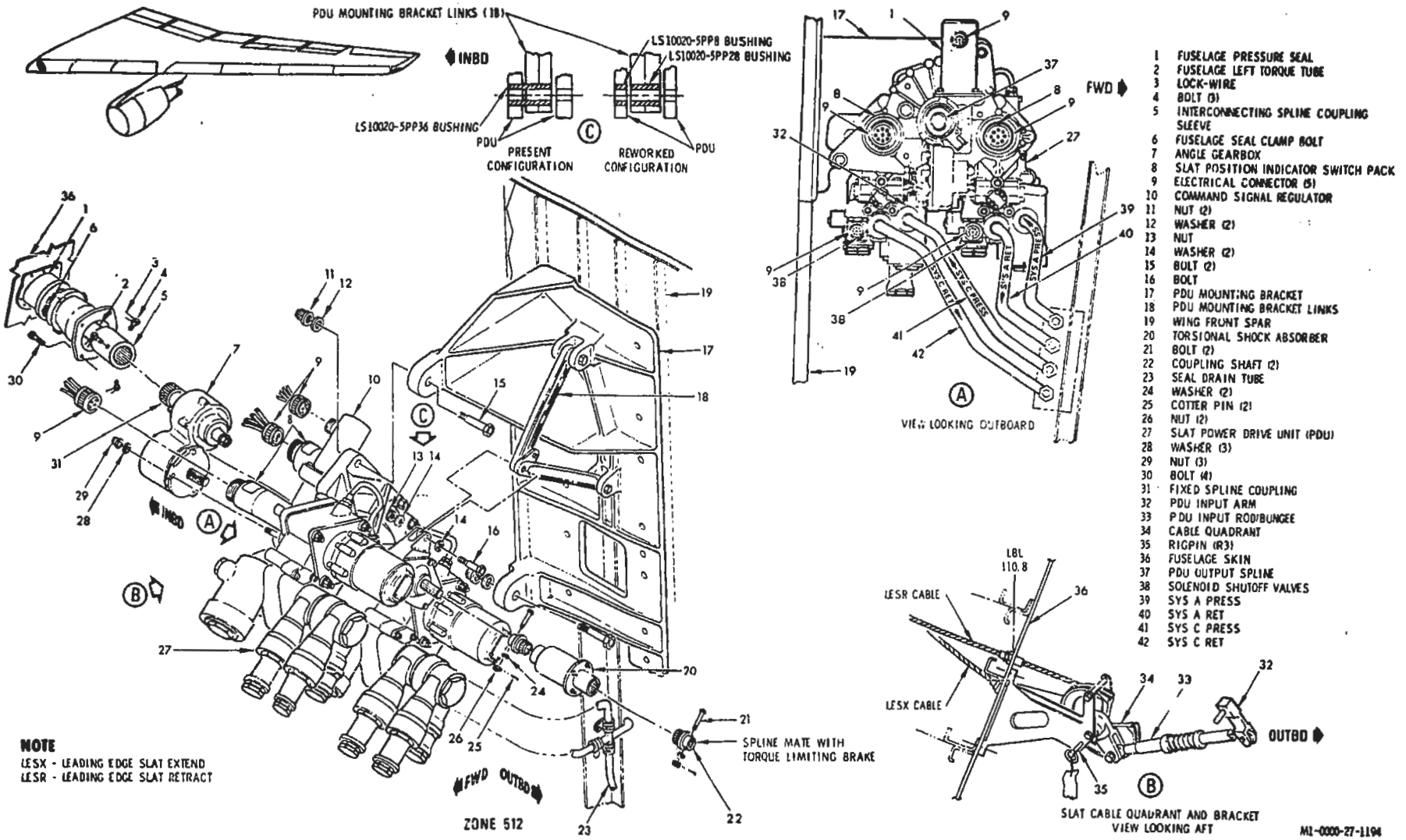


1 FUSELAGE PRESSURE SEAL
2 FUSELAGE LEFT TORQUE TUBE
3 LOCK-WIRE
4 BOLT (3)
5 INTERCONNECTING SPLINE COUPLING SLEEVE
6 FUSELAGE SEAL CLAMP BOLT
7 ANGLE GEARBOX
8 SLAT POSITION INDICATOR SWITCH PACK
9 ELECTRICAL CONNECTOR (5)
10 COMMAND SIGNAL REGULATOR
11 NUT (2)
12 WASHER (2)
13 NUT
14 WASHER (2)
15 BOLT (2)
16 BOLT
17 PDU MOUNTING BRACKET
18 PDU MOUNTING BRACKET LINKS
19 WING FRONT SPAR
20 TORSIONAL SHOCK ABSORBER
21 BOLT (2)
22 COUPLING SHAFT (2)
23 SEAL DRAIN TUBE
24 WASHER (2)
25 COTTER PIN (2)
26 NUT (2)
27 SLAT POWER DRIVE UNIT (PDU)
28 WASHER (3)
29 NUT (3)
30 BOLT (4)
31 FIXED SPLINE COUPLING
32 PDU INPUT ARM
33 PDU INPUT ROD/BUNGEE
34 CABLE QUADRANT
35 RIGPIN (R3)
36 FUSELAGE SKIN
37 PDU OUTPUT SPLINE
38 SOLENOID SHUTOFF VALVES
39 SYS A PRESS
40 SYS A RET
41 SYS C PRESS
42 SYS C RET

NOTE
LESX - LEADING EDGE SLAT EXTEND
LESR - LEADING EDGE SLAT RETRACT

Slat Power Drive Unit - Removal and Installation
Figure 401

R EFFECTIVITY: WITHOUT SB27-278
R
0018



NOTE
LESX - LEADING EDGE SLAT EXTEND
LESR - LEADING EDGE SLAT RETRACT

1 FUSELAGE PRESSURE SEAL
2 FUSELAGE LEFT TORQUE TUBE
3 LOCK-WIRE
4 BOLT (3)
5 INTERCONNECTING SPLINE COUPLING SLEEVE
6 FUSELAGE SEAL CLAMP BOLT
7 ANGLE GEARBOX
8 SLAT POSITION INDICATOR SWITCH PACK
9 ELECTRICAL CONNECTOR (5)
10 COMMAND SIGNAL REGULATOR
11 NUT (2)
12 WASHER (2)
13 NUT
14 WASHER (2)
15 BOLT (2)
16 BOLT
17 PDU MOUNTING BRACKET
18 PDU MOUNTING BRACKET LINKS
19 WING FRONT SPAR
20 TORSIONAL SHOCK ABSORBER
21 BOLT (2)
22 COUPLING SHAFT (2)
23 SEAL DRAIN TUBE
24 WASHER (2)
25 COTTER PIN (2)
26 NUT (2)
27 SLAT POWER DRIVE UNIT (PDU)
28 WASHER (3)
29 NUT (3)
30 BOLT (4)
31 FIXED SPLINE COUPLING
32 PDU INPUT ARM
33 PDU INPUT RODBUNGEE
34 CABLE QUADRANT
35 RIGPIN (R3)
36 FUSELAGE SKIN
37 PDU OUTPUT SPLINE
38 SOLENOID SHUTOFF VALVES
39 SYS A PRESS
40 SYS A RET
41 SYS C PRESS
42 SYS C RET

Slat Power Drive Unit - Removal and Installation
Figure 401

R EFFECTIVITY: WITH SB27-278
R
001B

SLAT POWER DRIVE UNIT - INSPECTION AND CHECK

1. General

This section details the allowable leakage for the slat PDU.

2. Inspection/Check

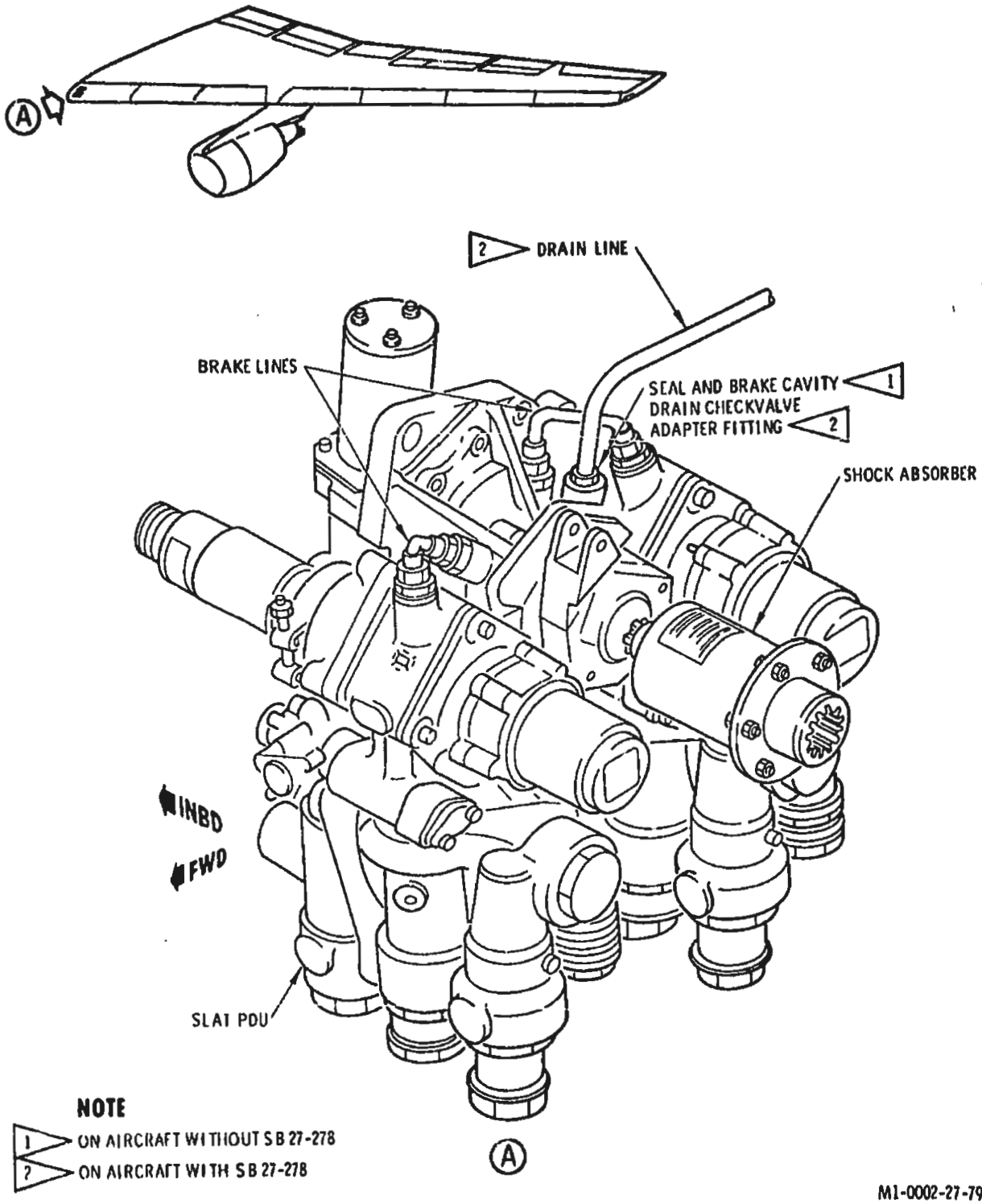
A. Brake Cavity Check Valve Leakage Check

(1) After pressurizing both valve modules and running unit to full extend and full retract at least once, observe
R brake lines for leakage. Leakage shall not form a drop
R (Ref. Fig. 601).

R (2) On aircraft without SB27-278,
R the allowable discharge of fluid from the seal and
R brake cavity drain check valve is approximately 4 drops
R (0.2 cc) per activation.

R NOTE: When brake cavity is full of fluid and brake
R piston activates to release the brake, movement
R of the piston displaces a volume of fluid
R through this check valve. This volume of fluid
R displaced is not to be interpreted as PDU
R leakage. After the volume of fluid is
R displaced, there is no visual leakage until this
R cavity is full again at which time the cycle
R repeats itself.

R Aircraft with SB27-278 have a drain line
R installed instead of the seal and brake cavity
R drain check valve making a check of fluid
R discharge impossible



NOTE

1 ON AIRCRAFT WITHOUT SB 27-278
2 ON AIRCRAFT WITH SB 27-278

M1-0002-27-796

R R Slat Power Drive Unit Leakage Check
Figure 601

SLAT POWER DRIVE UNIT - APPROVED REPAIRS

1. General

The following procedure is to be used to correct a hydraulic leak at the slat PDU when the leak is caused by a damaged O-ring under the threaded insert. These inserts are used in the oil-in, oil-out, and brake port of both valve modules. Leakage is caused by extrusion of the O-ring into the lock pin holes of the threaded insert or valve module. The repair consists of epoxy-filling the spring pin holes in the threaded insert and valve bosses. These repair procedures are covered in Sunstrand Service Bulletin No. 27-9.

R Revision 2 of Sunstrand Service Bulletin No. 27-9 provides
R instructions and parts to incorporate one-piece male adapter
R inserts to replace the two-piece threaded insert and tube
R coupling. Pin holes at the oil-in, oil-out, and brake ports of
R the valve modules must be epoxy-filled before installing
R one-piece adapter.

2. Equipment and Materials

Torque wrench, 0-100 foot pounds

Container, one gallon (for catching oil)

Bolt, 3/4-16UNJF-38 and two nuts

Bolt, 7/16-20UNJF-38 and two nuts

O-ring, P/N NAS1611-121 [(Ref. Fig. 801, Sheet 1, item (6)]

O-ring, P/N NAS1611-118 [(Ref. Fig. 801, Sheet 1, item (5)]

O-ring, P/N NAS1612-4 [(Ref. Fig. 801, Sheet 1, item (9)]

O-ring, P/N NAS1612-8 [(Ref. Fig. 801, Sheet 1, item (2)]

O-ring, P/N 3634-204-12-80 [(Ref. Fig. 801, Sheet 1, item (12)]

Cleaner, oil-free 1, 1, 1-trichlorethane, freon, or equivalent

Epoxy resins:

Armstrong, P/N A-60

B. F. Goodrich, P/N A-1177-B (MIL-A-8623, Type 1)

Cycle Weld, Catalyst P/N C-14B

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-13-01	Hydraulic Reservoir Air Bleed Check
20-29-01	Fluid Lines and Fittings - Maintenance Practices
24-41-00	External Power/Ground System - Maintenance Practices
27-81-03	Slat Power Drive Unit - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Approved Repairs

NOTE: The repairs can be made on the PDU while installed on the aircraft. If the PDU is repaired in the shop, the epoxy can be oven cured using Armstrong P/N A-60. If the PDU is repaired on the aircraft, use B.F. Goodrich P/N A-1177-B and cycle weld catalyst P/N C-14B; air cure for 15 minutes at 72 degrees Fahrenheit.

A. Slat PDU Oil-in, Oil-out, and Brake Port Threaded Insert Repair

CAUTION: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

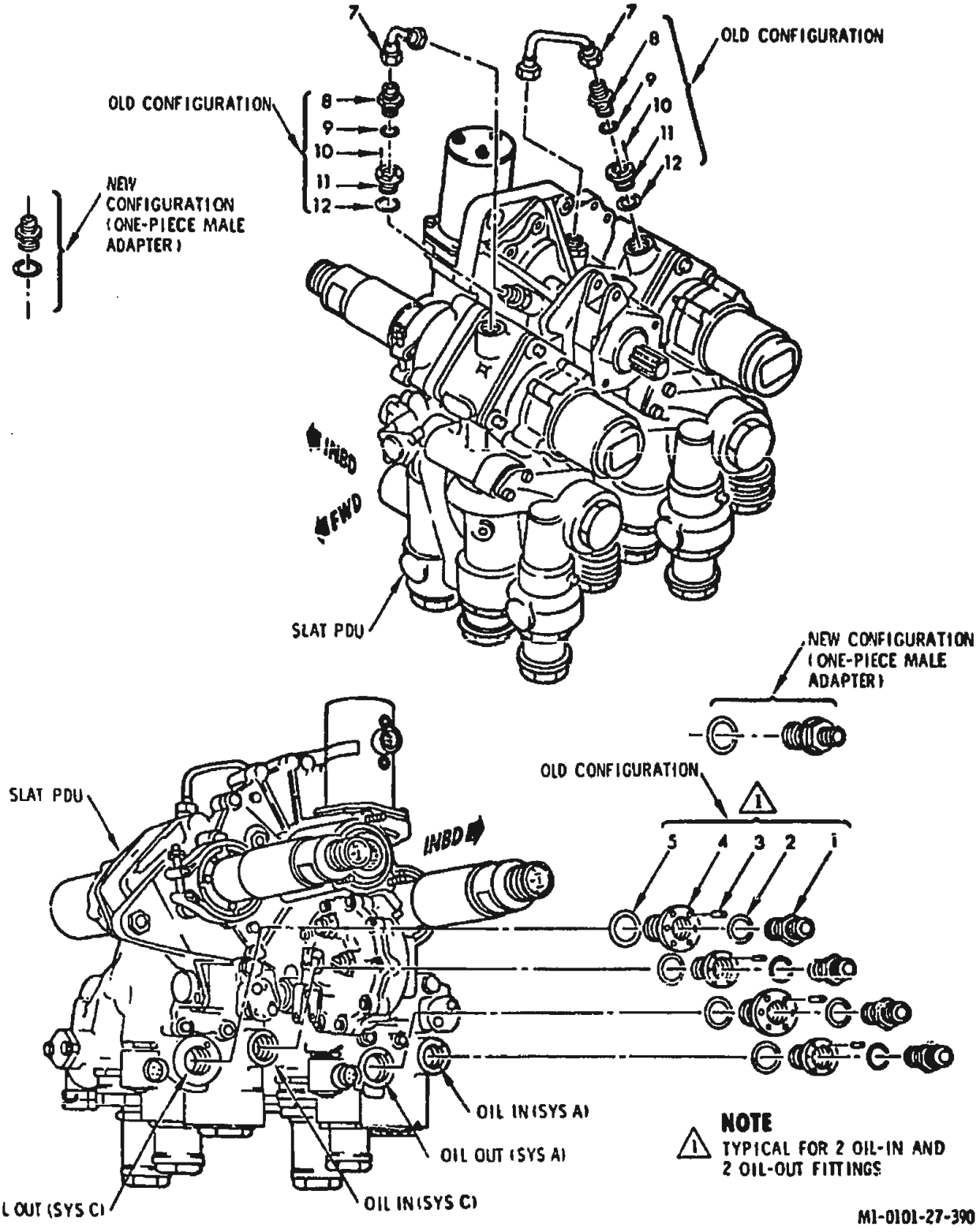
(1) Repair oil-in or oil-out threaded insert as follows (Ref. Fig. 801):

(a) Remove left wing lower access panel 511AB (under slat PDU) (Ref. 6-40-00).

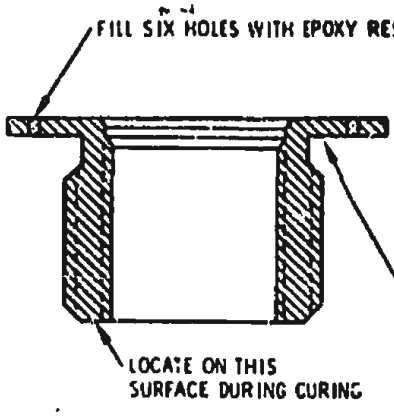
(b) Disconnect hydraulic line from PDU fitting to be reworked. Use container to catch oil.

(c) Remove fitting (1) and O-ring (2).

(d) Drive spring pin (3) below flange of threaded insert (4). Remove threaded insert and O-ring (5) with bolt and jamnuts in accordance with Fig. 801, Sheet 2.



R R Slat PDU Hydraulic Fitting Threaded Insert Repair
Figure 801 (Sheet 1)


FILL SIX HOLES WITH EPOXY RESIN
LOCATE ON THIS SURFACE DURING CURING
EPOXY RESIN MUST BE WORKED FLUSH WITH THIS SURFACE AFTER CURING

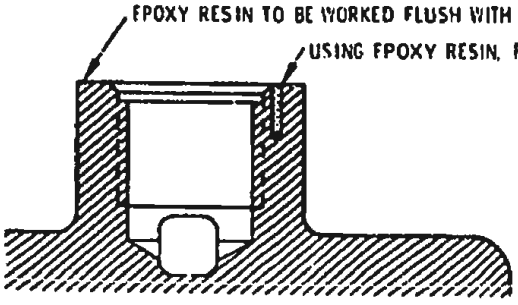
PROCEDURE

1 CLEAN THE INSERT WITH CLEANING SOLVENT

2 USING ARMSTRONG A-60 EPOXY, FILL SIX HOLES FLUSH WITH THE SURFACE OF THE INSERT. SCRAPE SURFACES CLEAN AFTER FILLING HOLES WITH EPOXY (A SINGLE EDGE RAZOR BLADE IS IDEAL FOR FILLING HOLES AND SCRAPING EPOXY). CURE THE EPOXY IN AN OVEN FOR 15 MINUTES AT 250° FAHRENHEIT

3 DURING CURING PERIOD, EPOXY WILL PROTRUDE FROM HOLES ON SEALING SURFACE SIDE. USING A FINE FILE AND EMERY CLOTH, REMOVE EXCESS PROTRUSION SO THAT EPOXY RESIN IS FLUSH WITH SEALING SURFACE

FILLING THREADED INSERT SPRING PIN HOLES WITH EPOXY RESIN



PROCEDURE

1 CLEAN THE PIN HOLE IN THE OIL-IN, OIL-OUT, AND BRAKE LINE BOSSES AND THE SURROUNDING AREA WITH CLEANING SOLVENT

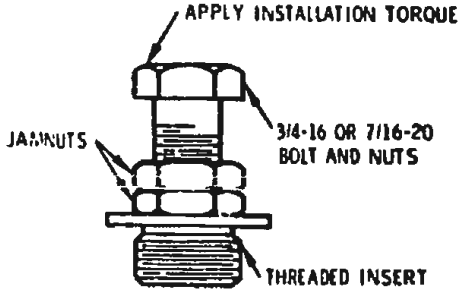
CAUTION DO NOT ALLOW SOLVENTS TO ENTER THE VALVE HOUSING; THEY ARE NOT COMPATIBLE WITH HYDRAULIC FLUID

2 USING ARMSTRONG A-60 EPOXY, FILL ALL EXISTING PIN HOLES FLUSH WITH THE SURFACE. CURE THE EPOXY IN AN OVEN AT 250° FAHRENHEIT FOR 15 MINUTES

3 REMOVE EXCESS EPOXY RESIN FROM SEAL SURFACE, AFTER CURING WITH A FINE FILE AND EMERY CLOTH

CAUTION DO NOT ALLOW FILINGS TO ENTER THE BORE

FILLING OIL-IN, OIL-OUT AND BRAKE LINE BOSS SPRING PIN HOLES WITH EPOXY RESIN



INSTALLATION AND REMOVAL OF THREADED INSERTS

M1-0100-27-391

R Slat PDU Hydraulic Fitting Threaded Insert Repair
R Figure 801 (Sheet 2)

NOTE: A No. 40 drill bit and angle drill may be used to remove 1/8 to 3/16 inch of the spring pin to assure that the pin will clear the fitting. Remove all burrs from the valve module flange area with a fine file.

R CAUTION: *USE CARE NOT TO GET ANY METAL INTO THE BORES.*

(e) Epoxy-fill pin holes in valve module (Fig. 801, Sheet 2).

(f) Epoxy-fill pin holes in threaded insert (Fig. 801, Sheet 2).

NOTE: If one-piece male adapter is available, install it instead of two-piece threaded insert and tube fitting (Ref. Sunstrand Service Bulletin 27-9, Rev. 2).

(g) Install new O-ring [(5) oil in or (6) oil out] on threaded insert (4). Coat O-ring with hydraulic fluid. Install insert in valve module using bolt and two jam nuts as shown in Fig. 801, Sheet 2. Torque threaded insert 80 to 90 foot pounds. Remove installation bolt by loosening jamnuts. Remove bolt.

(h) Install new O-ring (2) on fitting (1). Coat O-ring with hydraulic fluid. Install fitting on valve module.

(i) Connect hydraulic fluid line to fitting. Torque hydraulic line fitting (Ref. 20-29-01).

(j) Check slat PDU in accordance with Step (3).

(2) Repair brake line threaded insert as follows:

(a) Remove left wing lower and upper access panels 511AB, 511AT-1, and 511BT-1 (Ref. 6-40-00).

(b) Remove brake pressure hydraulic line (7, Fig. 801, Sheet 1) from PDU.

(c) Remove fitting (8) and O-ring (9).

(d) Drive spring pin (10) below flange of threaded insert (11). Remove threaded insert and O-ring (12) with bolt and jamnuts per Fig. 801, Sheet 2.

NOTE: A No. 40 drill bit and angle drill maybe used to remove 1/8 to 3/16 inch of the spring pin to assure that the pin will clear the fitting. Remove all burrs from valve module flange area with a fine file.

R CAUTION: USE CARE NOT TO GET ANY METAL INTO THE BORES.

(e) Epoxy-fill pin holes in valve module (Fig. 801, Sheet 2).

NOTE: If one-piece male adapter is available, install it instead of two-piece threaded insert and tube fitting (Ref. Sunstrand Service Bulletin 27-9, Rev. 2).

(f) Epoxy-fill pin holes in threaded insert (Fig. 801, Sheet 2).

(g) Install new O-ring (12) on threaded insert (11). Coat O-ring with hydraulic fluid. Install insert in valve module using bolt and two jamnuts as shown in Fig. 801, Sheet 2. Torque insert 35 to 40 foot pounds. Remove installation bolt by loosening jamnuts. Remove bolt.

(h) Install new O-ring (9) on fitting (8). Coat O-ring with hydraulic fluid. Install fitting on valve module.

(i) Install brake pressure hydraulic line (6) on fitting. Torque hydraulic line fittings (Ref. 20-29-01).

(j) Check slat PDU in accordance with Step (3).

(3) Check slat PDU as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Remove tags from hydraulic control panels.

(b) Turn on electrical power (Ref. 24-41-00).

(c) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(d) Bleed slat PDU by cycling slats from full up to full down and back to full up for several cycles, or until slats operate smoothly. Cycle slats by positioning flap handle from zero to the 4-degree detent and back to zero.

NOTE: After bleeding slat PDU, bleed associated hydraulic reservoir (Ref. 12-13-01).

(e) After bleeding, verify that slat operation is normal.

(f) Verify that slat PDU hydraulic fittings are not leaking.

(g) Turn off hydraulic power.

(h) Turn off electrical power.

(i) Install access panels.

SLAT PDU FLOW LIMITER VALVE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Drip pan, 1 gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0-032 inch diameter or equivalent

Hydraulic Fluid, LAC Spec C-34-1224 Type IV, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-13-01	Hydraulic Bootstrap Reservoir - Servicing
29-11-00	Hydraulic Power - Maintenance Practices

3. Removal/Installation

CR NOTE: Removal and installation is allowed only to change seals.
CR Original flow limiter valve must remain installed in PDU.

A. Removal

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF. ENSURE FE/SO HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147, ARE PLACARDED.

(1) Depressurize hydraulic systems A and C and tag FE/SO Hydraulic System Panel, zone 215, and Hydraulic Service Panel, zone 147 (Ref. 29-11-00).

(2) Open access panel 511AB to gain access to Slat PDU (Ref. 6-40-00).

(3) Place drip pan under Slat PDU to catch hydraulic fluid.

(4) Remove Flow Limiter Valve from Slat PDU (Ref. Fig. 401).

B. Installation

(1) Wet O-rings and ring seals with hydraulic fluid.

(2) Install Flow Limiter Valve in Slat PDU (Ref. Fig. 401).

(3) Torque Flow Limiter Valve 180 to 240 in lbs. and lock-wire.

(4) Remove tags from hydraulic control panels installed in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on hydraulic systems A and C (Ref. 29-11-00).

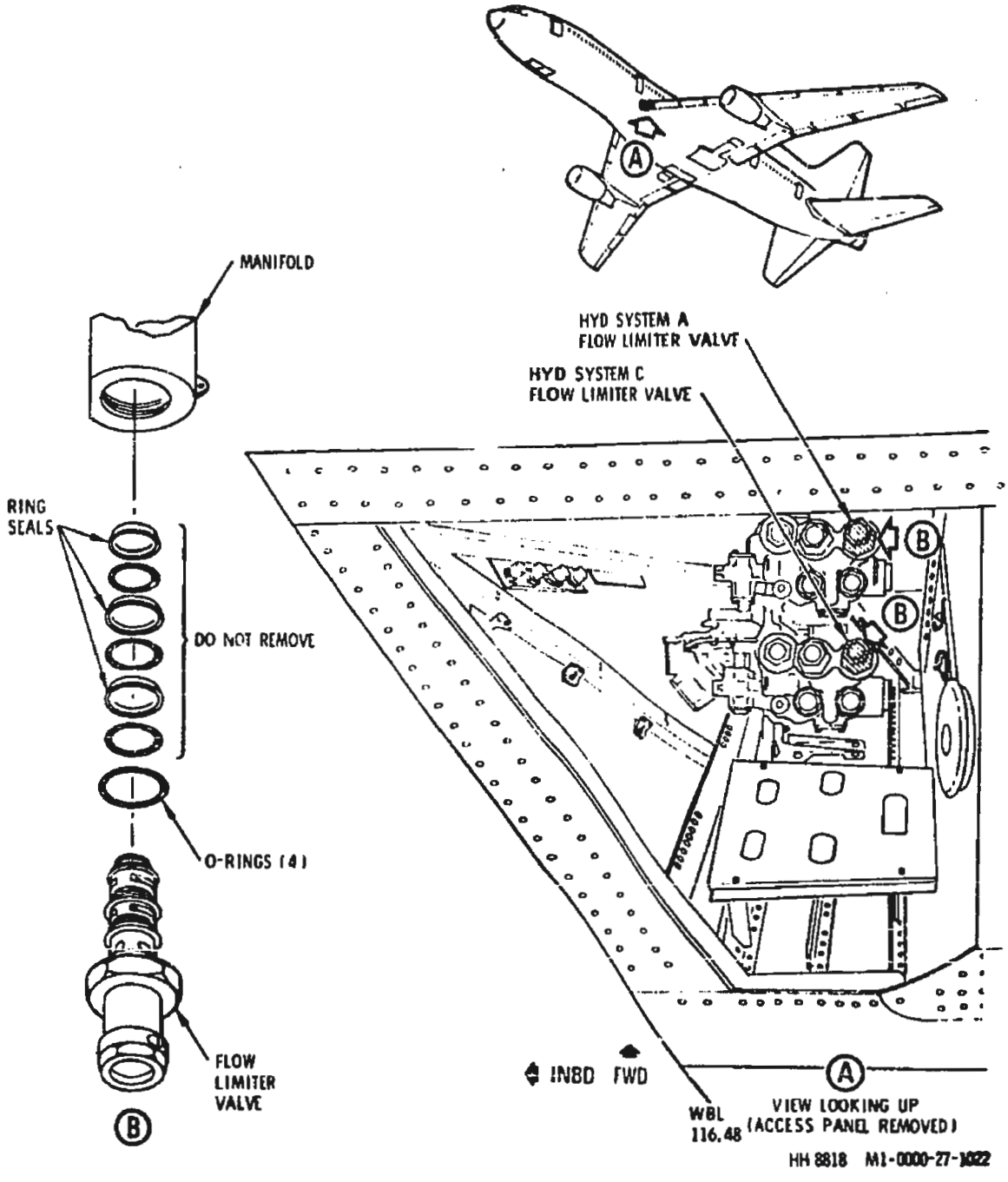
NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(6) Bleed Slat PDU by cycling Pilots flap control lever in Flight Station, zone 210, from 0-degree to 4-degree position and back to 0-degree position. Bleed until Slat PDU operates smoothly. Visually determine that Flow Limiter Valve is not leaking.

NOTE: After bleeding slat system, perform AIR CHECK of associated hydraulic reservoir. (See Reservoir Service Instruction Placard, Ref. 12-13-01).

(7) Turn off hydraulic power (Ref. 29-11-00).

(8) Install and secure access panel opened in Step 3A(2).



R Flow Limiter Valve - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

SLAT PDU SOLENOID SHUTOFF VALVE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent.

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

R (1) Verify that the following circuit breakers are opened
R and tagged:

(a) On the pilots overhead circuit breaker panel CB1, zone 210:

NO. 2 ASYM BK - LE SLAT (J10)

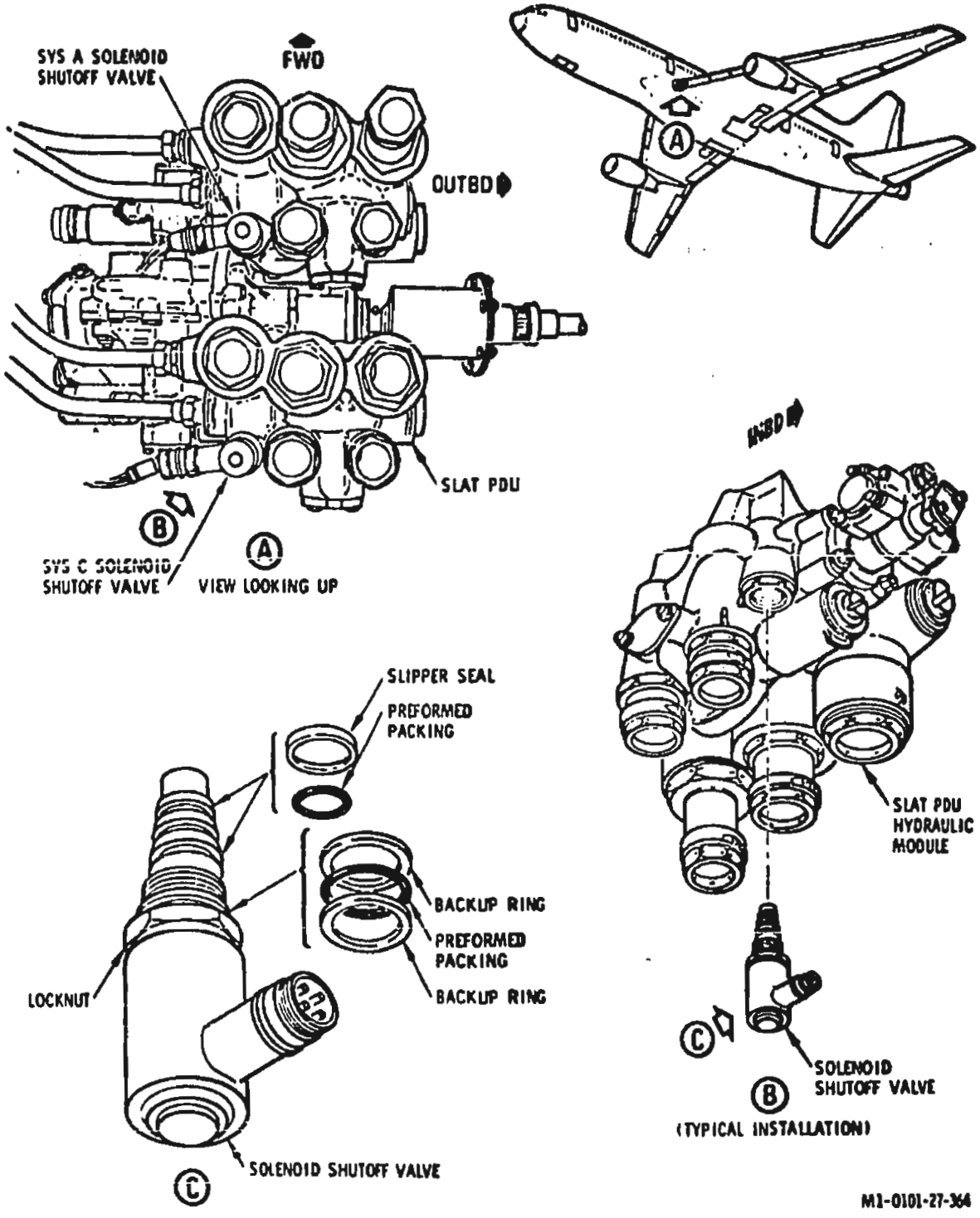
(b) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE - LE SLAT (H22)

(2) Remove access panel 511AB for access to slat PDU (Ref. 6-40-00).

NOTE: Forward shufoff valve is No. 1 (hydraulic system A). Aft shutoff valve is No. 2 (hydraulic system C).

(3) Disconnect electrical connector from shutoff valve (Ref. Fig. 401).



Slat PDU Solenoid Shutoff Valve - Removal and Installation
Figure 401

(4) Remove lock-wire from shutoff valve locknut. Loosen locknut until shutoff valve can be removed from manifold. Catch fluid spill with rags.

B. Installation

(1) Lubricate preformed packings on replacement shutoff valve with hydraulic fluid.

(2) Install shutoff valve in manifold. Position shutoff valve so that electrical connector points inboard.

(3) Tighten shutoff valve locknut and lock-wire to manifold.

(4) Install electrical connector.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Remove tags from hydraulic control panels.

(8) Turn on hydraulic system A and C (Ref. 29-11-00).

NOTE: Normal operation of flaps and slats requires system A and C with each system supplying 25 GPM at 3000 psi. Section 29-11-00, Maintenance Practices, details the capabilities of the various hydraulic supplies. Electric pumps must not be used as they do not meet this requirement.

CR
CR
CR

(9) Cycle slat system to bleed slat PDU by positioning flap handle from zero to the 4-degree detent. Repeat at least three times.

NOTE: After bleeding any hydraulic component, bleed associated reservoir. See reservoir servicing instruction placard (Ref. 12-13-00).

(10) Check replaced shutoff valve for any signs of external hydraulic leakage.

(11) Leave on only that hydraulic system supplying the replaced shutoff valve (forward shutoff valve, system A, aft shutoff valve, system C). Turn off other hydraulic system.

NOTE: For hydraulic system A, do not use AC pump. See Note Step (8).

(12) Open circuit breaker NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

(13) If system C solenoid shutoff valve has been replaced accomplish the following:

Gain access to the hydraulic service center (HSC). Disconnect the electrical connector of the slat PDU isolation valve located on lower forward right hand bulkhead of the HSC (Ref. 27-81-00, Figure 23). Apply 28V dc to pin 1 and ground pin 2 of the isolation valve.

NOTE: When circuit breaker CB2-H22 is pulled open, the slat PDU isolation valve is de-energized to the closed position, blocking system C hydraulic pressure to the slat PDU. The addition of 28V dc to pin 1 and the grounding of pin 2 of the isolation valve energizes the isolation valve open allowing system C hydraulic pressure to feed the slat PDU for slat operation.

(14) Position flap handle to zero. Verify that slat PDU shutoff valve actuates when slats fully retract (slat torque shaft rotation stops abruptly without coasting).

(15) Close circuit breaker No. 1 ASYM BRAKE - LE SLAT (CB2-H22). Open circuit breaker No. 2 ASYM BK - LE SLAT (CB1 - J10).

(16) Position flap handle to the 4-degree detent. Verify that the slat PDU shutoff valve actuates when slats fully extend (slat torque shaft rotation stops abruptly without coasting).

(17) Close access panel 511AB.

(18) Place all controls in normal position: Close circuit breaker No. 2 ASYM BK - LE SLAT (CB1 - J10); position flap handle to zero.

(19) Turn off electrical power if no longer required (Ref. 24-41-00).

(20) Turn off hydraulic power if no longer required (Ref. 29-11-00).

R SLAT PDU FREE WHEEL VALVE - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Drip pan, 1 gallon capacity

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0-032 inch diameter or
R equivalent

R Hydraulic Fluid, LAC Spec C-34-1224 Type IV, or equivalent

R 2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
R	29-11-00	Hydraulic Power - Maintenance Practices

R 3. Removal/Installation

R A. Removal

R WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT
R OFF. ENSURE FE/SO HYDRAULIC SYSTEM PANEL, ZONE
R 215, AND HYDRAULIC SERVICE PANEL, ZONE 147, ARE
R PLACARDED.

R (1) Depressurize hydraulic systems A and C and tag FE/SO
R Hydraulic System Panel, zone 215, and Hydraulic Service
R Panel, zone 147 (Ref. 29-11-00).

R (2) Open access panel 511AB to gain access to Slat PDU
R (Ref. 6-40-00).

R (3) Place drip pan under Slat PDU to catch hydraulic fluid.

R (4) Remove Free Wheel Valve from slat PDU (Fef. Fig. 401).

R B. Installation

R (1) Wet o-rings and ring seals with hydraulic fluid.

R (2) Install Free Wheel Valve in Slat PDU (Ref. Fig. 401).

R (3) Torque Free Wheel Valve 180 to 240 in. lbs. and
R lock-wire.

(4) Remove tags from hydraulic control panels installed in Step 3A(1).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on hydraulic systems A and C (Ref. 29-11-00).

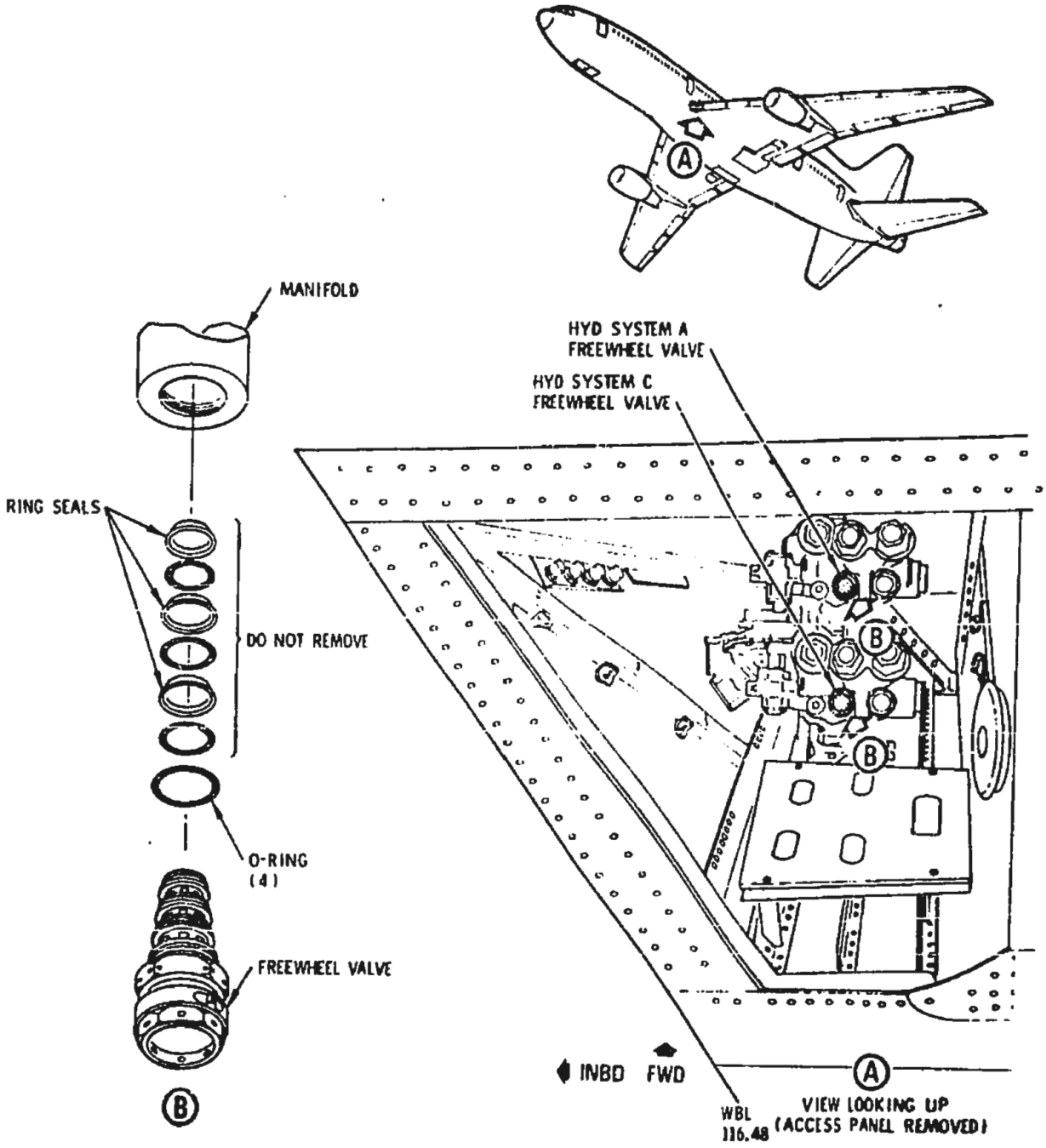
CR NOTE: To perform a valid test of the slat actuation
CR system, pressurize the B and C hydraulic systems
CR using ATM pumps and the A hydraulic system using
CR the PTU. Alternately, two ground sources, each
CR capable of 25 GPM at 3000 psi, may be used to
CR pressurize the A and C hydraulic systems.
CR Electric pumps must not be used as they do not
CR meet this requirement.

(6) Bleed Slat PDU by cycling Pilots flap control lever in Flight Station, zone 210, from 0-degree to 4-degree position and back to 0-degree position. Bleed until Slat PDU operates smoothly. Visually determine that Free Wheel Valve is not leaking.

NOTE: After bleeding slat system, perform AIR CHECK of associated hydraulic reservoir. (See Reservoir Service Instruction Placard, Ref. 12-13-01).

(7) Turn off hydraulic power (Ref. 29-11-00).

(8) Install and secure access panel opened in Step 3A(2).



M1-0000-27-1023

R Free Wheel Valve - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

R SLAT PDU BRAKE VALVE - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Drip pan, 1 gallon capacity

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0-032 inch diameter or
R equivalent

R Hydraulic Fluid, LAC Spec C-34-1224 Type IV, or equivalent

R 2. Referenced Procedures

R	6-40-00	Exterior Access Doors and Panels
R	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
R	29-11-00	Hydraulic Power - Maintenance Practices

R 3. Removal/Installation

R A. Removal

R WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT
R OFF. ENSURE FE/SO HYDRAULIC SYSTEM PANEL, ZONE
R 215, AND HYDRAULIC SERVICE PANEL, ZONE 147, ARE
R PLACARDED.

R (1) Depressurize hydraulic systems A and C and tag FE/SO
R Hydraulic System Panel, zone 215, and Hydraulic Service
R Panel, zone 147 (Ref. 29-11-00).

R (2) Open access panel 511AB to gain access to Slat PDU
R (Ref. 6-40-00).

R (3) Place drip pan under Slat PDU to catch hydraulic fluid.

R (4) Remove Brake Valve from Slat PDU (Ref. Fig. 401).

R B. Installation

R (1) Wet o-rings and ring seals with hydraulic fluid.

R (2) Install Brake Valve in Slat PDU (Ref. Fig. 401).

R (3) Torque Brake Valve 180 to 240 in lbs. and lock-wire.

R (4) Remove tags from hydraulic control panels installed in R Step 3A(1).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY R HYDRAULIC SYSTEM:

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR R SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES R AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL R AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT R HYDRAULIC PRESSURE.

R (5) Turn on hydraulic systems A and C (Ref. 29-11-00).

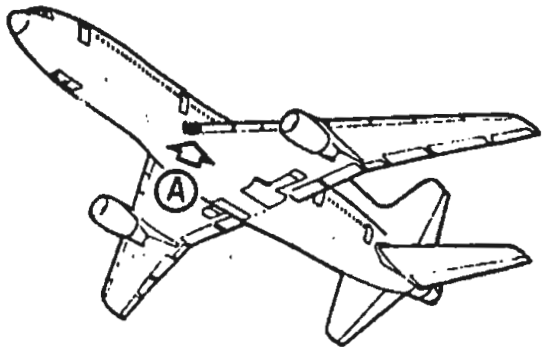
R NOTE: Operating flaps and slats with electric pumps R can cause "jerky" operation, trip the overspeed R governor in either or both brakes and give R invalid results. To perform a valid test of the R slat actuation system, pressurize the B and C R hydraulic system using ATM pumps and the A R hydraulic system using the PTU. Alternately, R two ground sources each capable of 25 GPM at R 3000 psi may be used to pressurize the A and C R hydraulic systems.

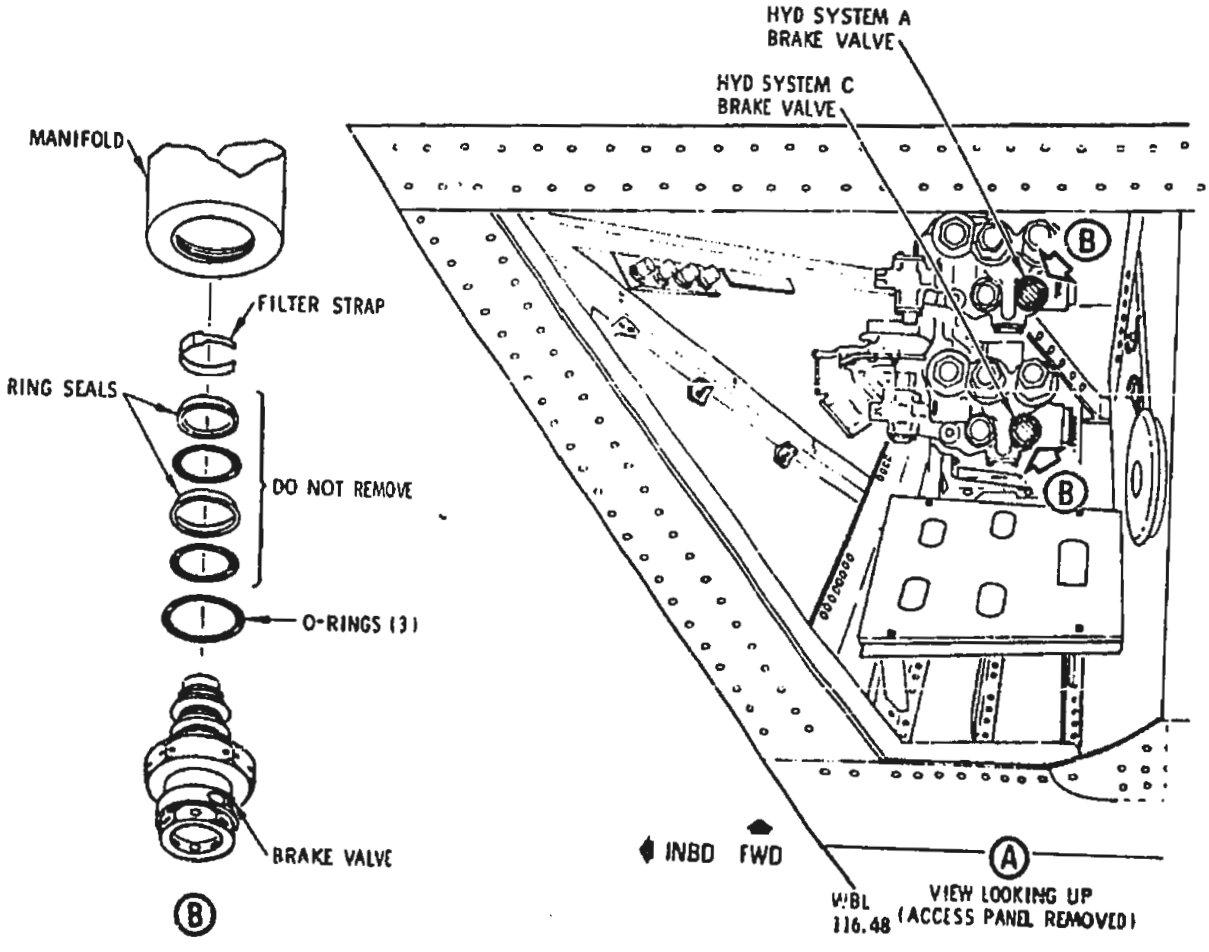
R (6) Bleed Slat PDU by cycling Pilots flap control lever in R Flight Station, zone 210, from 0-degree to 4-degree R position and back to 0-degree position. Bleed until R Slat PDU operates smoothly. Visually determine that R Brake Valve is not leaking.

R NOTE: After bleeding slat system, perform AIR CHECK of R associated hydraulic reservoir. (See Reservoir R Service Instruction Placard, Ref. 12-13-01).

R (7) Turn off hydraulic power (Ref. 29-11-00).

R (8) Install and secure access panel opened in Step 3A(2).





M1-0000-27-1024

R R Brake Valve - Removal and Installation
Figure 401

R EFFECTIVITY: ALL
R
001B

SLAT PDU POSITION INDICATOR SWITCH PACK REMOVAL AND INSTALLATION

CR 1. Deleted

2. Referenced Procedures

22-00-00	Auto Flight
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

C 3. Removal/Installation

A. Removal

(1) Verify that slats are in the fully retracted position.

(2) On pilots overhead circuit breaker panel CB1, open and tag the following circuit breakers:

AUTO THROT SERVO (A1)

SPEED CONT (A20)

FCES COMPUTER - AC & L AOA (B5)

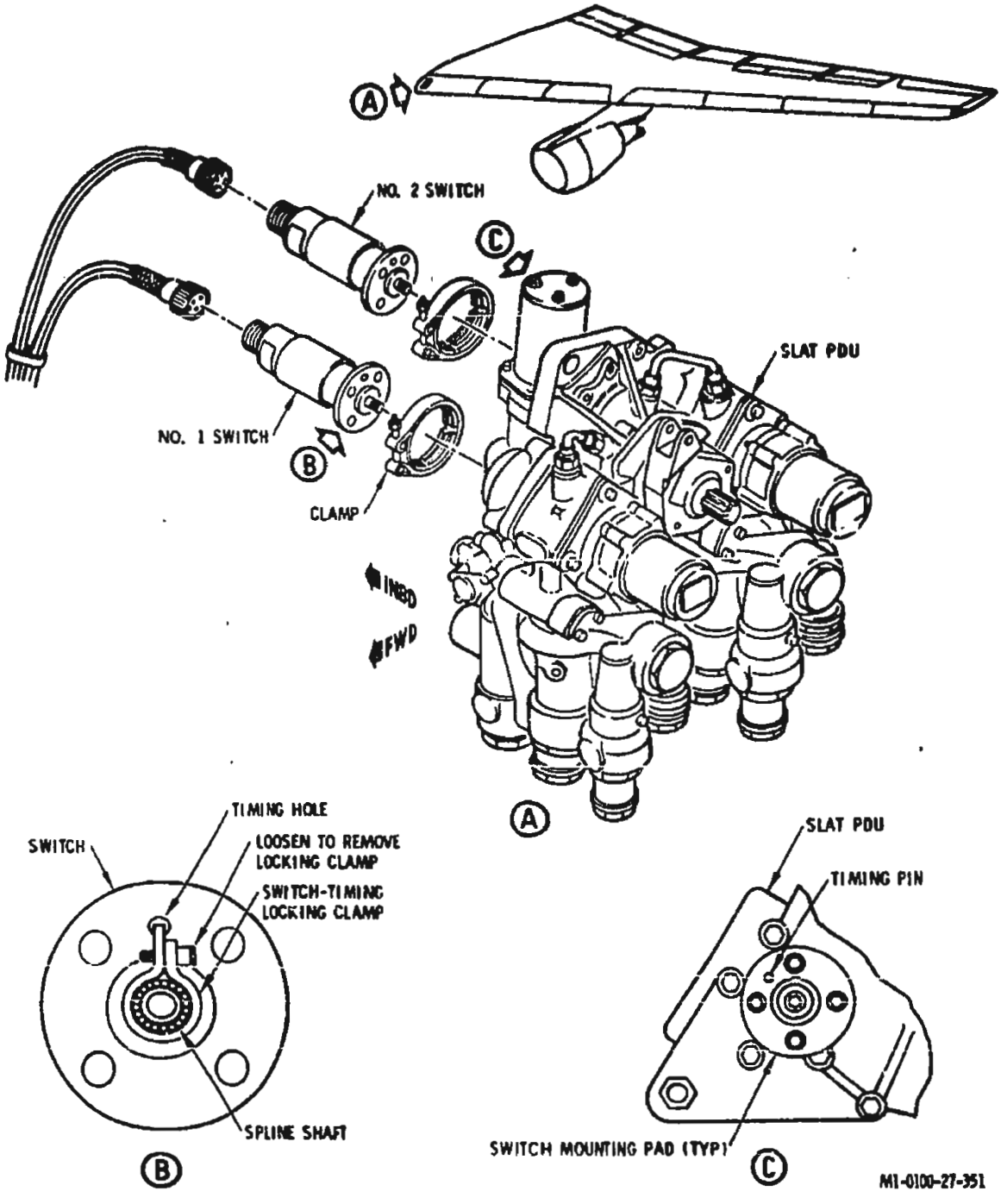
On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open and tag circuit breaker R AOA (F1).

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(3) Open access panel 511AB to slat PDU.

NOTE: Switch pack No. 1 is the forward switch assembly. Switch pack No. 2 is the aft switch assembly.

(4) Remove electrical connector from the switch pack which is being replaced (Ref. Fig. 401).



C Slat PDU Switch Pack - Removal and Installation
C Figure 401

R EFFECTIVITY: ALL
R
001B

(5) Remove clamp attaching switch to PDU. Remove switch from PDU by pulling straight out without rotating switch body.

NOTE: Switch-timing locking clamp will be installed on removed switch when replacement switch is installed. Do not rotate switch shaft until locking clamp is installed.

B. Installation

(1) Before removing switch-timing locking clamp from replacement switch, mark switch body and spline shaft with a timing reference mark (use paint).

(2) With the slat PDU in the slats fully retracted position, install switch as follows:

CAUTION: DO NOT ROTATE SPLINE ON REPLACEMENT SWITCH AFTER REMOVAL OF THE LOCKING CLAMP. HOWEVER, ROTATION OF THE SWITCH SPLINE UP TO 30 DEGREES IS ALLOWABLE TO ALIGN THE TIMING PIN ON PDU MOUNTING PAD WITH TIMING HOLE IN SWITCH MOUNTING FLANGE.

(a) Remove locking clamp from switch. Do not rotate spline.

(b) Position switch so that the switch spline and timing hole are aligned with the PDU spline and timing pin. Install switch until seated against flange.

CAUTION: DO NOT EXCEED 30 DEGREES OF SPLINE ROTATION TO ALIGN SWITCH ON PDU.

(c) Install switch attaching clamp and torque clamp nut 40 to 45 pounds inch.

(3) For switch pack No. 1 installation: install switch pack No. 1 electrical connector and install lockwire.

(3) For switch pack No. 2 installation: install switch pack No. 2 electrical connector. Do not install lockwire at this time.

(4) Install locking clamp on removed switch. Do not rotate switch spline.

(5) Remove tags and close circuit breakers opened in step A(2).

(6) Remove placards from hydraulic panels.

(7) Perform Operational Check of Switch Pack (Ref. Para. 2c).

C. Operational Check of Switch Pack

(1) Turn on electrical power (Ref. 24-41-00).

(2) Turn on Hydraulic system A, B, and C (Ref. 29-11-00).

(3) On APFDS engage panel, set AP [A] in CMD position (Ref. 22-00-00).

(4) Set flaps to 33 degrees.

(5) On flap position indicator, verify LE TRANS light is on during slat movement and goes off when slats fully extend. Verify that LE EXT light comes on when slats fully extend.

NOTE: If either light fails to perform normally indicator switch pack No. 2 should be suspected.

WARNING: IT IS ESSENTIAL THAT THE RAT AUTO DEPLOY CIRCUIT BREAKER IS OPENED BEFORE OPENING MLG GND SENSE CIRCUIT BREAKER.

(6) Simulate "airborne" condition by opening circuit breaker RAT AUTO DEPLOY (L3) on pilots overhead circuit breaker panel CB1 , THEN open MLG GND SENSE (L8) on Flight Engineer/Second Officers overhead circuit breaker panel CB2.

(7) Disconnect electrical connector on No. 2 switch pack (Ref. Fig. 401).

C NOTE: If Step 3C(5) is confirmed operational, abnormal
C operation of Step 3C(8) indicates that indicator
C switch pack No. 1 should be suspected.

R (8) On aircraft without SB34-178 and SB34-179,
R on pilots control wheel, depress "GO AROUND switch and
R verify GO ARND message appears on AFCS modes
R annunciator panel.

R (8) On aircraft with SB34-178 and SB34-179,
R on pilots control wheel, depress "GO AROUND" switch and
R verify TO/GA message appears on AFCS modes annunciator
R panel.

(9) Reconnect electrical connector on No. 2 switch pack.

(10) Turn off autopilot [A] (Ref. 22-00-00).

(11) Raise flaps to 0 degree.

(12) Close MLG GND SENSE (L8) circuit breaker on Flight Engineer/Second Officers overhead circuit breaker panel CB2.

(13) On APFDS engage panel, set AP [B] in CMD position (Ref. 22-00-00).

C (14) Repeat Steps 3C(4) through 3C(9).

(15) Install lockwire on switch pack No. 2 electrical connector.

(16) Turn off autopilot [B] (Ref. 22-00-00).

(17) Raise flaps to 0 degree.

(18) Revert to "on ground" condition by closing the following circuit breakers in the sequence shown:

MLG GND SENSE (CB2-L8)

RAT AUTO DEPLOY (CB1-L3)

(19) Turn off hydraulic system A, B, and C (Ref. 29-11-00).

(20) Turn off electrical power (Ref. 24-41-00).

R SLAT PDU HYDRAULIC MOTOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R (1) Ensure that all four hydraulic systems are shut off
R (Ref. 29-11-00).

R (2) Install warning tag on FE/SO Hydraulic System Panel,
R zone 215, and the Hydraulic Service Panel, zone 147.

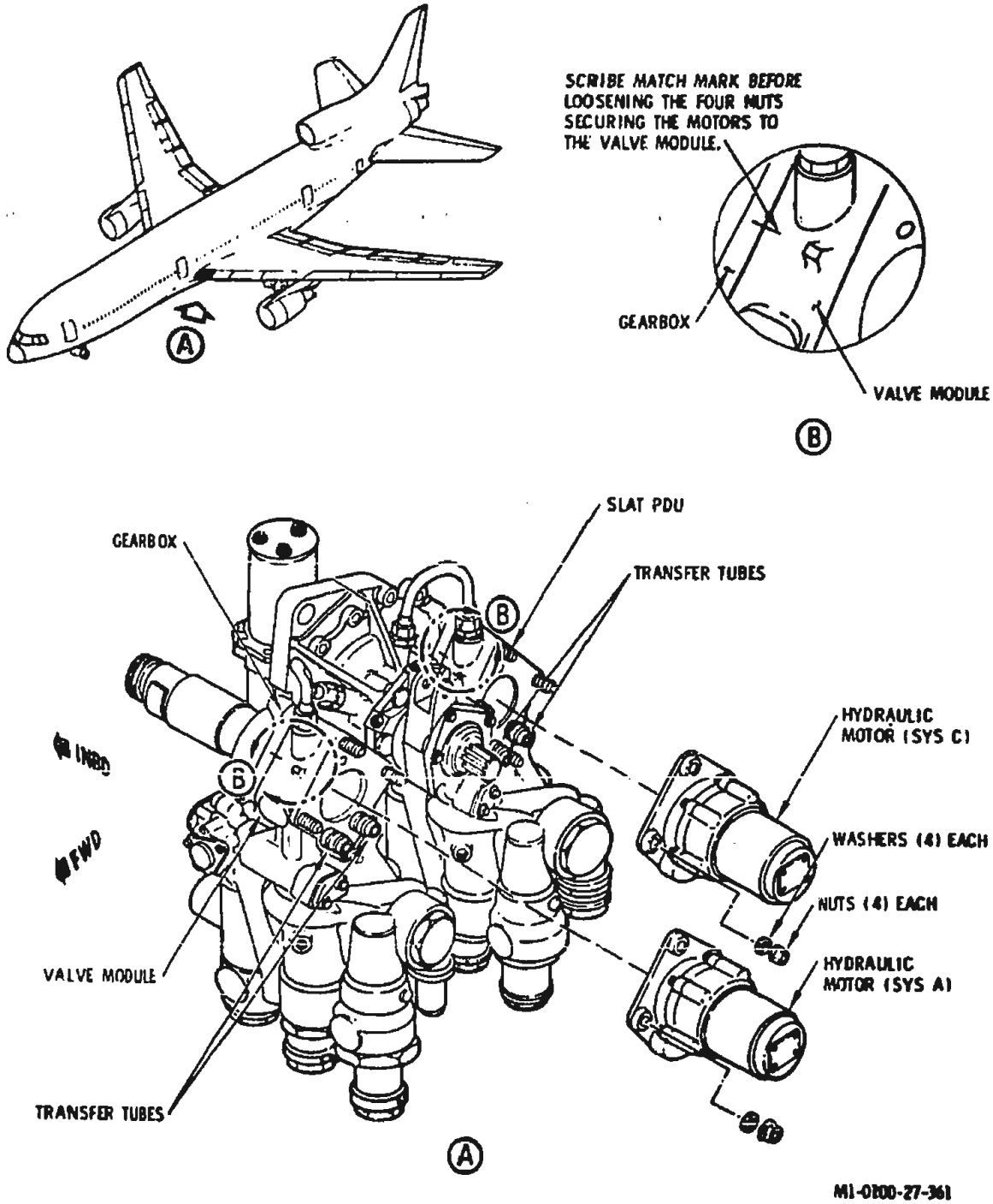
R (3) Remove access panel 511AB on bottom of left wing, and access panel 511AT-1 on top of left wing to expose slat PDU (Ref. 6-40-00).

NOTE: The forward hydraulic motor is system A; the aft hydraulic motor is system C.

R (4) Before loosening hydraulic motor attaching nuts, scribe a match mark across the hydraulic valve manifold and gearbox housing split line (Ref. Fig. 401).

NOTE: The hydraulic valve manifold is mounted to the gearbox on the same four studs that mount the hydraulic motor. The scribe mark is to ensure that the hydraulic transfer tubes between the gearbox and hydraulic motor are properly aligned. Slight misalignment of transfer tubes could result in internal leakage.

On later PDU's, valve module will be dowel-mounted to PDU gearbox and scribing a match mark will not be necessary. These later



R Slat PDU Hydraulic Motor - Removal and Installation
R Figure 401

PDU's can be identified by a 1 after manufacturers P/N (Example: 720001H1).

R (5) Remove the four nuts holding the hydraulic motor to the gearbox. Remove hydraulic motor. Use rags to catch oil spill.

NOTE: The hydraulic motor flange incorporates two transfer tubes. Some force may be required to separate the hydraulic motor from the hydraulic valve manifold.

R (6) If either of the two transfer tubes comes off with the hydraulic motor, reinstall transfer tube with the large diameter end in the hydraulic valve manifold. Lubricate preformed packings with hydarulic oil.

B. Installation

(1) Verify that all hydraulic power is turned off.

(2) Lubricate transfer tube and case drain preformed packings with hydraulic oil.

R CAUTION: VERIFY THAT CASE DRAIN PREFORMED PACKING IN BASE OF HYDRAULIC MOTOR REMAINS IN PLACE DURING INSTALLATION OF HYDRAULIC MOTOR ON VALVE MODULE.

(3) Position hydraulic motor on studs so that transfer tube holes in hydraulic motor flange are aligned with transfer tubes in valve manifold. Install hydraulic motor to the valve manifold.

(4) Verify that scribe marks are aligned. Install washers and nuts. Torque nuts 48 to 53 lb. in. Check scribe marks for alignment.

(5) Remove tags from hydraulic control panels.

(6) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps, and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(8) Bleed hydraulic system by cycling slats through at least three full extend and retract cycles. Cycle slats by positioning flap handle from 0 to the 4-degree detent and back to 0.

NOTE: After bleeding slat system, bleed hydraulic reservoir (Ref. servicing instruction placard on reservoir).

R (9) Leave on only the hydraulic system supplying
R replacement hydraulic motor (forward motor, System A; aft motor, System C).

(10) Cycle slats through three full cycles to verify proper coupling of gearbox to hydraulic manifold.

(11) Turn off hydraulic power (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 24-41-00).

(13) Install access panels.

SLAT PDU FILTER ELEMENT REMOVAL AND INSTALLATION

R 1. General

R R The power drive unit (PDU) has two identical, disposable filters.

R 2. Equipment and Materials

Drip pan, 1-gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

R 3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power - Maintenance Practices

R 4. Removal/Installation

A. Removal

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Ensure that all four hydraulic systems are shut off (Ref. 29-11-00).

(2) Install warning tag on FE/SO Hydraulic System Panel, zone 15, and the Hydraulic Service Panel, zone 147.

(3) Remove wing leading edge, front spar and slat drive access panel 511AB, for access to power drive unit (Ref. 6-40-00).

(4) Place drip pan under power drive unit to catch hydraulic fluid.

(5) Remove filter retainer from power drive unit (Ref. Fig. 401).

(6) Remove and discard preformed packing from filter retainer.

R (7) Pull filter element from power drive unit and inspect
R for contamination.

R NOTE: Filters are not reusable.

B. Installation

(1) Wet preformed packing with hydraulic fluid before installation.

(2) Install preformed packing on filter element.

(3) Install filter element in power drive unit.

(4) Install preformed packing in groove on filter retainer.

(5) Install filter retainer over filter element and torque until retainer seats flat against face of housing. Do not exceed 20 lb ft. Lock-wire filter retainer to manifold.

(6) Remove placards from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

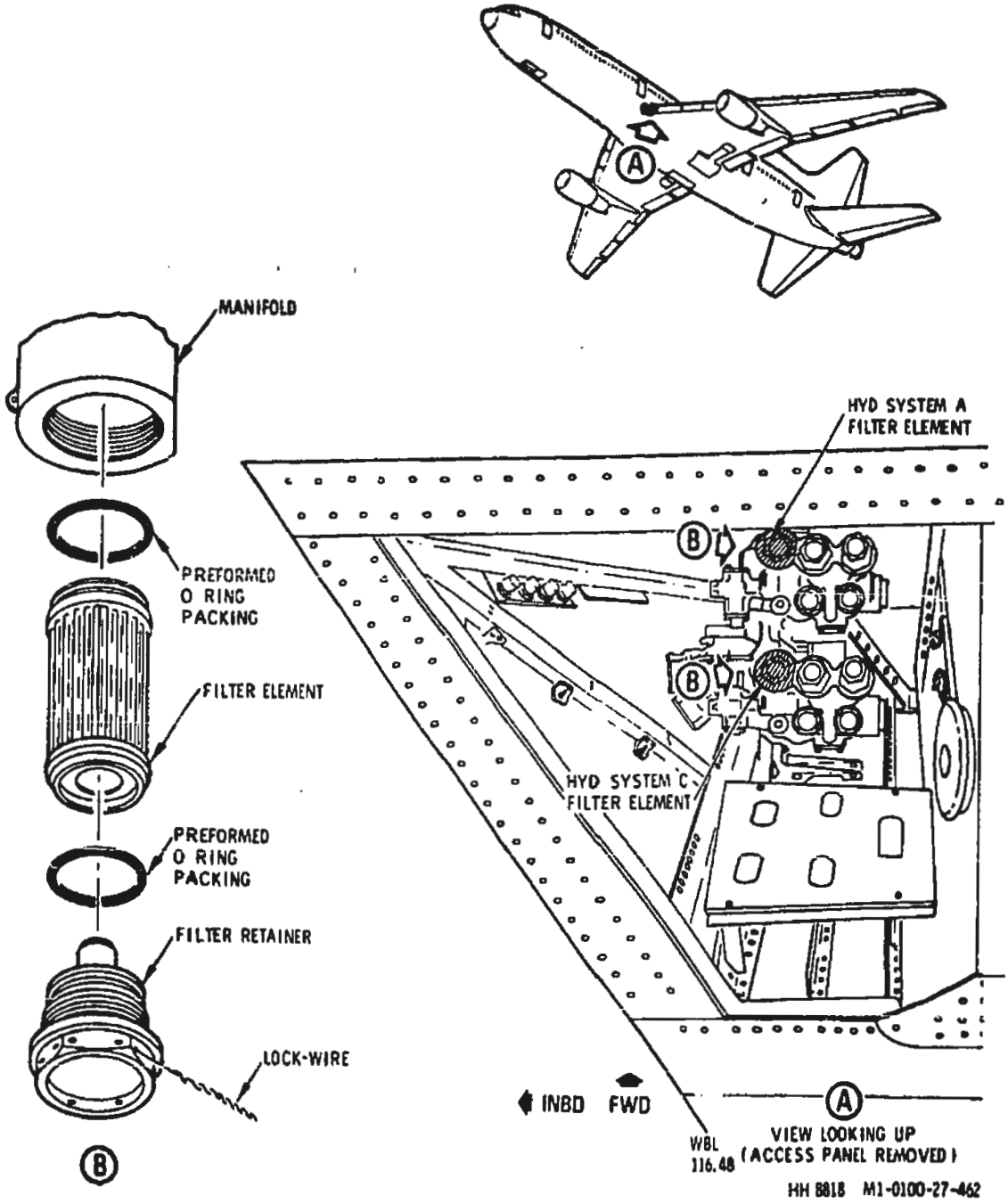
LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydrualic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.



Filter Element, Power Drive Unit - Removal and Installation
Figure 401

(8) Bleed power drive unit by cycling pilots flap control lever in flight station, zone 210, from 0-degree to 4-degree position and back to 0-degree position. Bleed until slat PDU operates smoothly. Visually determine that filter retainer is not leaking.

NOTE: After bleeding slat system, perform AIR CHECK of associated hydraulic reservoir. (See Reservoir Service Instruction Placard, Ref. 12-13-01).

(9) Turn off hydraulic power (Ref. 29-11-).

R (10) Install and secure access panel opened in Step 4A(1).

SLAT ANGLE GEARBOX - REMOVAL AND INSTALLATION

1. General

Separate removal and installation procedures are provided for the left and right angle gearboxes. The left angle gearbox is covered in Paragraphs 4A and 4B. The right angle gearbox is covered in Paragraphs 4C and 4D.

2. Equipment and Materials

R Grease, Aircraft and Instrument, MIL-G-23827A

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
20-51-04	Environmental Sealing of Model L-1011 Airplane - PB75-425D
24-41-00	External Power/Ground Service Systems - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal of Left Angle Gearbox

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Ensure that all four hydraulic systems are shut off (Ref. 29-11-00) and install warning tags on FE/SO Hydraulic System Panel, zone 215, and the Hydraulic Service Panel, zone 147.

(2) Actuate asymmetry brakes as follows to lock slat torque tube system and prevent a disconnected torque tube from rotating and becoming mis-rigged:

NOTE: Another method of preventing torque tube rotation is to tape or tie torque tube outboard of torque limiting brake.

R (a) Turn on electrical power (Ref. 24-41-00).

R (b) Open access doors 521TB and 621TB to asymmetry
R brakes (Ref. 6-40-00).

R (c) Remove screws securing rotary transducer to left
R leading edge asymmetry brake. Disengage
R transducer from brake. Do not disconnect
R electrical connector.

R (d) Rotate transducer shaft clockwise until slat
R asymmetry brake pop-out indicator is actuated.

R (e) Reinstall rotary transducer to slat asymmetry
R brake with screws. Lock-wire screws. No timing
R of rotary transducer is necessary.

R NOTE: If tri-wing screws are used to secure
R rotary transducer, replace with
R NAS1351-3H-6P socket-head capscrews, or
R equivalent.

R (f) Turn off electrical power (Ref. 24-41-00).

NOTE: The left angle gearbox is bolted to the inboard side of the slat PDU.

(3) Open left wing upper and lower access panels 511AB and 511AT-1 to gain access to slat PDU (Ref. 6-40-00).

(4) Loosen the pressure seal clamp bolt and push the bell housing inboard to expose the torque tube coupling (Ref. Fig. 401).

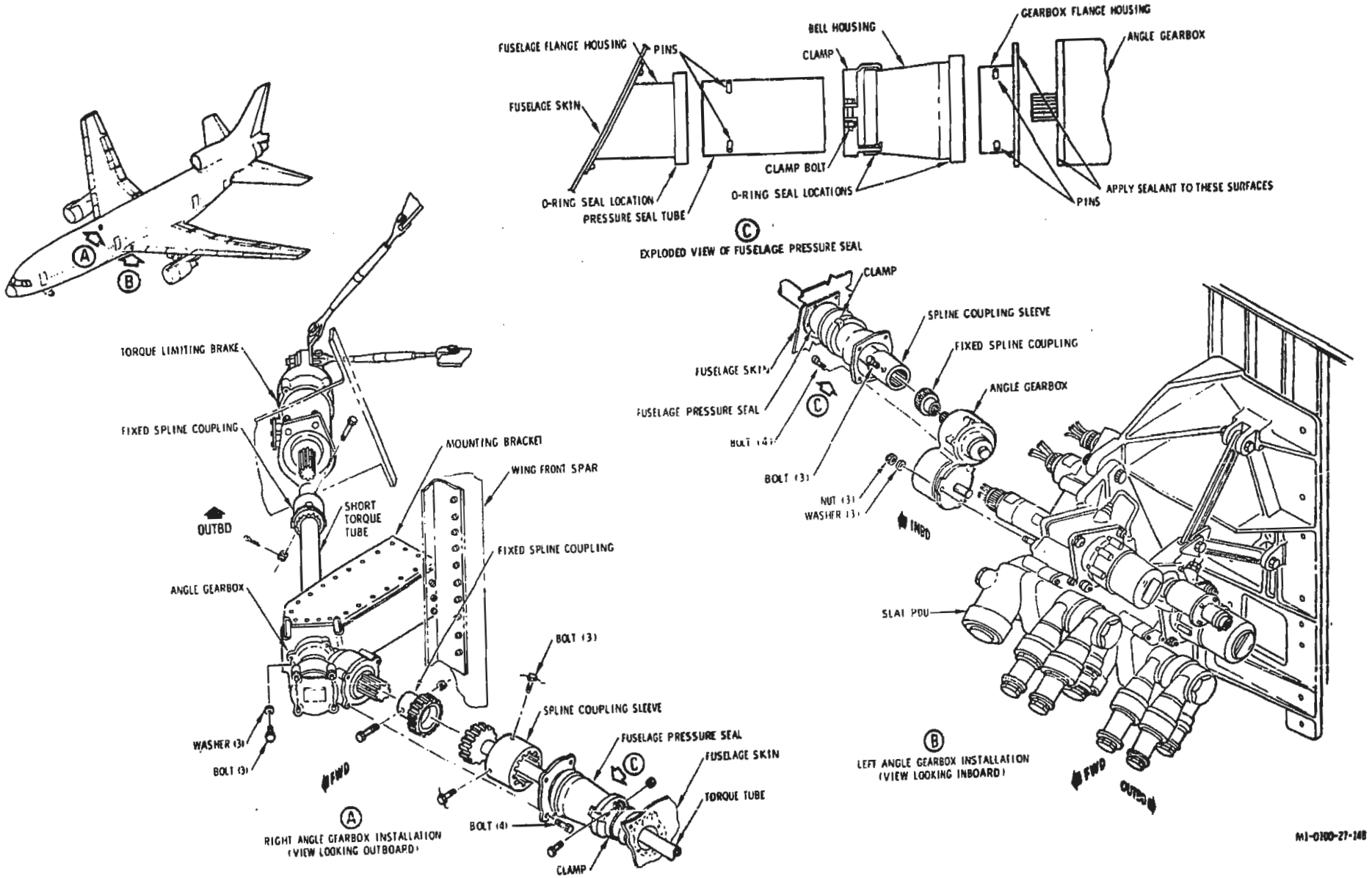
(5) Remove the three bolts securing the spline coupling sleeve to the fixed spline. Slide coupling sleeve inboard to separate the coupling.

(6) Remove bolt securing the fixed spline coupling to the angle gearbox output spline shaft. Remove fixed spline coupling from angle gearbox output spline.

(7) Remove bolts securing gearbox flange housing to angle gearbox. Carefully separate flange housing from gearbox. Slide flange housing inboard.

NOTE: Flange housing to angle gearbox joint is sealed with sealant.

(8) Remove three nuts securing angle gearbox to slat PDU. Remove angle gearbox.



R
R Slat Drive Angle Gearbox - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

(9) Remove old sealant from the gearbox flange housing.

B. Installation

(1) Butter-lube all coupling and angle gearbox spline mating surfaces with grease MIL-G-23827A.

R

(2) Install the fixed spline coupling to the angle gearbox output spline shaft. Verify that bolt holes are aligned. Do not install bolt.

(3) Install angle gearbox on PDU studs. Install washers and nuts to secure angle gearbox to PDU.

(4) Install bolt to secure fixed spline coupling to the angle gearbox output spline. Install cotter pin in nut.

(5) Apply sealant to the gearbox flange housing and gearbox mating surfaces. Use LCM 40-2121A, Type II, Class B (Ref. 20-51-04).

CAUTION: TURN THE TORQUE TUBE THE MINIMUM AMOUNT NECESSARY TO MATE THE COUPLING TO PREVENT MISRIGGING THE RIGHT WING SLATS.

(6) Slide spline coupling sleeve outboard to mate with the fixed spline coupling. Install three bolts securing spline coupling sleeve to fixed spline coupling. Lock-wire bolts.

(7) Slide the gearbox flange housing outboard to mate with angle gearbox mating surface. Install four bolts securing pressure seal flange to angle gearbox.

(8) Position pressure seal components as follows (Ref. Fig. 401):

(a) Slide bell housing outboard until it contacts pins on gearbox flange housing.

(b) While holding bell housing in place, slide pressure seat tube inboard until pins on tube contact the fuselage flange housing.

NOTE: Positioning of pressure seal components insure proper tube engagement of O-ring seals in bell housing and fuselage flange housing.

(c) Tighten the pressure seal clamp bolt to lock pressure seal components in place.

(9) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On Pilots overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds close circuit breakers opened in Steps (b) and (c).

R
R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(10) Check slat system as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic systems using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(c) Cycle the slat system through several full extend and retract cycles by positioning the flap control handle from zero to the 4-degree detent and back to the zero detent. Verify that slat operation is normal.

(d) Turn off hydraulic power (Ref. 29-11-00).

(e) Turn off electrical power (Ref. 24-41-00).

(11) Close access panels.

C. Removal of Right Angle Gearbox

WARNING: VERIFY ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Ensure all four hydraulic systems are shut off (Ref. 29-11-00) and install warning tags on FE/SO Hydraulic System Panel, zone 215, and the Hydraulic Service Panel, zone 147.

(2) Actuate asymmetry brakes as follows to lock slat torque tube system and prevent a disconnected torque tube from rotating and becoming mis-rigged:

NOTE: Another method of preventing torque tube rotation is to tape or tie torque tube outboard of torque limiting brake.

(a) Turn on electrical power (Ref. 24-41-00).

(b) Open access doors 521TB and 621TB to asymmetry brakes (Ref. 6-40-00).

(c) Remove screws securing rotary transducer to left leading edge asymmetry brake. Disengage transducer from brake. Do not disconnect electrical connector.

(d) Rotate transducer shaft clockwise until slat asymmetry brake pop-out indicator is actuated.

(e) Reinstall rotary transducer to slat asymmetry brake with screws. Lock-wire screws. No timing of rotary transducer is necessary.

NOTE: If tri-wing screws are used to secure rotary transducer, replace with

NAS1351-3H-6P socket-head capscrews, or equivalent.

(f) Turn off electrical power (Ref. 24-41-00).

(3) Open right wing lower access panel 611AB to gain access to the right angle gearbox (Ref. 6-40-00).

(4) Remove bolts securing the pressure seal flange to the angle gearbox (Ref. Fig. 401).

(5) Loosen the pressure seal clamp bolt and slide the pressure seal bell housing inboard to expose torque tube coupling.

(6) Remove three bolts securing the spline coupling sleeve to the fixed spline. Slide the spline coupling sleeve inboard to separate the coupling.

(7) Remove bolts securing gearbox flange housing to angle gearbox. Carefully separate flange housing from gearbox. Slide flange housing inboard.

NOTE: Flange housing to angle gearbox joint is sealed with sealant.

(8) At the torque limiting brake, just outboard of angle gearbox, remove the bolt securing the fixed spline coupling to the torque limiting brake input spline shaft.

(9) Remove the three bolts securing the angle gearbox to the mounting bracket.

(10) Rotate the angle gearbox to clear the fuselage pressure seal and remove angle gearbox and short torque tube.

(11) Remove short torque tube from angle gearbox as follows:

(a) Remove three bolts securing the spline copuling sleeve to the fixed spline. Separate torque shaft from gearbox.

(b) Remove end bolt securing fixed spline coupling to the angle gearbox output spline shaft. Remove spline coupling.

(12) Remove bolt securing fixed spline coupling to the angle gearbox input shaft. Remove fixed spline coupling.

(13) Remove old sealant from the pressure seal gearbox flange housing.

D. Installation of Right Angle Gearbox

(1) Butter-lube all mating spline surfaces on the coupling, angle gearbox shafts, and torque limiting brake input shaft with grease MIL-G-23827A.

(2) Install fixed spline coupling on replacement angle gearbox input spline shaft with bolt and nut. Install cotter pin in nut.

(3) Install fixed spline coupling on replacement angle gearbox output shaft with locking washer and bolt (use new locking washer). Bend locking washer to safety bolt.

(4) Couple the short torque tube and spline coupling sleeve to the fixed spline coupling of the angle gearbox output shaft. Install the three coupling bolts and lock-wire.

(5) Insert the short torque tube through the angle gearbox mounting bracket and position the angle gearbox on mounting bracket. Verify that the short torque tube coupling is engaged with torque limiting brake input spline shaft. Install the three bolts securing angle gearbox to the mounting bracket.

(6) Install bolt and nut securing fixed spline coupling to the torque limiting brake input shaft. Install cotter pin in nut.

CAUTION: TURN THE GEARBOX INPUT SHAFT THE MINIMUM AMOUNT NECESSARY TO MATE THE COUPLING TO PREVENT MISRIGGING THE RIGHT WING SLATS (BRAKE IN PDU WILL LOCK FUSELAGE TORQUE TUBES).

(7) Mate the spline coupling sleeve with the fixed spline coupling on the angle gearbox input shaft. Install the three coupling bolts and lock-wire bolts.

(8) Apply sealant to the pressure seal flange and gearbox mating surfaces. Use LCM 40-2121A, Type II, Class B (Ref. 20-51-04).

(9) Slide the pressure seal gearbox flange housing outboard to mate with angle gearbox. Install four bolts securing pressure seal flange to angle gearbox.

(10) Position pressure seal components as follows (Ref. Fig. 401):

(a) Slide bell housing outboard until it contacts pins on gearbox flange housing.

(b) While holding bell housing in place, slide pressure seal tube inboard until pins on tube contact the fuselage flange housing.

NOTE: Positioning of pressure seal components insure proper tube engagement of O-ring seals in bell housing and fuselage flange housing.

(c) Tighten the pressure seal clamp bolt to lock pressure seal components in place.

(11) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On Pilots overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds close circuit breakers opened in Steps (b) and (c).

R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY
R BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(12) Check slat operation in accordance with Step B(10).

(13) Close access panels.

Slat Drive FUSELAGE TORQUE TUBE - REMOVAL AND INSTALLATION

1. General

The fuselage torque tubes consist of the left, center, and right torque tubes. Separate removal and installation procedures are provided. The left and right torque tubes are covered in Paragraphs 4A and 4C; the center torque tube is covered in Paragraphs 4B and 4D.

NOTE: If a discrepancy is noted at the universal coupling, both the crowned splined and the coupling sleeve should be replaced.

2. Equipment and Materials

R Grease, Aircraft and Instrument, MIL-G-23827A

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal of Fuselage Left or Right Torque Tube

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Shut off all four hydraulic systems (Ref. 29-11-00) and install warning tags on Flight Engineer/Second Officers Hydraulic System Panel, zone 215, and on Hydraulic Service Panel, zone 147.

(2) Actuate asymmetry brakes as follows to lock slat torque tube system and prevent a disconnected torque tube from rotating and becoming mis-rigged.

R NOTE: Another method of preventing torque tube
R rotation is to tape or tie torque tube outboard
R of torque limiting brake.

R (a) Turn on electrical power (Ref. 24-41-00).

R (b) Open access doors 521TB and 621TB to asymmetry
R brakes (Ref. 6-40-00).

R (c) Remove screws securing rotary transducer to left
R leading edge asymmetry brake. Disengage
R transducer from brake. Do not disconnect
R electrical connector.

R (d) Rotate transducer shaft clockwise until slat
R asymmetry brake pop-out indicator is actuated.

R (e) Reinstall rotary transducer to slat asymmetry
R brake with screws. Lock-wire screws. No timing
R of rotary transducer is necessary.

R NOTE: If tri-wing screws are used to secure
R rotary transducer, replace with
R NAS1351-3H-6P socket-head capscrews, or
R equivalent.

R (f) Turn off electrical power (Ref. 24-41-00).

(3) Remove access panel 511AB or 611AB (Ref. 6-40-00) for access to slat drive fuselage pressure seal.

(4) Remove bolts securing seal assembly to angle gearbox (Ref. Fig. 401).

(5) Disconnect clamp in center of seal assembly and slide seal inboard to expose fuselage torque tube connection to angle gearbox.

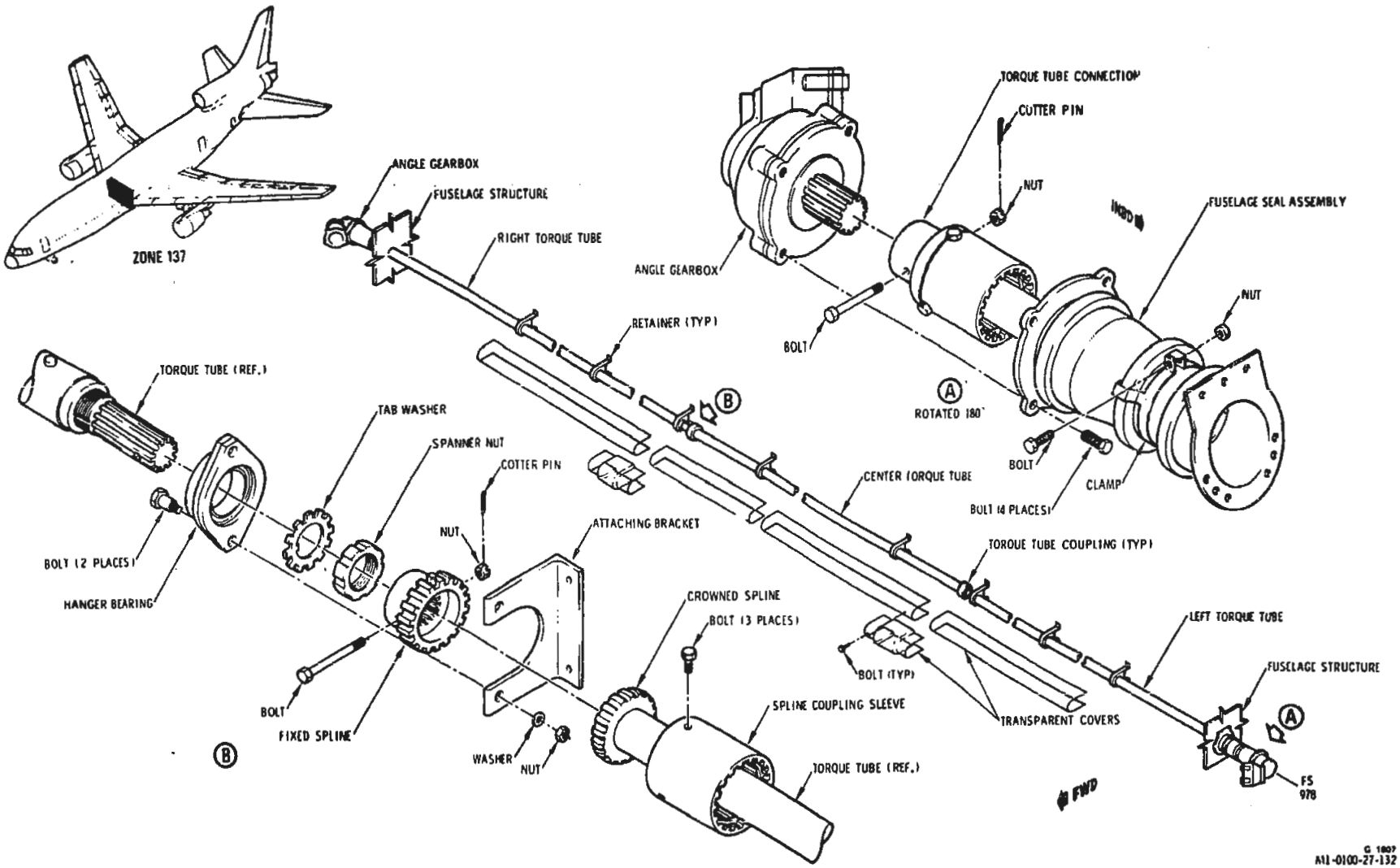
(6) Remove bolt securing fixed spline to angle gearbox.

(7) Open mid electrical service center access door 192K.

(8) Remove bolts securing transparent torque tube covers along fuselage torque tube. Remove covers.

(9) Remove one bolt from each torque tube retainer and rotate retainers away from torque tube.

(10) Remove bolts securing spline coupling sleeve and slide coupling sleeve inboard to disengage torque tubes.



R Slat Drive Fuselage Torque Tube - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

CAUTION: DO NOT ALLOW TORQUE TUBE SYSTEM TO RIGHT OF DISCONNECTED TORQUE TUBE TO ROTATE OR RIGHT WING SLATS WILL BE OUT OF RIG. TAPE OR TIE TORQUE TUBE TO PREVENT ROTATION.

(11) Remove bolts securing bearing hanger to attaching bracket.

(12) Remove torque tube.

(13) Remove bolt securing fixed spline on bearing end of torque tube. Remove fixed spline.

(14) Disengage tab washer and remove spanner nut securing hanger bearing. Remove hanger bearing.

B. Removal of Fuselage Center Torque Tube

R (1) Shut off all four hydraulic systems (Ref. 29-11-00) and
R install warning tags on Flight Engineer/Second Officers
R hydraulic system panel, zone 215, and on hydraulic
R service panel, zone 147.

R (2) Actuate asymmetry brakes as follows to lock slat torque
R tube system and prevent a disconnected torque tube from
R rotating and becoming mis-rigged:

R NOTE: Another method of preventing torque tube
R rotation is to tape or tie torque tube outboard
R of torque limiting brake.

R (a) Turn on electrical power (Ref. 24-41-00).

R (b) Open access doors 521TB and 621TB to asymmetry
R brakes (Ref. 6-40-00).

R (c) Remove screws securing rotary transducer to left
R leading edge asymmetry brake. Disengage
R transducer from brake. Do not disconnect
R electrical connector.

R (d) Rotate transducer shaft clockwise until slat
R asymmetry brake pop-out indicator is actuated.

R (e) Reinstall rotary transducer to slat asymmetry
R brake with screws. Lock-wire screws. No timing
R of rotary transducer is necessary.

R NOTE: If tri-wing screws are used to secure
R rotary transducer, replace with
R NAS1351-3H-6P socket-head capscrews, or
R equivalent.

R (f) Turn off electrical power (Ref. 24-41-00).

(3) Open mid electrical service center access door 192K.

(4) Remove bolts securing transparent torque tube covers along center fuselage torque tube. Remove covers.

(5) Remove bolts securing spline coupling sleeves and slide sleeves inboard to disengage torque tubes (two places).

CAUTION: DO NOT ALLOW TORQUE TUBE TO RIGHT OF DISCONNECTED TORQUE TUBE TO ROTATE OR RIGHT WING SLATS WILL BE OUT OF RIG. TAPE OR TIE TORQUE TUBE TO PREVENT ROTATION.

(6) Remove one bolt from each torque tube retainer and rotate retainers away from torque tube.

(7) Remove torque tube.

C. Installation of Fuselage Left or Right Torque Tube

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Install hanger bearing on threaded end of torque tube. Install tabbed washer and spanner nut. Torque nut 36 to 40 lb in. and secure by bending one washer tab into machined slots in nut.

NOTE: Position hanger bearing with base of support housing nearest the end of the torque tube.

(2) Butter-lubricate fixed spline from fuselage center torque tube connection. Align mounting holes in fixed spline and bearing end of torque tube. Install bolt, nut, and cotter pin. Torque nut 10 to 12 lb in.

(3) Butter-lubricate fixed spline on outboard end of turque tube.

NOTE: Steps 4C(4) and 4C(5) require two men.

(4) Insert torque tube into fuselage seal and position torque tube in place.

(5) Gain access to slat drive fuselage pressure seal. Align mounting holes on torque tube fixed spline and angle gearbox output spline. Install bolt, nut, and washer. Torque nut 10 to 12 lb in.

(6) Install bolts connecting fuselage seal assembly to angle gearbox.

(7) Tighten clamp in center of fuselage seal assembly.

(8) Close access panel 511A or 611AB.

(9) Position hanger bearing on outboard side of attaching bracket and install bolts, nuts, and washers.

(10) Butter-lubricate fixed spline and coupling sleeve at fuselage center torque tube connection.

(11) Align mounting holes in coupling sleeve and fixed spline. Install bolts. Torque bolts 10 to 12 lb in. and lock-wire.

(12) Install bolts and washers securing torque tube retainers.

(13) Install transparent torque tube covers with bolts and washers.

(14) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On Pilots overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds close circuit breakers opened in Steps (b) and (c).

R R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(15) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (16) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

R (17) Cycle slats from full up to full down and back to full up for several cycles. Verify that slats operate normally. Visually verify normal operation of replaced torque tube.

R (18) Turn off hydraulic power (Ref. 29-11-00).

R (19) Close access door 192K.

D. Installation of Fuselage Center Torque Tube

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Butter-lubricate coupling sleeves and fixed splines at fuselage torque tube connections (two places).

(2) Position torque tube in place. Align mounting holes in coupling sleeves and fixed splines (two places). Install bolts in coupling sleeves. Torque bolts 10 to 12 lb in. and lock-wire.

(3) Install bolts and washers securing torque tube retainers.

(4) Install transparent torque tube covers with bolts and washers.

(5) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On Pilots overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds close circuit breakers opened in Steps (b) and (c).

R
R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(6) Check operation of slats per Steps 4C(15) through 4C(18).

(7) Close access door 192K.

R SLAT DRIVE FUSELAGE TORQUE TUBES - INSPECTION AND CHECK

1. General

This section provides the procedures to inspect and check the fuselage slat torque tubes for wear.

2. Inspection/Check

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Fuselage Torque Tubes

(1) Gain access to mid electrical service center and visually inspect torque tubes for signs of wear (indicated by a radial groove).

NOTE: Wear can be caused by interference with torque tube retainer.

R (2) If wear is less than limits in Table 601, smooth abraded area and brush alodine in accordance with Structural Repair Manual 51-21-02. If wear exceeds limits in Table 601, replace torque tube.

Fuselage Slat Torque Tube Wear Limits
Table 601

LAC P/N	VENDOR P/N	MAXIMUM RADIAL GROOVE WEAR LIMITS (INCHES)
672156-119	720012-1	0.004
672156-121	720012-2	0.004
672156-123	720013-1	0.004

(3) Remove tags from hydraulic control panels.

SLAT DRIVE FUSELAGE TORQUE TUBE BEARING AND HANGER ASSEMBLY REMOVAL AND INSTALLATION

1. Equipment and Materials

R Grease, Aircraft and Instrument, MIL-G-23827A

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Shut off all four hydraulic systems (Ref. 29-11-00).

(2) Install warning tags on Flight Engineers/Second Officers Hydraulic System Panel, zone 215, and on Hydraulic Service Panel, zone 147.

(3) Actuate asymmetry brakes as follows to lock slat torque tube system and prevent a disconnected torque tube from rotating and becoming mis-rigged:

NOTE: Another method of preventing torque tube rotation is to tape or tie torque tube outboard of disconnect area.

(a) Turn on electrical power (Ref. 24-41-00).

(b) Open access doors 521TB and 621TB to asymmetry brakes (Ref. 6-40-00).

(c) Remove screws securing rotary transducer to left leading edge asymmetry brake. Disengage transducer from brake. Do not disconnect electrical connector.

(d) Rotate transducer shaft clockwise until slat asymmetry brake pop-out indicator is actuated.

(e) Reinstall rotary transducer to slat asymmetry brake with screws. Lock-wire screws. No timing of rotary transducer is necessary.

(4) Open applicable access door to bearing hanger assembly (Ref. 6-40-00).

(5) Remove bolts securing spline coupling sleeve and slide coupling sleeve inboard to disengage torque tubes (Ref. Fig. 401).

R R (6) Remove bolt securing fixed spline on bearing end of torque tube. Remove fixed spline.

R R (7) Disengage tab washer and remove spanner nut securing hanger bearing.

R R (8) Remove bolts securing hanger bearing to attaching bracket.

R (9) Remove hanger bearing.

NOTE: Note hanger bearing orientation for reinstallation.

B. Installation

(1) Install hanger bearing on threaded end of torque tube.

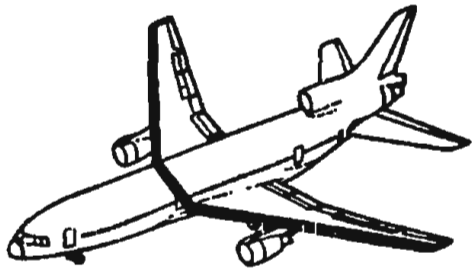
NOTE: Verify hanger bearing orientation is the same as that noted in Step 3A(13).

(2) Install tabbed washer and spanner nut. Torque nut 36 to 40 lbs in. and secure by bending one washer tab into machined slots in nut.

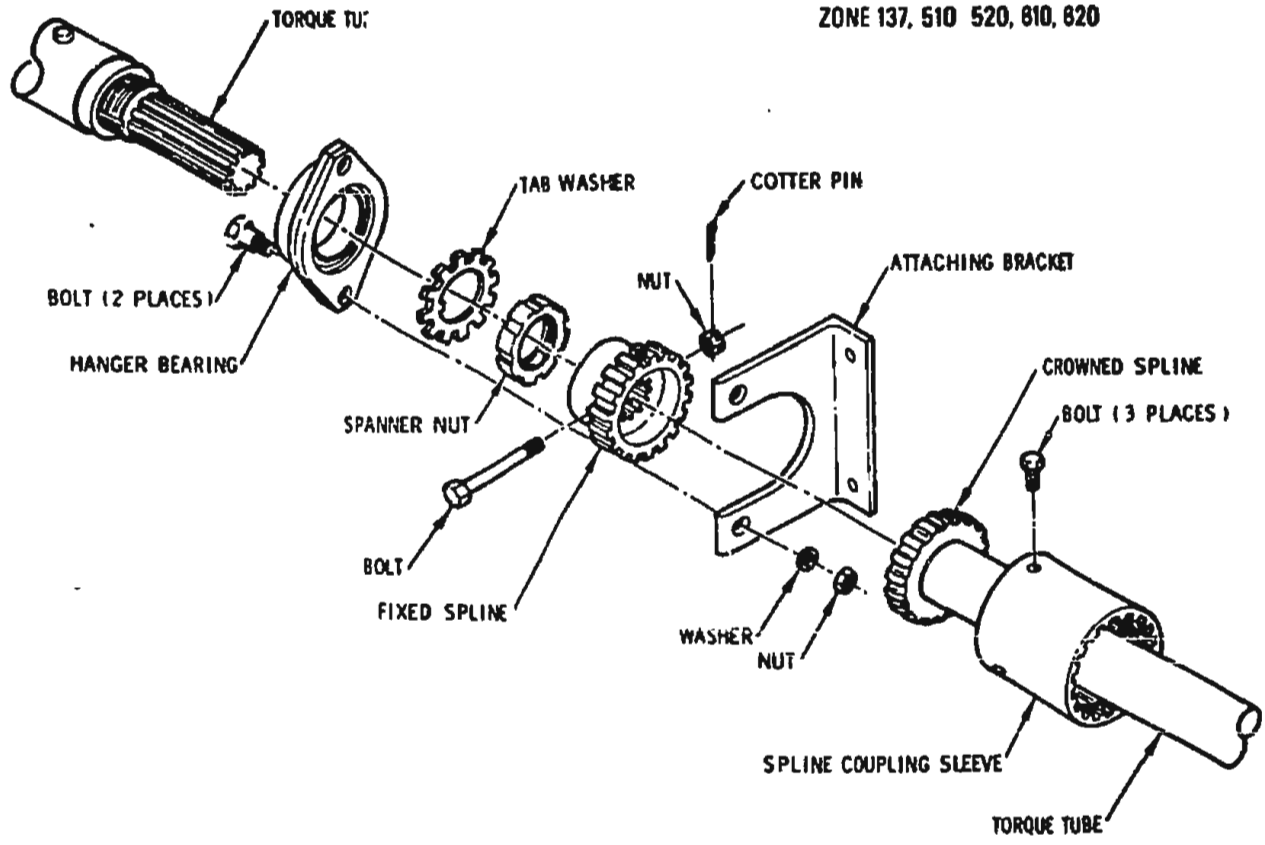
(3) Position hanger bearing on attachment bracket and install bolts, nuts, and washers.

(4) Butter-lubricate all splined surfaces with grease.

(5) Align mounting holes and engage fixed spline and bearing end of torque tube. Install bolt and nut. Torque nut 10 to 12 lb in. and install cotter pin.



ZONE 137, 510 520, 810, 820



M1-0100-27-133

R Slat Drive Fuselage Torque Tube Bearing and Hanger Assembly
R Removal and Installation
R Figure 401

(6) Align mounting holes and engage spline coupling sleeve and fixed spline. Install bolts. Torque bolts 10 to 12 lb in. and lock-wire.

(7) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On pilot overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds, close circuit breakers opened in Steps (b) and (c).

R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY
R BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(8) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at

3000 psi may be used to pressurize the A and C hydraulic systems.

(10) Cycle slats from full up to full down and back to full up for several cycles. Verify normal operation of slat system. Visually verify normal operation of replaced bearing and hanger assembly.

(11) Turn off, hydraulic power (Ref. 29-11-00).

(12) Close access door.

SLAT DRIVE TORSIONAL SHOCK ABSORBER - REMOVAL AND INSTALLATION

1. Equipment and Materials

R Grease, Aircraft and Instrument, MIL-G-23827A

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Ensure that hydraulic systems A and C are shut off (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers Hydraulic System Panel, zone 215, and on Hydraulic Service Panel, zone 147.

(3) Actuate asymmetry brakes as follows to lock slat torque tube system and prevent a disconnected torque tube from rotating and becoming mis-rigged:

NOTE: Another method of preventing torque tube rotation is to tape or tie torque tube outboard of torsional shock absorber.

(a) Turn on electrical power (Ref. 24-41-00).

(b) Open access doors 521TB and 621TB to asymmetry brakes (Ref. 6-40-00).

(c) Remove screws securing rotary transducer to left leading edge asymmetry brake. Disengage transducer from brake. Do not disconnect electrical connector.

(d) Rotate transducer shaft clockwise until slat asymmetry brake pop-out indicator is actuated.

(e) Reinstall rotary transducer to slat asymmetry brake with screws. Lock-wire screws. No timing of rotary transducer is necessary.

(f) Turn off electrical power (Ref. 24-41-00).

(4) Remove access panel 511BT-1 (Ref. 6-40-00) to gain access to shock absorber.

(5) Remove bolt from shock absorber coupling splines (two places) and slide coupling splines away from shock absorber (Ref. Fig. 401).

(6) Remove shock absorber.

B. Installation

(1) Position shock absorber between power drive unit (PDU) and torque limiting brake with flanged end outboard from PDU.

(2) Butter-lubricate all splined surfaces with grease.

(3) Slide shock absorber coupling splines inward onto shock absorber shafts. Align mounting holes and install bolt and nut (two places). Torque nut 10 to 12 lb in. and install cotter pin.

(4) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On pilots overhead circuit breaker panel CB1, zone 210, open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds close circuit breakers opened in Steps (b) and (c).

R CAUTION: DO NOT EXCEED 30 LB-FT TORQQUE ON ASYMMETRY
R BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hexhead reset device.

(5) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

THE PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

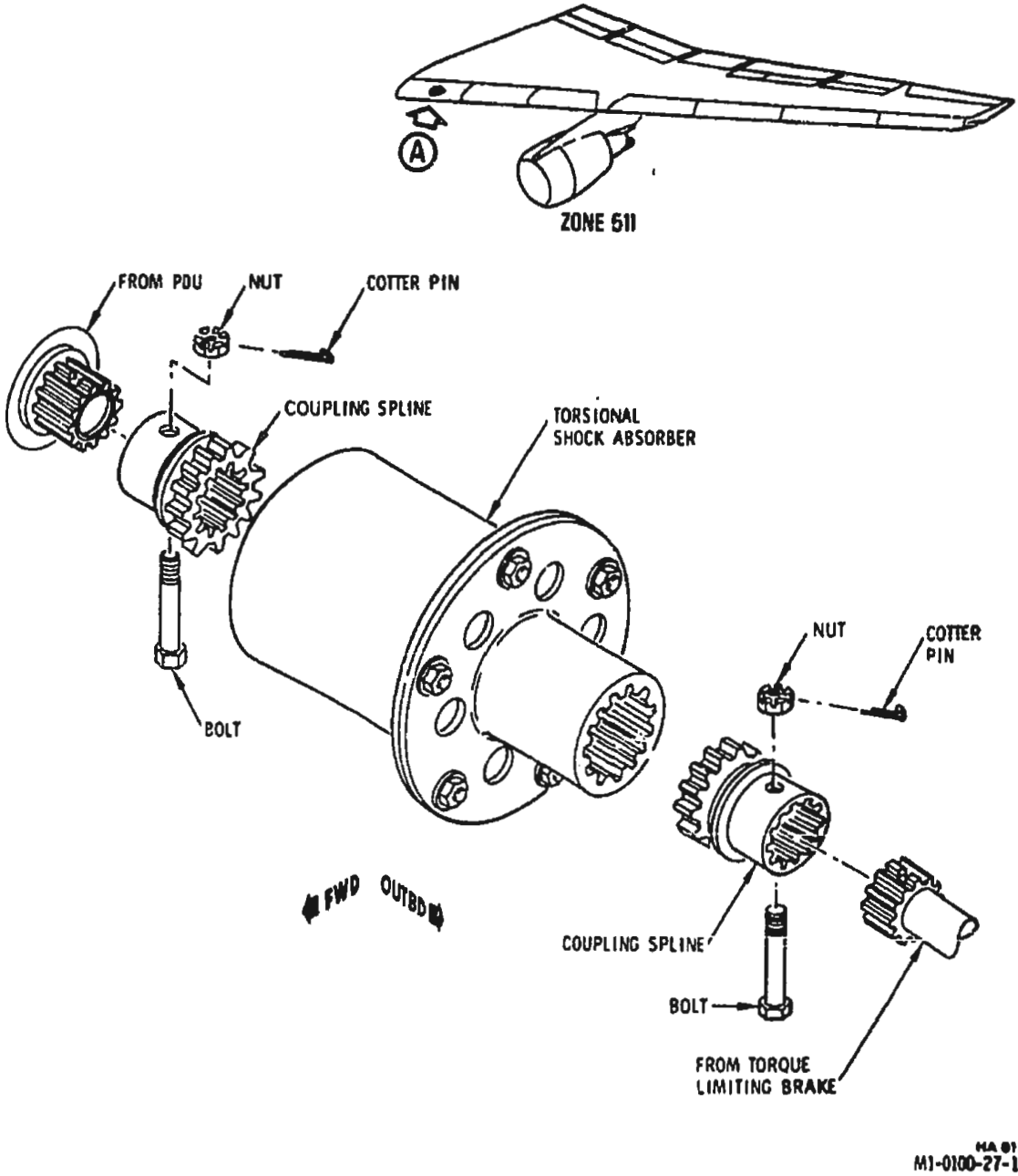
(6) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(7) Cycle slats from full up to full down and back to full up for several cycles. Verify that slat operation is normal. Visually verify normal operation of replaced torsional shock absorber.

(8) Shut off hydraulic power (Ref. 29-11-00).

(9) Install access panel 511BT-1 and close access door 521TB and 621TB (Ref. 6-40-00).



R Slat Drive Torsional Shock Absorber - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

SLAT TORQUE-LIMITING BRAKE - REMOVAL AND INSTALLATION

1. General

Two torque-limiting brakes are installed in the torque tube drive train inboard of the No. 1 inboard slat actuator in each wing. The left brake is located between the shock absorber and a torque tube. The right brake is located between two torque tubes. Removal and installation procedures are identical for both brakes, except for the inboard connection.

2. Equipment and Materials

R Grease, Aircraft and Instrument, MIL-G-23827A

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

WARNING: VERIFY HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Ensure hydraulic systems A and C are shut off (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers Hydraulic System Panel, zone 215, and on Hydraulic Service Panel, zone 147.

(3) Actuate asymmetry brakes as follows to lock slat torque tube system and prevent a disconnected torque tube from rotating and becoming mis-rigged:

NOTE: Another method of preventing torque tube rotation is to tape or tie torque tube outboard of torque limiting brake.

(a) Turn on electrical power (Ref. 24-41-00).

(b) Open access doors 521TB and 621TB to asymmetry brakes (Ref. 6-40-00).

(c) Remove screws securing rotary transducer to left leading edge asymmetry brake. Disengage transducer from brake. Do not disconnect electrical connector.

(d) Rotate transducer shaft clockwise until slat assymmetry brake pop-out indicator is actuated.

(e) Reinstall rotary transducer to slat asymmetry brake with screws. Lock-wire screws. No timing of rotary transducer is necessary.

NOTE: If tri-wing screws are used to secure rotary transducer, replace with NAS1351-3H-6P socket-head capscrews, or equivalent.

R (f) Turn off electrical power (Ref. 24-41-00).

(4) Open the following wing upper and lower access panels: 511BT, 511AB, and 511BB, or 611AB and 611BB (Ref. 6-40-00).

(5) Detach brake inboard connection (Ref. Fig. 401).

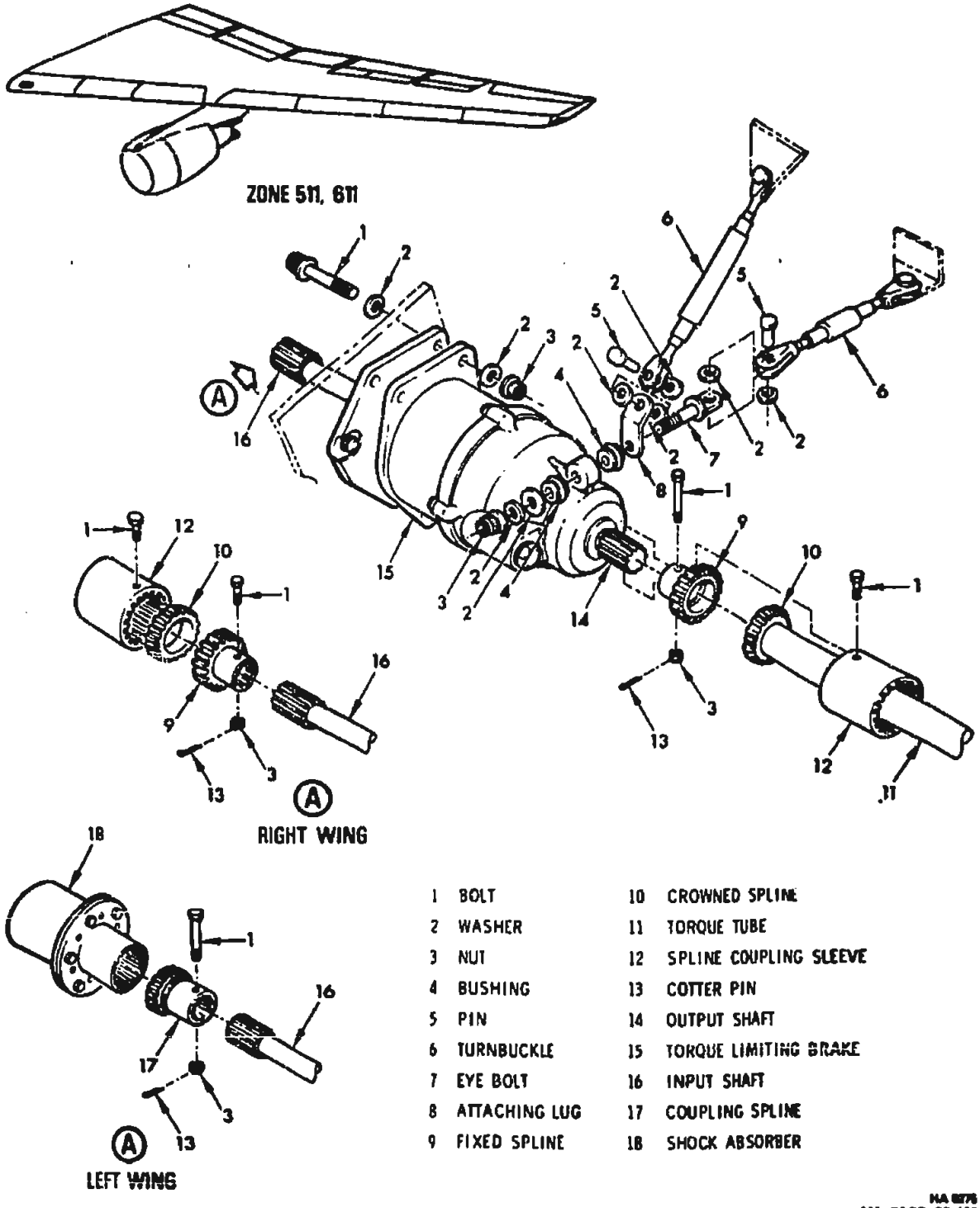
(a) On right wing, remove bolts from spline coupling sleeve and slide coupling sleeve away from brake.

(b) On left wing, remove bolt from shock absorber coupling spline and slide coupling spline away from shock absorber.

(6) Remove bolts from spline coupling sleeve on outboard side of brake. Slide coupling sleeve away from brake.

(7) Loosen turnbuckle and remove pins from turnbuckle clevis to brake attachment lug (two places).

(8) Remove bolts securing brake to track rib, and remove torque-limiting brake from aircraft.



1	BOLT	10	CROWNED SPLINE
2	WASHER	11	TORQUE TUBE
3	NUT	12	SPLINE COUPLING SLEEVE
4	BUSHING	13	COTTER PIN
5	PIN	14	OUTPUT SHAFT
6	TURNBUCKLE	15	TORQUE LIMITING BRAKE
7	EYE BOLT	16	INPUT SHAFT
8	ATTACHING LUG	17	COUPLING SPLINE
9	FIXED SPLINE	18	SHOCK ABSORBER

M1-0100-27-135

R Slat Torque-limiting Brake - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

(9) Remove shock absorber coupling spline and fixed spline from left torque-limiting brake, or remove fixed splines (two places) from right torque-limiting brake.

(10) Remove eyebolt from torque-limiting brake.

B. Installation

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

R (1) Butter-lubricate all splined drive train surfaces with
R grease.

NOTE: Internal lubrication of torque limiting brake is applied during assembly and overhaul. Excessive lubrication can cause brake to malfunction. Do not add oil.

(2) Align mounting holes and engage fixed spline and outboard shaft of torque-limiting brake. Install bolt, nut, and cotter pin. Torque nut 15 to 20 lb in.

(3) Slide shock absorber coupling spline on inboard shaft of left torque-limiting brake, or align mounting holes and engage fixed spline and inboard shaft of right torque-limiting brake. Install bolt, nut, and cotter pin. Torque nut 15 to 20 lb in.

(4) Install eyebolt, associated bushings, washers, and nut on torque-limiting.

(5) Position torque-limiting brake on track rib.

(6) Install bolts, washers, and nuts securing torque-limiting brake to track rib.

(7) Adjust turnbuckles until pins pass freely (no binding) through turnbuckle clevis and attaching lug on torque-limiting brake (two places). Lock-wire turnbuckles.

(8) Attach brake inboard connection to drive train.

(a) On right wing, align mounting holes and engage spline coupling sleeve and fixed spline. Install bolts. Torque bolts 15 to 20 lb in. and lock-wire.

(b) On left wing, align mounting holes and engage shock absorber coupling spline and torque-limiting brake shaft while sliding coupling spline into

shock absorber. Install bolt, nut, and cotter pin. Torque nut 10 to 12 lb in.

(9) Align mounting holes and engage spline coupling sleeve and fixed spline at brake outboard connection to torque tube. Install bolts. Torque bolt 15 to 20 lb in. and lock-wire.

(10) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On Pilots overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds close circuit breakers opened in Steps (b) and (c).

R
R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(11) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(12) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C

hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(13) Cycle slats from full up to full down and back to full up for several cycles. Verify that slat operation is normal. Visually verify normal operation of replaced torque limiting brake.

(14) Shut off hydraulic power (Ref. 29-11-00).

(15) Close access doors.

SLAT TORQUE-LIMITING BRAKE - ADJUSTMENT AND TEST

1. General

This procedure tests the input torque required to set the slat torque limiting brake

Testing the slat torque limiting brake as described in this procedure is performed with the brake installed on the aircraft.
R It is possible to bench test the brake using procedures found in
R Sunstrand overhaul manual 27-81-11 or an equivalent procedure. If brake is to be bench tested, use maintenance manual procedures for removal and installation (Ref. 27-81-17, 401) and verify torque limiter brake meets requirements as specified in this procedure.

2. Equipment and Materials

Lubricant, MIL-G-23827A, or equivalent

Spline wrench Adapter, G/ITEL 27-81-54 and 27-81-55

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

Torque wrench, 2000 pound-inch with dial readout, or equivalent (2)

3. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
	24-41-00	External Power/Ground Service System - Maintenance Practices
R R	27-81-11	Slat Torque Limiting Brake Overhaul Manual (Sunstrand)
R	27-81-17	Torque Limiting Brake - Removal and Installation
	29-11-00	Hydraulic Power System - Maintenance Practices

4. Adjustment/Test

A. Torque Check

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Ensure all four hydraulic systems are shut off (Ref. 29-11-00).

(2) Install warning tags on FE/SO Hydraulic System Panel, zone 215, and the Hydraulic Service Panel, zone 147.

(3) Energize slat asymmetry brakes as follows to lock slat actuation system:

(a) Turn on electrical power (Ref. 24-41-00).

(b) Open access door 521TB and 621TB to gain access to slat asymmetry brakes (Ref. 6-40-00).

(c) Remove screws securing either the left or right asymmetry transducer to the asymmetry brake (Ref. Fig. 501).

(d) Rotate transducer shaft in either direction until asymmetry brakes are actuated (pop-out indicator protrudes).

(e) Reinstall rotary transducer to asymmetry brake. Lock-wire screws. No timing of rotary transducer is necessary.

(f) Turn off electrical power.

(4) Open the following wing access panels to gain access to the slat torque limiter (Ref. 6-40-00):

(a) Left wing: 511AB and 511BB.

(b) Right wing: 611AB and 611BB.

(5) On the outboard side of torque limiter, remove bolt connecting fixed spline to the torque limiter output shaft. Remove three bolts from spline coupling sleeve. Slide spline coupling sleeve outboard and remove fixed spline from torque limiter output shaft (Ref. Fig. 501).

R (6) For the right torque limiter,
R remove bolt connecting fixed spline to the torque
R limiter input shaft. Remove three bolts from spline
R coupling sleeve. Slide spline coupling sleeve inboard

and remove fixed spline from torque limiter input shaft (Ref. Fig. 501).

(6) For the left torque limiter, remove bolts connecting coupling spline to PDU output shaft and torque limiter input shaft. Slide coupling splines away from shock absorber and remove shock absorber.

R (7) Install spline wrench adapter on torque limiter output spline. Install a 0-2000 pound inch torque wrench on wrench adapter.

(8) Support torque wrench handle by bracing it against aircraft structure. Torque wrench must not move when load is applied. Useful tools used for bracing torque wrench may include wood or metal blocks, pipes, metal rods or a combination of these. Verify aircraft structure can support the load and that the aircraft is not damaged.

(9) Install spline wrench adapter on torque limiter input spline. Install a 0-2000 pound inch torque wrench on wrench adapter.

NOTE: Access between torque limiter input shaft and Power Drive Unit (PDU) for left torque limiter is limited. Verify torque wrench and spline wrench adapter assembly is not wider than 5 7/8 inches.

Steps 4A(10) thru 4A(12) will require three persons; one person to apply input torque, one to support and steady the output torque wrench and one to read and record output torque.

(10) Apply torque to input spline (in either direction) while the output torque wrench is resisting the input torque. The input and output torque will remain equal until a torque of 910 to 1075 pounds inch is reached (this is lockout torque). As input torque is increased over the lockout torque, the output torque must remain within lockout torque range, indicating that lockout brake has applied. If output torque exceeds 1075 pounds inch, replace torque limiting brake.

Variables in identifying LOCKOUT LIMITS are as follows:

R (a) Lockout values of the torque limiting brake may vary. It is recommended that the torque limiting brake be operated several times in both directions to establish a pattern of lockout limits.

(b) Repeatability of lockout values may be improved by applying input torque to the torque limiting brake in the same manner and at the same rate of application for each operation of the torque limiting brake.

(c) An occasional (approximately 1 out of 5 operations per direction) high lockout value may be disregarded when establishing lockout limits.

(d) A lockout value of approximately 1500 inch pounds may be experienced during the initial test of a cleaned or overhauled torque limiting brake. This is no cause for rejection or concern since the operating limit torque for the torque tubes is 2100 inch pounds.

(e) Lockout values which consistently fail to meet test limits indicate the brake is incorrectly adjusted, or that bench calibration is necessary.

(11) Relieve input torque.

(12) Repeat Steps 4A(8) thru 4A(10) with torque in opposite direction.

(13) Relieve input torque.

(14) Remove torque wrenches and adapters.

NOTE: When assembling any splined joint, butter-lube mating splined surfaces with grease MIL-G-23827A.

(15) Install fixed spline on torque limiter output shaft. Install bolt through fixed spline and output shaft. Install cotter pin.

(16) Engage spline coupling sleeve with fixed spline. Install three bolts through coupling sleeve and into fixed spline. Lock-wire bolts.

(17) For right torque limiter, install fixed spline on torque limiter input shaft. Install bolt through fixed spline and input shaft. Install cotter pin.

(18) For right torque limiter, engage spline coupling sleeve with fixed spline. Install three bolts through coupling sleeve and into fixed spline. Lock-wire bolts.

R (18) For left torque limiter,
R engage coupling splines on the flap PDU output shaft
R and the torque limiter input shaft. Position shock
R absorber in place and slide coupling splines into
R engagement with shock absorber. Install bolt through
R both coupling splines. Install cotter pins.

R (19) Reset asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On pilots overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds close circuit breakers opened in Steps 4A(19)(b) and 4A(19)(c).

CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(e) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(20) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(21) Turn on hydraulic systems A and C (Ref. 29-11-00).

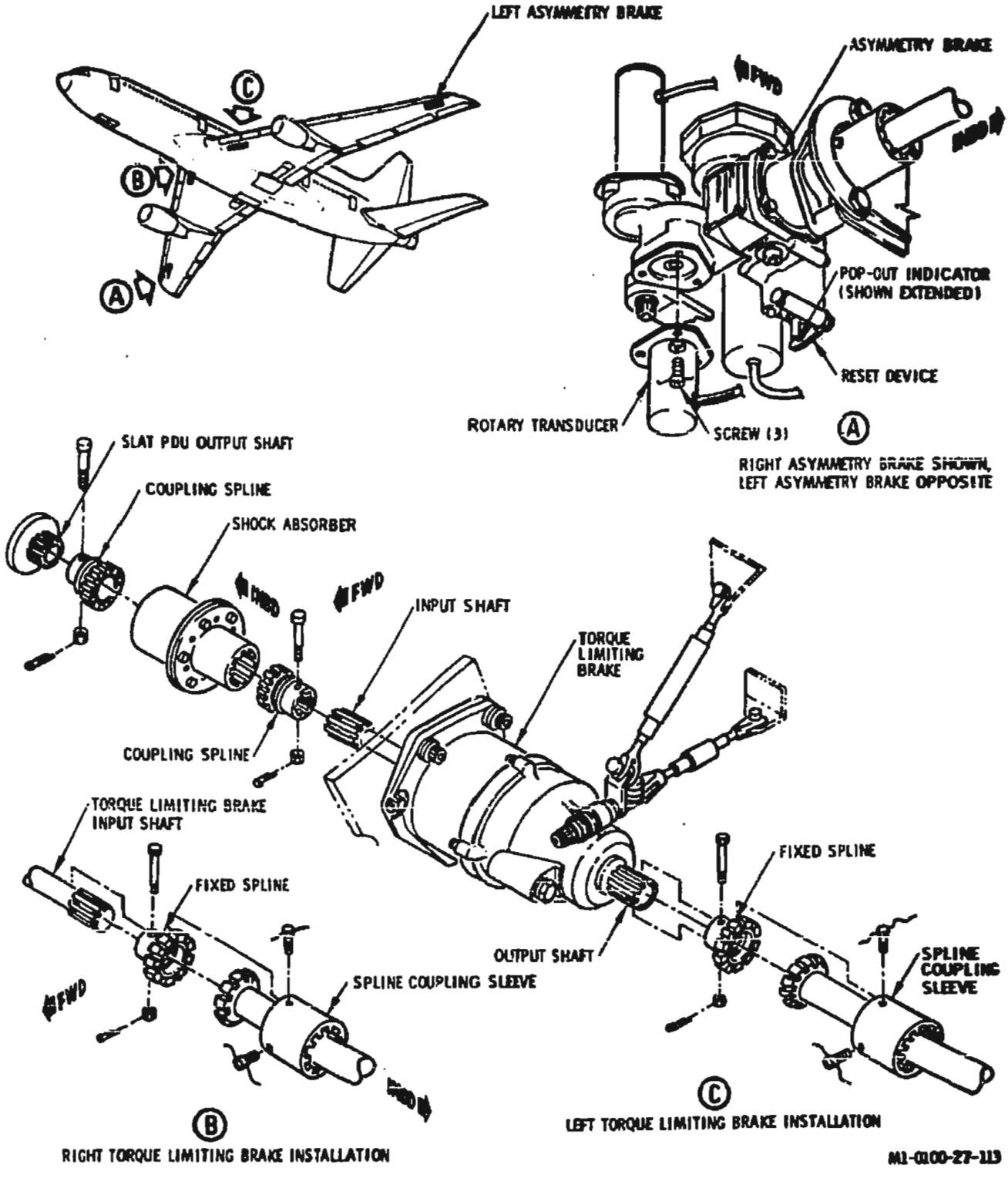
NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A

hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(22) Cycle slats from full up to full down and back to full up for several cycles. Verify that slat operation is normal. Visually verify normal operation of torque limiting brake.

(23) Shut off hydraulic power if no longer required (Ref. 29-11-00).

(24) Close access doors.



Torque Limiting Brake - Functional Test
Figure 501

R SLAT DRIVE WING TORQUE TUBE - REMOVAL AND INSTALLATION

1. General

There are 39 wing torque tubes: 19 in the left wing and 20 in the right wing (Ref. Fig. 401). Basically, there are two different types of torque tubes: a torque tube without a hanger bearing and a torque tube with a hanger bearing. Separate removal and installation procedures are provided for each type of torque tube. Torque tubes without hanger bearings are covered in Paragraphs 4A and 4C. Torque tubes with hanger bearings are covered in Paragraphs 4B and 4D.

NOTE: If a discrepancy is noted at the universal coupling, both the crowned spline and the coupling sleeve should be replaced.

2. Equipment and Materials

R Lubricant MIL-G-23827, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-01	Flight Controls Lubrication
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal of a Wing Torque Tube Without a Hanger Bearing

(1) Actuate asymmetry brakes as follows to lock slat torque tube system and prevent a disconnected torque tube from rotating and becoming mis-rigged:

NOTE: Another method of preventing torque tube rotation is to tape or tie torque tube outboard of removed torque tube.

(a) Turn on electrical power (Ref. 24-41-00).

(b) Open access doors 521TB and 621TB (Ref. 6-40-00).

(c) Remove screws securing rotary transducer to the left leading edge slat asymmetry brake. Disengage
R transducer from brake. Do not disconnect
R electrical connector.

(d) Rotate transducer shaft clockwise until slat asymmetry brake pop-out indicator is actuated.

(e) Reinstall rotary transducer to slat asymmetry brake with screws. Lock-wire screws. No timing of rotary transducers is necessary.

(f) Turn off electrical power (Ref. 24-41-00).

(2) Turn off hydraulic systems A and C (Ref. 29-11-00).

(3) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(4) Remove applicable wing leading edge, front spar and slat drive access panels (Ref. 6-40-00) and gain access to torque tube.

(5) Remove bolts securing spline coupling sleeve at one end of torque tube (Ref. Fig. 401, Sheet 2). Slide coupling sleeve off splines.

(6) Remove bolt, nut, and fixed spline from connecting torque tube.

(7) Remove bolt and nut from torque tube coupling at other connecting torque tube.

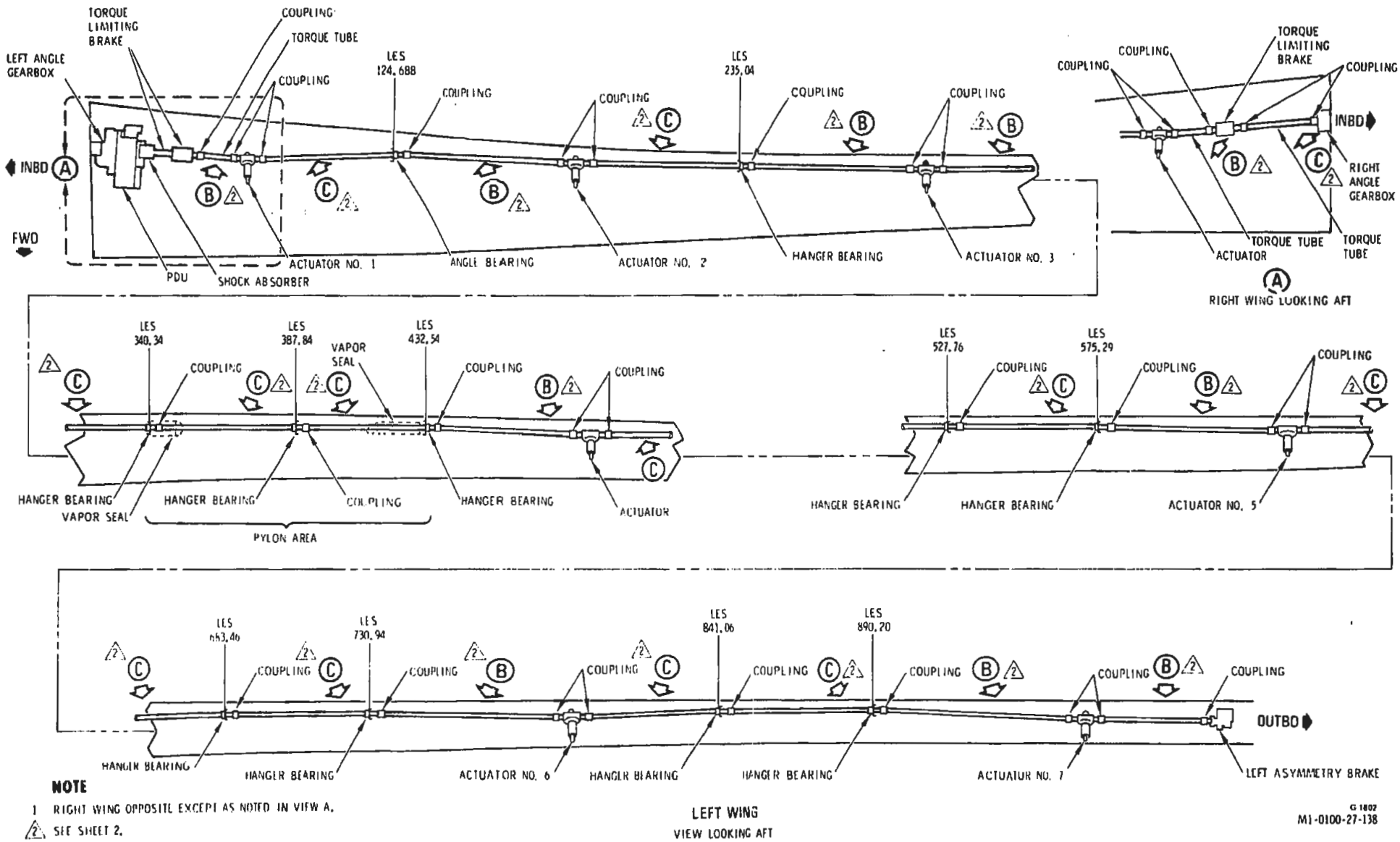
(8) Remove bolts securing torque tube retainers to front spar, and remove retainers from torque tube.

(9) Remove torque tube from aircraft.

NOTE: Some leading rib braces must be removed to gain clearance for torque tube removal. Replacement is extremely important.

B. Removal of Wing Torque Tube With a Hanger Bearing

(1) Actuate asymmetry brakes to lock slat torque tube per Step A(1).



NOTE

1 RIGHT WING OPPOSITE EXCEPT AS NOTED IN VIEW A.

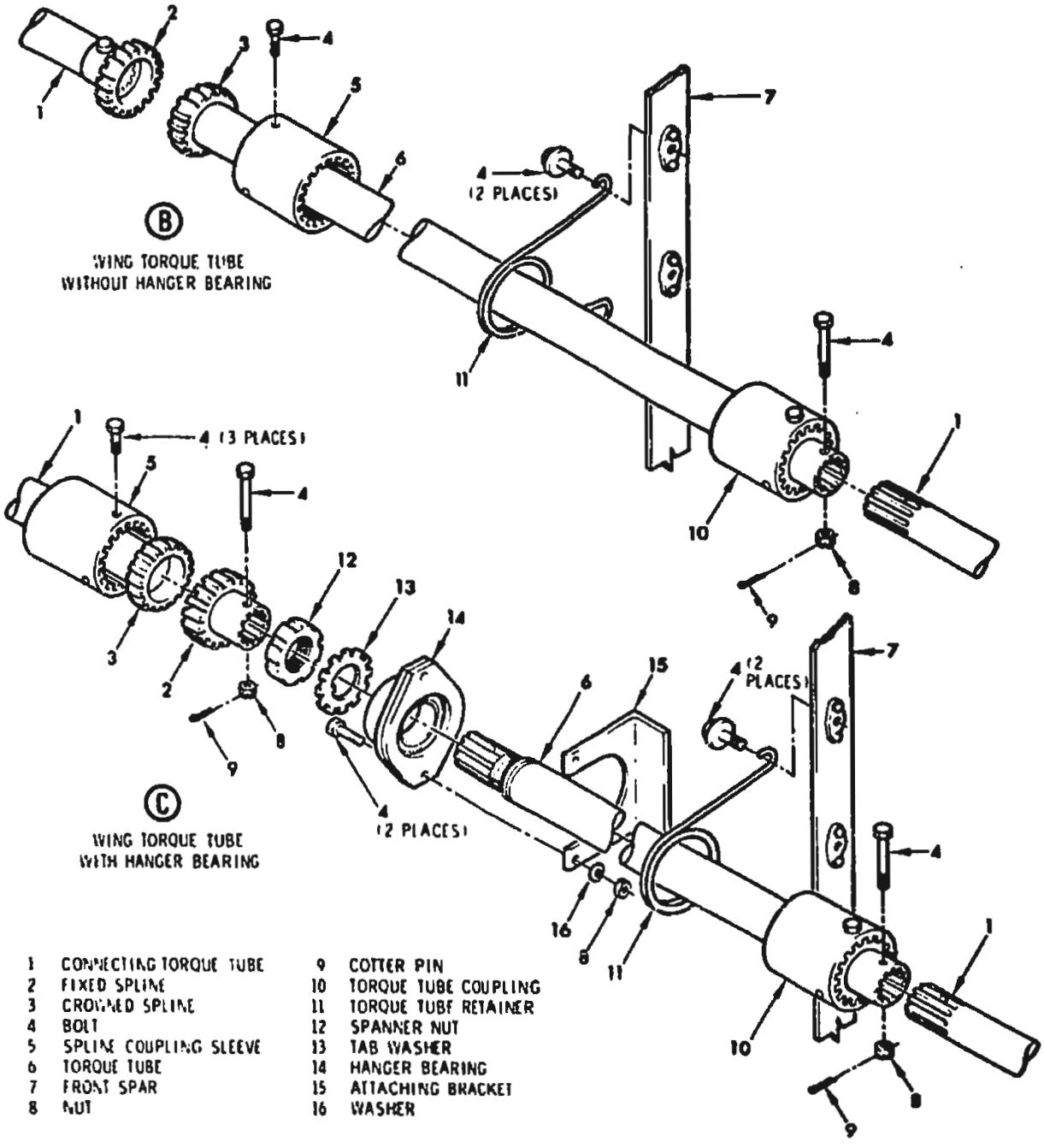
2 SEE SHEET 2.

G 1802
M1-0100-27-138

R Wing Torque Tube - Removal and Installation
R Figure 401 (Sheet 1)

R EFFECTIVITY: ALL

050



A11-0100-27-139

R Wing Torque Tube - Removal and Installation
R Figure 401 (Sheet 2)

R EFFECTIVITY: ALL
R
050B

(2) Turn off hydraulic systems A and C (Ref. 29-11-00).

(3) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(4) Remove applicable wing leading edge front spar and slat drive access panels (Ref. 6-40-00) and gain access to torque tube.

(5) Remove bolts securing spline coupling sleeve at bearing end of torque tube (Ref. Fig. 401, Sheet 2). Slide coupling sleeve off splines.

NOTE: In the pylon area, the vapor seal must be disconnected to provide access to torque tube coupling. Disconnect vapor seal clamp and slide vapor seal housing away from torque tube coupling. Connect vapor seal after installation of torque tube.

(6) Remove bolt and nut from torque tube coupling at other end of torque tube.

(7) Remove bolts and nuts securing hanger bearing to attaching bracket.

(8) Remove bolts securing torque tube retainers to front spar, and remove retainers from torque tube.

(9) Remove torque tube from aircraft.

R NOTE: Some leading edge rib braces must be removed to
R gain clearance for torque tube removal. Replacement of rib braces is extremely important.

(10) Remove bolt, nut, and fixed spline from bearing end of torque tube.

(11) Disengage tab washer. Remove spanner nut and hanger bearing from torque tube.

NOTE: Note hanger bearing orientation for reinstallation.

C. Installation of a Wing Torque Tube Without a Hanger Bearing

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) At one end of torque tube, remove bolts securing spline coupling sleeve and slide sleeve off splines. (Ref. Fig. 401, Sheet 2).

R R (2) Butter lubricate all splined surfaces with grease, MIL-G-23827.

(3) Install fixed spline on connecting torque tube with bolt and nut. Torque nut to 12 lb in. and install cotter pin.

(4) Position torque tube in place on aircraft with torque tube retainers on torque tube.

NOTE: Orient torque tube with crowned spline next to fixed spline from connecting torque tube [Ref. Step 4C(3)].

(5) Align mounting holes and engage torque tube coupling and the other connecting torque tube. Install bolt and nut. Torque nut 10 to 12 lb in. and install cotter pin.

(6) Align mounting holes and engage spline coupling sleeve and fixed spline from connecting torque tube. Install bolts. Torque bolts 15 to 20 lb in. and lock-wire.

(7) Install torque tube retainers to front spar with bolts.

R R R R R R NOTE: On the full-circle retainers, verify that the torque tube is centered within the retainer. On U-shaped retainers, verify that there is a minimum of 0.32 inch clearance between the torque tube and the retainer. Reposition or form retainer as required.

(8) Lubricate torque tube couplings (Ref. 12-23-01).

(9) Reset slat asymmetry brakes as follows:

(a) Turn on electrical power (Ref. 24-41-00).

(b) On pilots overhead circuit breaker panel CB1, zone 210, remove tag and open circuit breaker NO. 2 ASYM BK LE SLAT (J10).

(c) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, remove tag and open circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

(d) After a minimum of 5 seconds, close circuit breakers opened in Steps (b) and (c).

R R CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(e) Reset both asymmetry brake pop-out indicators by applying wrench torque to hex head reset device.

(10) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(11) Turn on hydraulic systems, A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(12) Cycle the slats from full up to full down and back to full up for several cycles. Verify that slat operation is normal. Visually verify normal operation of replaced torque tube.

(13) Shut off hydraulic power (Ref. 29-11-00).

(14) Close access doors.

D. Installation of a Wing Torque Tube With a Hanger Bearing

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Install hanger bearing on threaded end of torque tube. Secure hanger bearing with tab washer and spanner nut. Torque nut 40 to 45 lb in. and engage one tab from washer into machined slot in spanner nut.

NOTE: Verify hanger bearing orientation is the same as that noted in Step B(11).

(2) Butter-lubricate all splined surfaces with grease, MIL-G-23827.

(3) Align mounting holes and engage fixed spline and bearing end of torque tube. Install bolt and nut. Torque nut 10 to 12 lb in. and install cotter pin.

(4) Position torque tube in place on aircraft with torque tube retainers on torque tube.

(5) Align mounting holes and engage torque tube coupline and connecting torque tube. Install bolt and nut. Torque nut 10 to 12 lb in. and install cotter pin.

(6) Align mounting holes and engage spline coupling sleeve and fixed spline at bearing end of torque tube. Install bolts. Torque bolts 15 to 20 lb in. and lock-wire.

(7) Install torque tube retainers to front spar with bolts.

(8) Install securing hanger bearing to attaching bracket with bolts and nuts.

NOTE: On full-circle retainers, verify that the torque tube is centered within the retainer. On U-shaped retainers, verify that there is a minimum of 0.32-inch clearance between the torque tube and the retainer. Reposition or form retainer as required.

(9) Lubricate torque tube couplings (Ref. 12-23-01).

(10) Reset slat asymmetry brakes per Step C(9).

(11) Check slat actuation system per Steps C(10) through C(13).

(12) Close access doors.

R

SLAT DRIVE WING TORQUE TUBES - INSPECTION AND CHECK

1. General

This section provides the procedures to inspect and check the wing torque tubes for wear.

2. Referenced Procedures

6-40-00 Exterior Access Doors and Panels

3. Inspection/Check

WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Wing Torque Tubes

(1) Open appropriate wing leading edge lower access doors to gain access to slat torque tubes (Ref. 6-40-00).

(2) Inspect torque tubes for signs of wear (indicated by a radial groove).

NOTE: Wear can be caused by interference with the torque tube retainer, or other leading edge components.

(3) If wear is less than limits in Table 601, smooth abraded area and alodine per structural repair manual 51-21-02. If wear exceeds limits in Table 601, replace torque tube.

Wing Slat Torque Tube Wear Limits
Table 601

LAC P/N	VENDOR P/N	MAXIMUM RADIAL GROOVE WEAR LIMITS (INCHES)
672156-101	720010-1	0.013
672156-103	720010-2	0.013
672156-105	720010-3	0.013
672156-107	720010-4	0.013
672156-109	720010-5	0.013
672156-111	720011-1	0.013
672156-113	720011-2	0.013
672156-115	720011-3	0.013
672156-117	720011-4	0.013
672156-119	720012-1	0.004
672156-121	720012-2	0.004
672156-123	720013	0.004

(4) Close access doors opened for inspection.

(5) Remove placards from hydraulic control panels.

SLAT BALLSCREW ACTUATOR - REMOVAL AND INSTALLATION

1. General

Three inboard ballscrew actuators and four outboard ballscrew actuators are located in each wing. Removal and installation procedures are identical for both inboard and outboard actuators.

2. Equipment and Materials

Slat Downstop Gage, G/ITEL 27-81-93, or equivalent

Lubricant, MIL-G-23827A, Grease, Aircraft and Instrument, or equivalent

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-01	Wing Leading Edge Slat Actuator Lubrication
24-41-00	External Power/Ground Service System - Maintenance Practices
27-81-00	Leading Edge Slat System - Adjustment and Test
27-81-23	Inboard Slats - Removal and Installation
27-81-26	Outboard Slats - Removal and Installation
27-81-38	Slat Asymmetry Rotary Transducer - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal (Ref. Fig. 401)

(1) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(3) Extend leading edge slats to the fully extended position (Ref. 27-81-00).

(4) Open access doors 521TB and 621TB (Ref. 6-40-00).

(5) Lock slat drive system to prevent system movement as follows:

(a) Remove bolts securing rotary transducer to either the left or right leading edge slat asymmetry brake. Disengage transudcer from brake (Ref. 27-81-38).

(b) Rotate transducer shaft in either direction until slat asymmetry brake pop-out indicator is actuated.

(c) Reinstall rotary transducer to slat asymmetry brake with bolts. No timing of rotary transducer is necessary.

(6) Shut off hydraulic systems A and C (Ref. 29-11-00).

(7) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(8) Remove applicable wing leading edge, front spar, and slat drive access panels to gain access to actuator (Ref. 6-40-00).

(9) Measure and record actuator extend dimension A (Ref. Fig. 401).

(10) Detach actuator from torque tubes by removing the three bolts from each spline coupling sleeve, one on each side of actuator. Slide sleeves away from actuator to disengage splines.

NOTE: Do not remove the single bolt connecting the fixed spline to the actuator spline shafts as this will not allow disengagement of the torque tube from the actuator.

(11) Disconnect actuator from clevis connection on slat. Remove bolt, nut, washers, bushing, and cotter pin.

(12) Rotate actuator input shaft, or output ball screw (rotating nut), to retract actuator and provide working clearance.

(13) At actuator-to-spar clevis connection, remove bolt, nut, washer, and cotter pin.

(14) Remove actuator from aircraft.

(15) Remove bolt, nut, and fixed spline from actuator input and output shafts.

(16) Check slat extend stop adjustment. Verify the dimension from the center of the upper aft track roller shaft to the face of the extend stop bolt (Ref. Fig. 401, Track Stop Adjustment). Use Slat Downstop Gage - Adjust extend stop as required. Lock-wire stop bolt.

B. Installation (Ref. Fig. 401)

CR NOTE: Assure transmission body will fit into spar clevis
CR fitting. Transmission body width is 2.250 to 2.245
CR inches. Some aircraft have spar clevis fittings
CR which are narrow. When this is encountered, dress
CR bushing flange face in the transmission body. Remove
CR equal amount of material from each bushing.

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Butter-lubricate all spline surfaces and actuator clevis bolts with MIL-G-23827A grease.

(2) Align connecting bolt holes and install fixed splines on actuator input and output shafts. Install bolt and nut (two places). Torque nut 15 to 20 lb. in. and install cotter pin.

(3) With actuator retracted for ease of handling, align clevis connection at spar and actuator gearbox. Install clevis bolt with head against anti-rotation flange on clevis fitting.

NOTE: Grease fitting (on actuator clevis) is positioned down at spar connection.

(4) Secure clevis bolt with washer, nut, and cotter pin. Lock-wire bolt-head end.

(5) Position the actuator ballscrew to the full retracted position by rotating the output ballscrew (rotating nut) against the internal stop. With the output ballscrew (rotating nut) against the internal retract stop, rotate the rod end only to obtain dimension B (Ref. Fig. 401) with grease fitting positioned up. Dimension B is 0.150 (±0.050) inch for 672152-103 or
C 672425-103 actuators (without floating seals) and 0.090
C (±0.050) inch for all others (with floating seals) (If necessary, loosen rod end nut and adjust rod end to obtain dimension. Torque rod end nut 80 to 100 lb ft and lock-wire nut to tab locking washer. Verify that locking washer tab is properly engaged in ballscrew slot.)

NOTE: On aircraft with 672152-103 or 672425-103 actuators,
the 0.150 inch dimension B is an initial adjustment only and will change when dimension A (next step) is obtained.

On aircraft with any actuators except 672152-103 or 672425-103,
the 0.090 inch dimension B is an initial adjustment only and will change when dimension A (next step) is obtained.

Dimension B ensures that the output ballscrew contacts the internal retract stop before the

small diameter ballscrew contacts the rotating nut.

(6) While holding rod end with grease fitting up, turn actuator gearbox input shaft, or output ballscrew (rotating nut), to obtain dimension A recorded in Step 4A(9). (Dimension A is a preliminary adjustment to position the replacement actuator in the same relative position as the removed actuator.)

(7) Verify that bushings are installed in the slat clevis fitting. Align clevis connection at slat and rod end of actuator. Install clevis bolt, washer, flanged bushing and nut (bolt head facing inboard on inboard slats, outboard on outboard slats).

(8) Torque nut 175 to 190 lb. in. and install cotter pin.

(9) Connect actuator to torque tubes. Align connecting bolt holes and engage spline coupling sleeves and fixed splines on actuator shafts. Install bolts. Torque bolts 10 to 12 lb. in. and lock-wire.

(10) Lubricate actuator and actuator attach torque tube couplings (Ref. 12-23-01).

(11) Turn on electrical power (Ref. 24-41-00).

(12) Reset asymmetry comparator and brakes as follows:

(a) On pilots overhead circuit breaker panel CB1, zone 210, open circuit breaker NO. 2 ASYM BK LE SLAT.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open circuit breaker NO. 1 ASYM BRAKE LE SLAT.

(b) After a minimum of 5 seconds close circuit breakers opened in Step (a) above.

CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(c) Reset both slat asymmetry brake pop-out indicators by applying wrench torque to reset devices hex head.

(13) Remove tags from hydraulic control panels.

(14) Turn on hydraulic system A and C (Ref. 29-11-00).

(15) Position flap handle to zero degrees to fully retract slats.

(16) With slats fully retracted, check the following (Ref. Fig. 401):

(a) Actuator dimension C must be 4.0 (±0.20) inches.

(b) Slat mismatch at the leading edge should not exceed 0.15 inch.

(c) A clearance exists between at least one retract stop and the stop bolt. If not, adjust stop bolt to provide some clearance.

(d) If any requirement of (a) and (b) is out of tolerance, adjust actuator length within dimension C tolerance of 4.0 (±0.20) inches as follows:

• Disconnect torque tube coupling on both sides of actuator.

• Rotate actuator input or output spline to change actuator retract length.

• Reconnect torque tube couplings and recheck [Ref. Steps (a) through (c)].

(17) Fully extend slats. Verify that clearance between slat extend stop and stop bolt on both tracks is a minimum of 0.030 inch.

NOTE: Extend stop clearance is satisfactory if the total of both extend stop clearances on any one slat is a minimum of 0.060 inch. One stop screw can be contacting the stop.

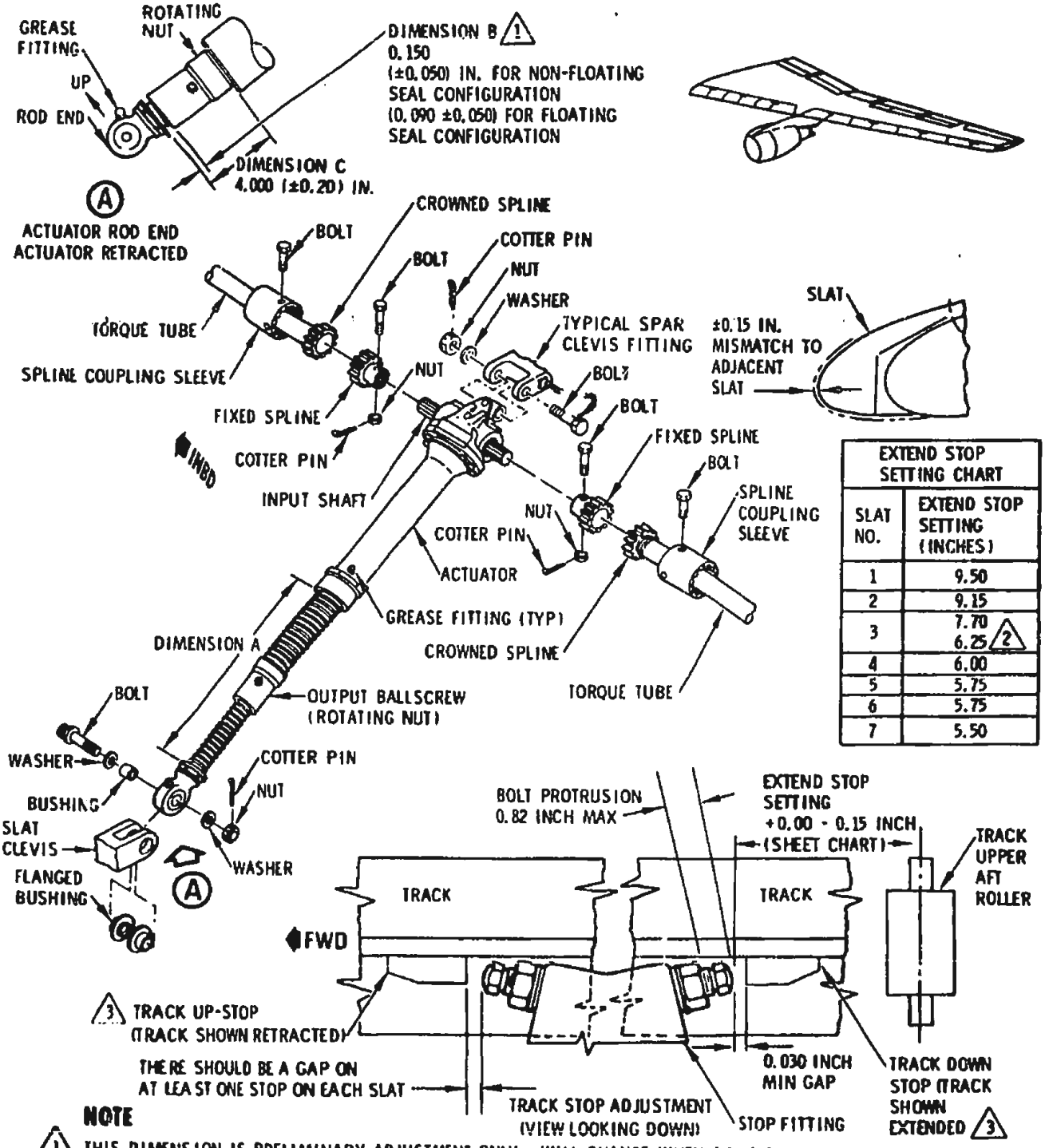
(18) Close access doors.

(19) Operate flap handle from 0° to 4° several times to cycle slats. Verify normal slat operation.

(20) Retract slats.

(21) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(22) Turn off electrical power if no longer required (Ref. 24-41-00).



EXTEND STOP SETTING CHART	
SLAT NO.	EXTEND STOP SETTING (INCHES)
1	9.50
2	9.15
3	7.70 6.25 (2)
4	6.00
5	5.75
6	5.75
7	5.50

NOTE

(1) THIS DIMENSION IS PRELIMINARY ADJUSTMENT ONLY. WILL CHANGE WHEN 4.0 ±0.20 DIMENSION ACCOMPLISHED
(2) THIS SETTING FOR OUTBOARD TRACK OF NO. 3 SLAT ONLY
(3) INBOARD TRACK STOP SHOWN, OUTBOARD TRACK STOP CONSISTS OF INTEGRAL WEB ON SLAT TRACK

M1-0000-27-1090

CR CR

Ballscrew Actuator - Removal and Installation
Figure 401

SLAT BALLSCREW ACTUATOR - INSPECTION AND CHECK

1. General

The ballscrew actuator backlash check is accomplished to determine if the ballscrew actuator has worn to the point of requiring overhaul.

2. Equipment and Materials

Kidde Inspection tool, PN 898489 (G/ITEL 27-81-94) (dial indicator for measuring backlash), or equivalent.

3. Referenced Procedure

27-11-00 Hydraulic Power Systems - Maintenance Practices

27-81-21 Slat Ballscrew Actuator - Removal and Installation

4. Inspection/Check

A. L.E. Slat Actuator Radial Backlash Check Procedure (Ref. Fig. 601)

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Pressurize hydraulic systems "A" and/or "C" and extend the L.E. slats to full down. Depressurize the hydraulic systems and tag.

CR (2) Position inspection tool on small diameter screwshaft so that tool pins have 0.030 to 0.050 clearance with adjacent face of ballnut and dial indicator probe is on top-center or bottom center of ballnut. Secure tool in place using tool wing nut.

C (3) Check that slat has freedom to move up and down at one
C end. Two people are to lift up on the slat while
C performing the lash check.

C (4) Shake jack screw up and down several times.

C (5) Grip inspection tool at clamping jaws and manually push
C and pull (cycle) ballscrew in vertical (up and down)
C direction, using 50 to 70 pounds force. Zero dial indicator with ballscrew in full up position and record total displacement with ball jackscrew in full down position.

C (6) Repeat Steps (3) thru (5) a minimum of three times.
C The largest reading recorded is the freeplay of the
C screw. Disregard all the lower readings.

C (7) Remove inspection tool.

NOTE: Numerous reversals (cycles) are required to obtain repetitive maximum displacement readings.

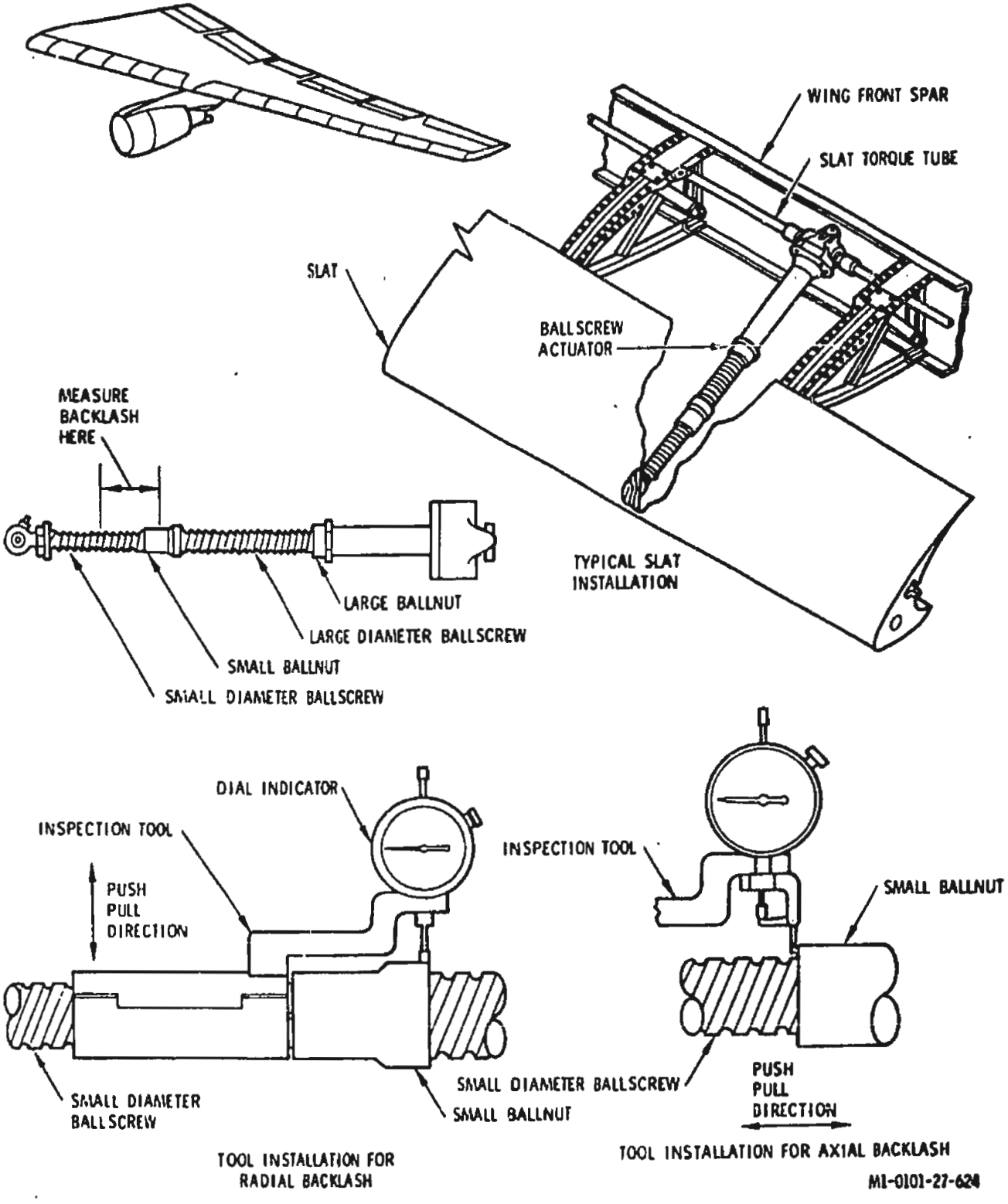
CR (8) Inboard ballscrews - if radial lash exceeds 0.034
C inches, replace screw assembly.

CR (9) Outboard ballscrews - if radial lash exceeds 0.044
C inches replace screw assembly.

C (10) Turn on hydraulic system C (Ref. 29-11-00).

C (11) Remove tag and position flap handle to the 0-degree
C detent to retract the flaps and slats.

C (12) Shut off hydraulic power if no longer required
C (29-11-00).



Slat Ballscrew Actuator Backlash Check
Figure 601

INBOARD SLATS - REMOVAL AND INSTALLATION

R 1. General

R There are two basic configurations of inboard L.E. slats. The
R two types of slats are interchangeable. Some modifications to
R the fixed leading edge may be required for slat intermix.
R Specified interslat seals and seal protectors must be used when
R a mixed slat configuration is installed on one or both wings.

R A. On aircraft 001-031 without SB57-112,
R the early configuration inboard slats (part no. 1526334,
R 1526335, and/or 1526336), may be replaced with the later
R light weight slats (part no. 1611901, 1611902, and/or
R 1611903) with the following changes:

R (1) Remove the snubbers from the lightweight slat.

R (2) For no. 2 and 3 slats only, replace the existing inner
R slat seal deflector on the inboard side with part no.
R 1616160-103/-104 or 1616161-103/-104 deflector.

R (3) For no. 1 and 2 slats only, install 1616160-105/106 or
R 1616161-105/-106 plate on the outboard side.

R (4) To prevent possible scuffing it is recommended that rub
R strips be added to the fixed leading edge panel lower
R surface in the area where the increased length slat
R fairing has metal to metal contact with the panel (Ref.
R SB57-112).

R B. On aircraft 001-031 with SB57-112 and 032-999,
R the later lightweight inboard slats (part no. 1611901,
R 1611902, and/or 1611903) may be replaced with the early
R configuration slats (part no. 1526334, 1526335, and/or
R 1526336) with the following changes:

R (1) For no. 2 and 3 slats only, replace the existing inner
R slat seal deflector on the inboard side with part no.
R 1592982-103/-104 or 1592983-103/-104 deflector.

R (2) It is permissible for the rubber trailing edges of the
R early slats to contact areas of the fixed leading edge
R unprotected by rub strips on a temporary basis; however
R panel damage may occur if left is unprotected for an
R extended time.

R NOTE: When accomplishing either A or B above, the
R inner slat seal at the interface between the
R lightweight and early configuration slats will

be slightly distorted, also an approximate 0.5 inch difference in length of upper trailing edge will exist.

Both of these conditions are acceptable.

2. Equipment and Materials

Sling, General Purpose, PN B715, or equivalent

Overhead Hoist or Crane

C C Tool Kit Nbr. 27-80-00-0044 for di ing individual slats or sets of slats without hydraulic power. ull-Strips, stainless steel, .016-inch thick, 6.0 inches wide by approximately 12 inches long (3 each). (Used to check slat upper trailing edge to wing leading edge contact.)

Slat Downstop Gage, G/ITEL 27-81-93, or equivalent

Lock-wire 0.040-inch diameter, Fed Spec QQ-W-390, COND A, or equivalent

R Sealant, LCM40.218 (PR7301K) or equivalent

R Solvent, 1,1,1 Trichloroethane

3. Referenced Procedures

12-23-20	Flap, Vane, and Spoiler Lubrication
27-81-00	Leading Edge Slat Control System - Adjustment and Test
27-81-09	Slat PDU Command Signal Regulator - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

4. Removal/Installation

A. Removal

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(2) Operate slats to the fully extended position.

R (3) Remove inter-slat seals (Ref. Fig. 401).

(4) Measure and record the slat-to-track dimension at both tracks on slat to be removed (Ref. Fig. 402). (This dimension will be used to adjust slat-to-track link eccentrics on replacement slats and will simplify rigging slat to contour.)

(5) Disconnect actuator from slat clevis fitting (Ref. Fig. 401).

CAUTION: DURING THE FOLLOWING OPERATION, THE ACTUATOR ROD END MUST BE HELD SO IT DOES NOT ROTATE OUT OF ADJUSTMENT, AND THE ACTUATOR MUST BE GUIDED TO PREVENT DAMAGE TO STRUCTURE.

(6) Carefully operate slats to retract disconnected actuator until it clears slat clevis by several inches. After retraction, secure actuator rod end to structure to prevent disturbing actuator adjustment.

NOTE: Normal operation of slat is either full retract or full extend. To modulate slats between full retract or full extend, shut off hydraulic power when slats reach the desired position or use the LOCK switchlight on the SLAT MONITOR panel.

(7) Turn off hydraulic power. Install warning tags on Flight Engineers/Second Officers HYDRAULIC SYSTEM panel, zone 215, and on the HYDRAULIC SERVICE PANEL, zone 147.

(8) Install sling lifting adapters on slat at the three 1/4-inch screw attach points.

NOTE: The three sling attach points incorporate 1/4-inch flush screws installed in nutplates. There are two attach points at the forward end of slat, one at each track rib, and one near the trailing edge at the actuator rib.

(9) Attach sling to hoist and operate hoist to take up slack.

NOTE: Slat weighs approximately 140 pounds.

(10) Disconnect the slat-to-track links at the slat end only.

(11) Remove the bolt which attaches the slat to the track.

(12) Maneuver slat away from aircraft and lower to suitable support.

(13) Disconnect sling from sling adapters. Remove adapters from slat and install three flush screws in slat.

B. Installation

Installation of a slat panel includes adjustment of the slat panel to meet contour requirements. This involves the following (Ref. Fig. 402):

- Adjustment of the main rollers and track-to-slat link eccentrics to meet slat upper and lower trailing edge to fixed leading edge contour requirements. [Main rollers and the slat-to-track eccentrics must be adjusted equally to provide parallel track operation; if not, slat skewing (one end of slat moving ahead of other end) can result.]

- Adjustment of the ballscrew actuator length [within slat-retract rig tolerance of 4.0 (±0.20) inches] to

meet slat-to-slat and slat-to-fixed leading edge contour requirements. (If slat-to-slat or slat-to-fixed leading edge contour cannot be brought into tolerance by adjusting ballscrew actuator length, then slat skewing can be cause of problem.)

Normally, when replacing a slat panel, the aft main rollers will not require adjustment other than regapping. The forward main rollers control the mismatch at the lower trailing edge (and slightly affects mismatch at the upper trailing edge). The slat-to-track link eccentrics control the mismatch at the upper trailing edge (and slightly affect mismatch at the lower trailing edge). Consequently, adjusting a slat to contour requires the trial and error adjustment of actuator length, forward main roller, and track-to-slat eccentrics.

A temporary shim is installed on the underside of the slat trailing edge main structure during the rigging procedure. The shim ensures that the slat panel main structure does not contact the fixed leading edge structure. Slat panel contact of the fixed leading edge is permitted only at the slat lower and upper trailing edge seals.

(1) Prepare replacement slat for installation as follows:

(a) Verify that proper bushings are installed at the track and actuator attach fittings.

NOTE: If new bushings are not available, the bushings from the removed slat may be used.

(b) Install temporary rigging shim to underside of slat along aft edge of lower surface (Ref. Fig. 403).

(c) Install sling lifting adapters on slat at the three 1/4-inch bolt locations.

(2) Prepare fixed leading edge for slat installation as follows:

(a) On aircraft 032-999, position inboard slat snubber rollers out of the way at both rib positions as follows (Ref. Fig. 404):

Remove lock plate bolt and lock plate. Loosen the bellcrank retaining bolt; rotate eccentric to position roller in the full up position. Tighten bellcrank retaining bolt sufficiently to retain bellcrank in this position.

(b) Adjust the slat retract stop bolts all the way in to provide maximum stop clearance and lock-wire stop bolt.

(c) Check slat extend stop adjustment. Verify the dimension from the center of the upper aft ground roller shaft to the face of the extend stop bolt (Ref. Fig. 402, Sheet 2). (Use slat downstop gage to check adjustment.)Adjust extend stop as required. Lock-wire stop bolt.

NOTE: Disregard FWD indicating arrow on track stop fitting. Fitting may be reversed if necessary to achieve rigging dimensions.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(d) Remove tags from hydraulic control panels. Turn on hydraulic systems A and C (Ref. 29-11-00).

CAUTION: DURING THE FOLLOWING OPERATION, THE ACTUATOR ROD END MUST BE HELD SO IT DOES NOT ROTATE OUT OF ADJUSTMENT, AND THE ACTUATOR MUST BE GUIDED TO PREVENT DAMAGE TO STRUCTURE.

(e) Carefully operate slats to full up to retract disconnected actuator completely. After retraction, secure actuator rod end to structure to prevent disturbing actuator adjustment.

(3) If actuator rod-end adjustment is lost or is suspect, accomplish following to adjust actuator rod-end to the slat retract rig dimension:

NOTE: The fully retracted rig position of slats is provided when slat PDU is shut down by electrical actuation of PDU shutoff valves. This can be checked as follows:

Open No. 1 and No. 2 asymmetry brake circuit breakers CB1-J10 and CB2-H22. When circuit breakers are opened, the slat torque tubes must rotate approximately 1.5 revolutions in the retract direction before hydraulic shutdown by the PDU control valve. (If slat torque tubes do not rotate approximately 1.5 revolutions, check PDU electrical shutdown rigging in accordance with installation procedures of 27-81-09, slat PDU Command Signal Regulator.)After checking for slat retract rig position, close circuit breakers CB1-J10 and CB2-H22, and position flap handle to 4-degree detent. When slats partially extend, position flap handle to 0-degree detent and allow slats to retract to rig position.

(a) With slat control system in the fully retracted rig position, turn off hydraulic power.

NOTE: When torque shaft is disconnected on outboard side of slat actuator gearbox, slat seal compression can cause disconnected slats to extend slightly. To ensure correct rigging, on first slat outboard of disconnected actuator, measure and record gap between inboard track and retract stop bolt.

(b) Disconnect torque shafts on both sides of slat actuator gearbox. When disconnecting torque shaft on outboard side of gearbox, note amount and direction torque shaft rotates.

(c) Turn gearbox spline shaft until the output ballscrew (rotating nut) contacts the internal retract stop.

R (d) On aircraft with 672425-103 actuators, with rotating nut held against the internal retract stop, rotate rod-end only to obtain the 0.150 (±0.050) inch dimension with grease fitting on top (Ref. Fig. 402). (The 0.150 inch dimension is an initial adjustment only and will change when the actuator retract dimension (next step) is accomplished.)

NOTE: If the 0.150 (±0.050) inch dimension cannot be obtained with the lube fitting on top, loosen the actuator rod end nut and reposition the rod end. Verify that locking washer tab is properly engaged in ballscrew slot. Retorque rod end nut 80 to

100 lb ft and lock-wire nut to tab locking washer.

R (d) On aircraft with any actuator except 672425-103, with rotating nut held against the internal retract stop, rotate rod-end only to obtain the 0.090 (±0.050) inch dimension with grease fitting on top (Ref. Fig. 402). (The 0.090 inch dimension is an initial adjustment only and will change when the actuator retract dimension (next step) is accomplished.)

NOTE: If the 0.090 (±0.050) inch dimension cannot be obtained with the lube fitting on top, loosen the actuator rod end nut and reposition the rod end. Verify that locking washer tab is properly engaged in ballscrew slot. Retorque rod end not 80 to 100 lb ft and lockwire nut to tab washer.

(e) Hold the rod-end with grease fitting on top and turn the gearbox spline shaft to obtain the 4.0 (±0.20) inch actuator retract rig dimension (Ref. Fig. 402).

(f) Connect inboard torque shafts to actuator gearbox.

(g) Verify that slats outboard of disconnected actuator is still in the retract rig position as follows:

Manually rotate slat torque tube to position slat to dimension recorded in Step 4B(3)(a) NOTE. While maintaining slats in the retract rig position, connect torque tube to outboard side of actuator.

(4) Attach sling to hoist and lift slat clear of support. To facilitate installation, position slat in sling to approximate attitude of extended slat.

(5) Hoist slat into position for installation and install the slat-to-track attach bolts (Ref. Fig. 401).

(6) Install the slat-to-track links and check the slat-to-track dimension at both tracks (Ref. Fig. 402, Sheet 2). If necessary, adjust the link eccentrics to obtain the dimension recorded for the previously installed slat [Ref. Step 4A(4)].

NOTE: The slat-to-track dimension is a preliminary adjustment only so that the replacement slat is

installed in approximately the same position as the removed slat.

(7) A change in shimming of the side rollers is normally not required when replacing a slat. If a check of the side rollers is desired, proceed as follows (Ref. Fig. 402, Sheet 1):

(a) Manually push the slat in to align the leading edge with adjacent slats or fixed leading edge. Take up hoist slack to prevent slat from falling to the extended position.

(b) Push slat in outboard direction until slat tracks contact outboard side rollers.

(c) With slats retracted, verify that both tracks are contacting both outboard rollers. If not, remove outboard roller assembly and add or remove shims as required (Ref. Fig. 402, Sheet 1).

NOTE: Due to possible track twist, contact on only the upper or lower side of track is acceptable. Do not taper the side roller shims.

If track contacts only one side roller assembly, remove or add shims to side roller assembly that will cause track to be centered between and parallel to the support ribs.

(d) With both tracks contacting both outboard rollers, verify 0.030 to 0.050 inch gap between inboard side rollers and the same part of track (upper or lower) that is in contact with the outboard side rollers. If not, remove affected inboard side roller assembly and add or remove shims as required.

(e) If side rollers were adjusted, check for smooth operation of side rollers by manually positioning slat panel through several full extend to full retract cycles. Provide hoist slack to allow manual positioning of slat. After checking operation of side rollers, manually position slat full up to align the leading edge with adjacent slats or fixed leading edge. Take up on hoist slack.

(8) With slats in retracted position, use the eccentrics at the slat-to-track links to adjust slat to meet the

contour requirements of the slat upper and lower trailing edge (Ref. Fig. 403).

NOTE: Mismatch between the slat lower trailing edge and wing leading edge can be affected by contour irregularities in the slat. To properly check mismatch, use the flat (wide) surface of a flexible steel 24 to 36 inch scale (a piece of 0.015 to 0.020 inch thick spring steel, 0.050 inch wide, can also be used). Lay flat side of steel scale across slat-to-wing gap and measure mismatch.

(a) If the slat is skewed (not parallel to fixed leading edge), adjust eccentrics separately.

NOTE: If interference exists, or if the slat cannot be adjusted to contour with the eccentrics, the main rollers will require adjustment. Connect the actuator to the slat [Ref. Steps 4B(9) through 4B(12)], then readjust the main rollers as outlined in Step 4B(15).

(9) Carefully slacken hoist and allow slat to fully extend. Remove sling from slat and plug the sling attach holes using the screws provided.

(10) With slat against extend stops, check to verify that the end of each track extends aft of upper and lower aft rollers centerline a minimum of 0.12 inch. If not, recheck extend stop setting per Step 4B(2)(c).

CAUTION: DURING THE FOLLOWING OPERATION, THE ACTUATOR ROD END MUST BE HELD SO IT DOES NOT ROTATE OUT OF ADJUSTMENT, AND THE ACTUATOR MUST BE GUIDED TO PREVENT DAMAGE TO STRUCTURE.

WARNING: DO NOT ATTEMPT TO FULLY EXTEND THE ACTUATOR AS A JAM MAY OCCUR, CAUSING DAMAGE TO STRUCTURE. ALSO, PERSONAL INJURY CAN RESULT IF FINGERS ARE CAUGHT BETWEEN ROD END AND CLEVIS FITTING.

(11) Carefully operate the slat system to extend actuator rod end to within several inches of the clevis fitting on the slat.

(12) Manually push the slat in to mate the actuator rod end with the slat clevis fitting. (The rod end must be carefully guided into the clevis fitting.)Install bolt,
R washers, and nut with threadsoutboard. Tighten nut and install cotter pin.

(13) If a new (never installed) No. 1 slat is installed, accomplish following:

NOTE: Some early No. 1 slat panels required some minor trimming on initial installation at factory. This has since been corrected, however, there may be some spare No. 1 slat panels that may need some trimming when first installed.

(a) Remove seal from inboard edge of slat.

(b) Fully retract slat.

(c) At the lower inboard trailing edge section of the slat, verify that the gap between the slat inboard edge and the face of the fixed leading edge rib is a minimum of 0.75 inch. If not, trim edge of slat. (Be careful to maintain minimum rivet edge distance.)

NOTE: The minimum gap of 0.75 inch is required between the entire inboard edge of slat and fixed leading edge. However, on a new slat, only the lower trailing edge section may require trimming.

(d) Reinstall seal.

(14) Recheck slat contour as follows (Ref. Fig. 403):

(a) Fully retract slats; check for interference and conformance to contour. (Check contour at slat upper and lower trailing edges, and at leading edge between adjacent slats or fixed wing structure).

(b) With slats fully retracted, verify the 4.0 (±0.20) inch actuator-retracted dimension.

NOTE: Actuator length can be adjusted within above tolerance to meet slat-to-slat and slat-to-fixed leading edge contour requirements as follows:

On first slat outboard of actuator to be disconnected, measure and record retract stop gap on inboard track, then disconnect torque tubes on both sides of actuator. Rotate actuator gearbox spline shaft to change actuator length, then reconnect torque tubes, making sure to rotate torque tube to position first slat outboard of

disconnected actuator to dimension recorded above.

(15) If slat contour cannot be achieved using the slat-to-track link eccentrics, readjust the main rollers as follows (Ref. Fig. 402, Sheet 1):

(a) Remove eccentric locks, washers, and nuts from both sides of the upper and lower forward rollers.

NOTE: Normally it will not be necessary to adjust the aft rollers except for eliminating slat racking (non-parallel slat operation).

(b) Adjust the upper forward flight rollers fully up to provide maximum adjustment clearance.

(c) With the slats retracted, adjust the lower forward ground rollers to minimize mismatch between the slat lower trailing edge and the fixed leading edge.

NOTE: Inboard and outboard track rollers must be adjusted equal amounts to maintain parallel track operation.

(d) Adjust the slat-to-track link eccentrics, if necessary, to achieve slat contour (Ref. Fig. 403).

NOTE: It may be necessary to install the roller eccentric lockplates to maintain adjustment.

(e) Repeat Steps 4B(15)(c) and 4B(15)(d) as required to meet slat contour requirements.

(f) Verify that both inboard and outboard tracks are in contact with lower forward and upper aft ground rollers. Adjust ground rollers as necessary.

(g) Install the eccentric locks, washers, and nuts at both the lower forward and upper aft ground rollers.

NOTE: Steps 4B(15)(h) thru 4B(15)(j) can be performed with slats in any position for ease of access.

(h) Adjust the upper forward and lower aft flight rollers to provide a gap of 0.020 (±0.010) inch

between upper forward flight roller and track and between the lower aft flight roller and track.

(i) Install the eccentric locks, washers, and nuts at both the upper forward and lower aft flight rollers.

(j) Torque roller nuts as follows, and lock-wire: Upper forward and lower aft flight rollers - 475 to 525 lb in.; Lower forward and upper aft ground rollers - 200 to 250 lb in.

WARNING: IF ANY AFT FLIGHT OR GROUND ROLLER IS ADJUSTED, CHECK FOR CORRECT TRACK EXTENSION AFT OF ROLLERS IN ACCORDANCE WITH STEP 4B(10).

(16) Extend slats and remove temporary rigging shim.

(17) Position a pull-strip at each track rib and at the actuator rib so that the pull-strips will be between the slat upper trailing edge and the wing leading edge. (Verify that the temporary rigging shim is removed.)

(18) Fully retract slats.

R (19) With slats fully retracted, pull load to remove the
R pull-strips should be 10 to 60 pounds. If pull-load is
R not 10 to 60 pounds, adjust the slat-to-track link eccentrics to meet the pull load.

R (20) Verify that there are no gaps between the aluminum slat upper trailing edge and the wing leading edge. If there is, bend the trailing edge as required to remove any gaps.

NOTE: If upper trailing edge is plastic or the .012-inch steel angle, do not bend.

R (21) On aircraft 001-031 without SB57-112,
R verify that the slat lower trailing edge seal seats
R against the fixed leading edge along the entire length
R of slat.

R (21) On aircraft 001-031 with SB57-112 and 032-999,
R bend slat lower trailing edge to match wing structure.

R (22) On aircraft 001-031 without SB57-112,
R verify that the tabouts at the track and actuator
R locations clear the fixed leading edge by 0.08 (±0.02)
R inch (Ref. Fig. 403). Trim if necessary.

(22) On aircraft 001-031 with SB57-112 and 032-999, verify that the tabouts cover the track and actuator cutouts without gaps. Do not trim tabouts.

(23) With slats fully retracted, verify that a gap exists on at least one retract stop on each slat.

NOTE: Disregard FWD indicating arrow on track stop fitting. Fitting may be reversed if necessary to achieve rigging dimensions.

(24) Check for minimum clearance between each slat track and any portion of the adjustable stop fitting (stop body, bolt head, or tab washer) as follows:

(a) With track held against the outboard rollers, verify minimum 0.020 inch clearance between slat track and stop fitting.

(b) If clearance is less than minimum, add laminated shim between stop fitting and rib.

(25) Extend slats. Verify that the actuator extend dimension is 25.84 (±0.33) inches (Ref. Fig. 402).

(26) Check that the clearance between the track extend stop and track stop bolt is a minimum of 0.030 inch.

NOTE: Stop clearance is satisfactory if the total of both extend stop clearances on any one slat is a minimum of 0.060 inch. One stop screw can be contacting the stop.

Disregard FWD indicating arrow on track stop fitting. Fitting may be reversed if necessary to achieve rigging dimension.

(27) Install inter-slat seals.

NOTE: A new interslat seal assembly is available as a preferred spare. The new seal assembly includes a metal deflector to alleviate wind erosion wear of the seal. Install the new seal assembly if available.

NOTE: If new slat and existing interslat seal screw holes do not align, using new slat as a guide, redrill slat seal as required.

Slats incorporating spanwise bulb seal (Ref. SB57-112), shall have openings between interslat and spanwise seal, sealed with PR7301K sealant.

(28) On aircraft 032-999, adjust inboard slat snubber roller on both track ribs as follows (Fig. 404):

(a) Fully retract slats.

(b) Remove lockplate retaining bolt and the lockplate.

(c) Loosen the eccentric bolt.

(d) Rotate eccentric bolt in forward direction until roller contacts snubber rib then rotate aft until roller contacts snubber rib. Eccentric bolt should turn approximately same number of degrees forward and aft to ensure proper installation and engagement of snubber components. Then rotate eccentric bolt forward again until roller contacts snubber rib. In this position, tighten eccentric bolt and install lock plate and lock plate bolt.

NOTE: If eccentric bolt cannot be rotated forward or aft, slat may be rigged too high. Recheck slat adjustment [Reference Step 4B(8)].

R CAUTION: DO NOT ADJUST SLAT TO TRACK LINK ECCENTRICS OR TRACK ROLLERS TO ACHIEVE SLAT SPANWISE SEAL COMPRESSION. ADD SHIMS UNDER SEAL TO INCREASE SEAL COMPRESSION.

R (29) On aircraft 001-031 with SB57-112 and 032-999, with slats fully retracted, verify slat spanwise seal is compressed at least 25 percent. If not, use following procedure to shim seal:

R (a) Extend flaps and remove spanwise slat seal.

R (b) Prepare shim, Part No. 1620366-101 by drilling holes to match spacing of seal screws.

R (c) Clean faying surfaces with 1,1,1 trichloroethane and wipe dry before solvent evaporates.

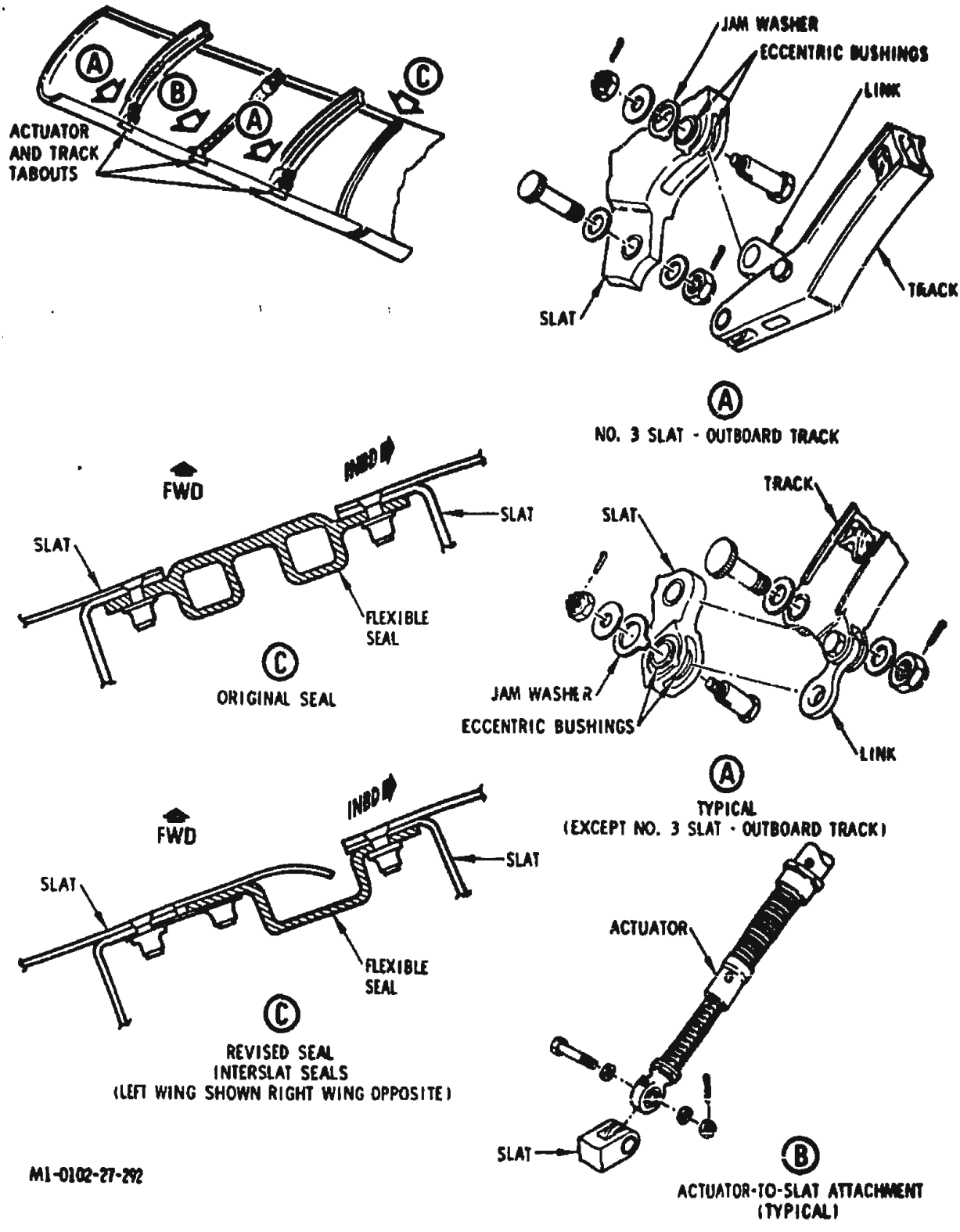
R (d) Wet install shim and slat seal using sealing compound LCM40-2180 or equivalent.

R (30) Lubricate actuator rod end bearing (Ref. 12-23-20).

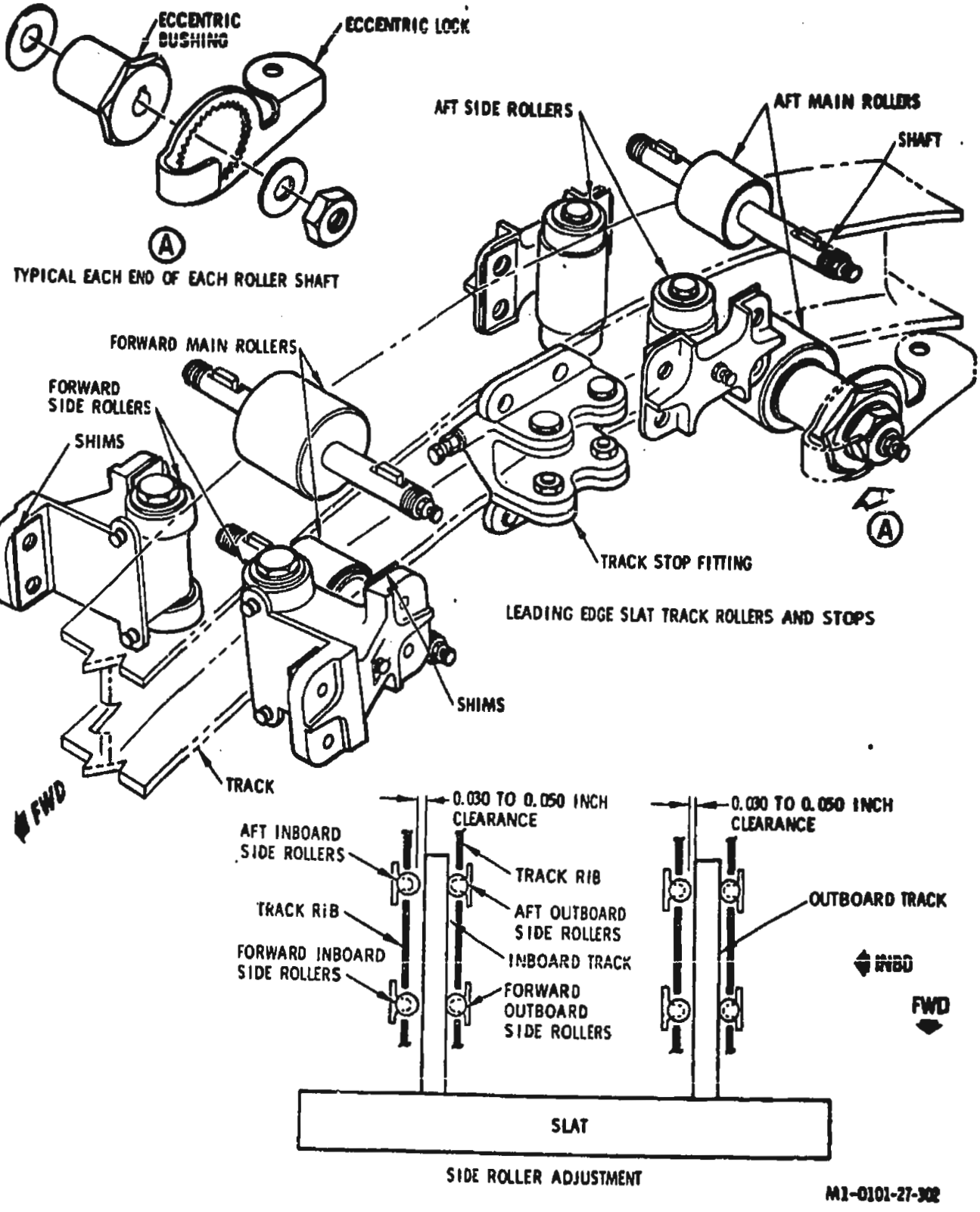
R (31) Verify that all attachments are torqued and saftied.

R (32) Cycle slats from full up to full down and back to full up for several cycles. Verify normal operation of slat

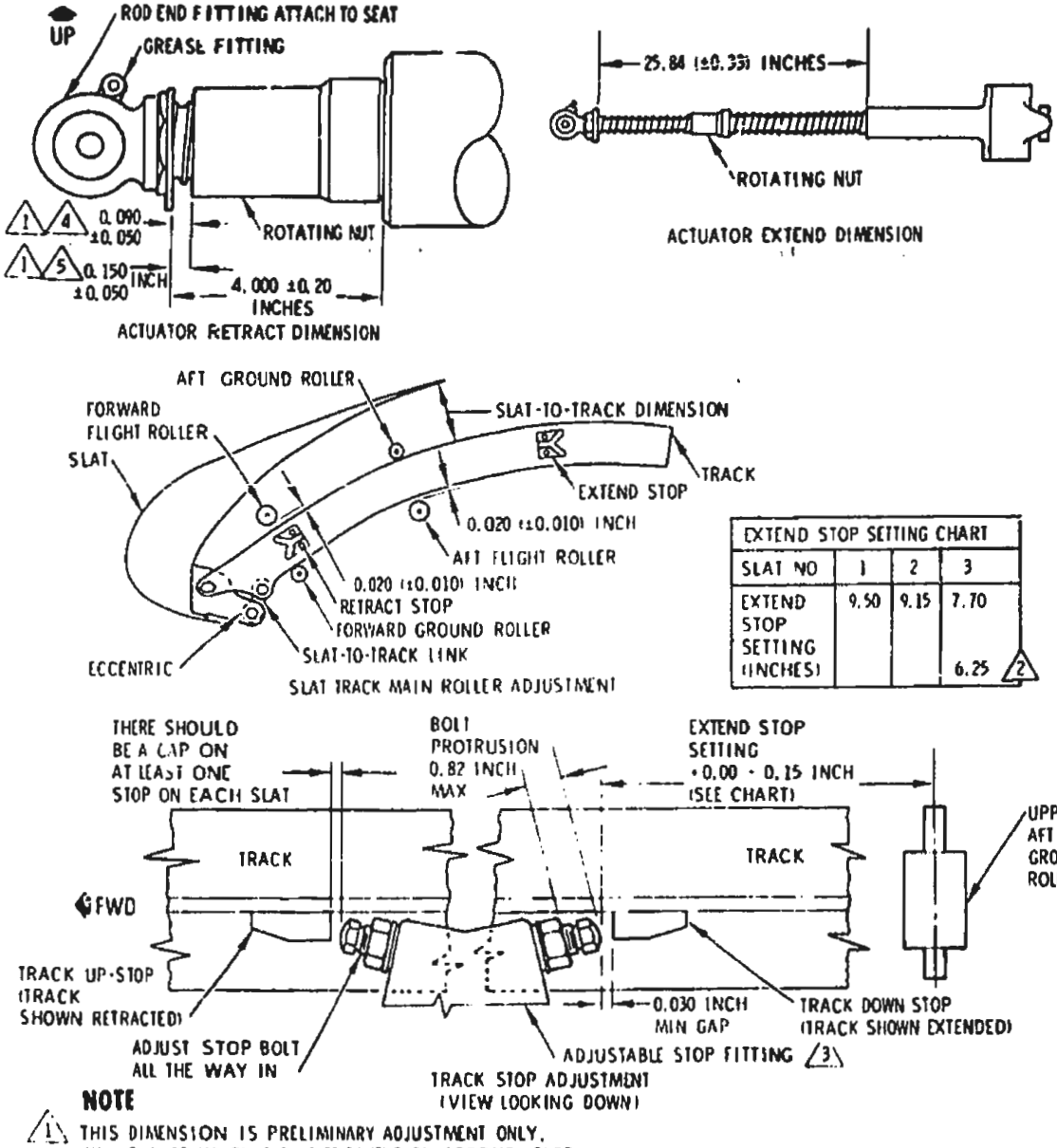
R system. (33) Turn off hydraulic power if no longer
R required (Ref. 29-11-00). (34) Close all access
panels.



Inboard Slat - Removal and Installation
Figure 401



Slat Rigging
Figure 402 (Sheet 1)



EXTEND STOP SETTING CHART			
SLAT NO	1	2	3
EXTEND STOP SETTING (INCHES)	9.50	9.15	7.70 6.25 2

NOTE

1. THIS DIMENSION IS PRELIMINARY ADJUSTMENT ONLY. WILL CHANGE WHEN 4.0 ±0.20 DIMENSION ACCOMPLISHED
2. THIS SETTING FOR OUTBOARD TRACK OF NO. 3 SLAT ONLY
3. DISREGARD FORWARD INDICATING ARROW ON TRACK STOP FITTING. FITTING MAY BE REVERSED IF NECESSARY TO ACHIEVE RIGGING DIMENSION
4. FOR ALL ACTUATORS EXCEPT 672425-103
5. FOR 672425-103 ACTUATORS

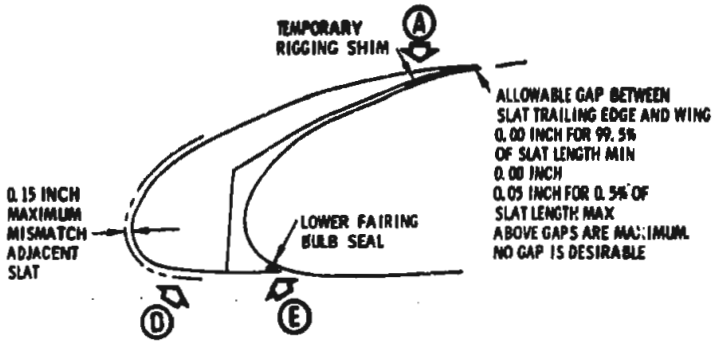
M1-0007 27-053

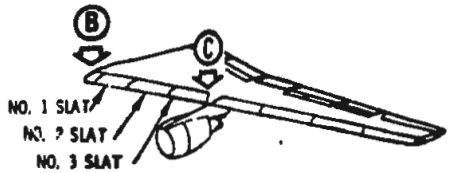
CR
CR

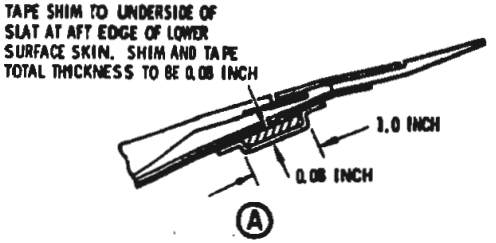
Slat Rigging
Figure 402 (Sheet 2)

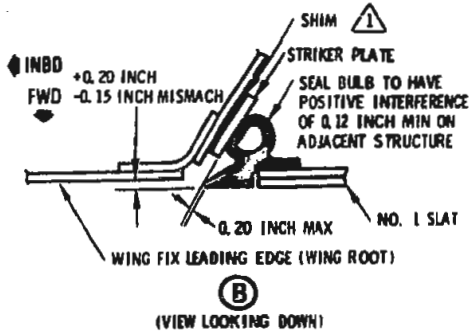
EFFECTIVITY: ALL

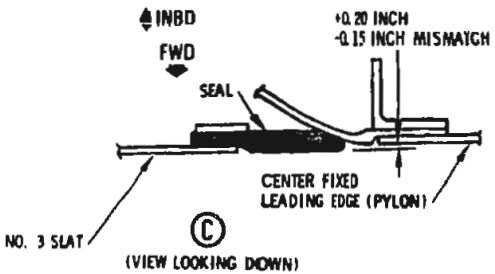
001B

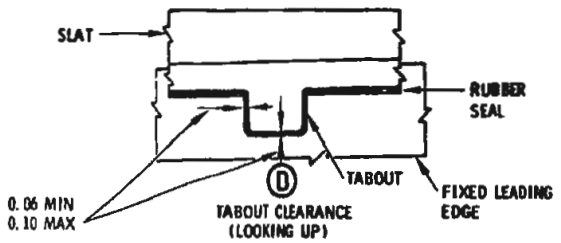

TEMPORARY RIGGING SHIM
A
ALLOWABLE GAP BETWEEN SLAT TRAILING EDGE AND WING
0.00 INCH FOR 99.5% OF SLAT LENGTH MIN
0.00 INCH
0.05 INCH FOR 0.5% OF SLAT LENGTH MAX
ABOVE GAPS ARE MAXIMUM. NO GAP IS DESIRABLE
0.15 INCH MAXIMUM MISMATCH ADJACENT SLAT
LOWER FAIRING BULB SEAL
D
E

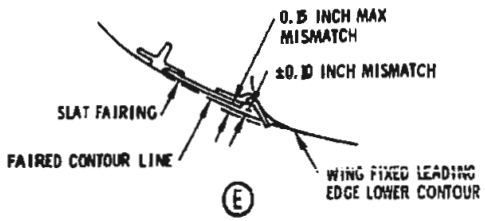



TAPE SHIM TO UNDERSIDE OF SLAT AT AFT EDGE OF LOWER SURFACE SKIN. SHIM AND TAPE TOTAL THICKNESS TO BE 0.08 INCH
1.0 INCH
0.08 INCH
A









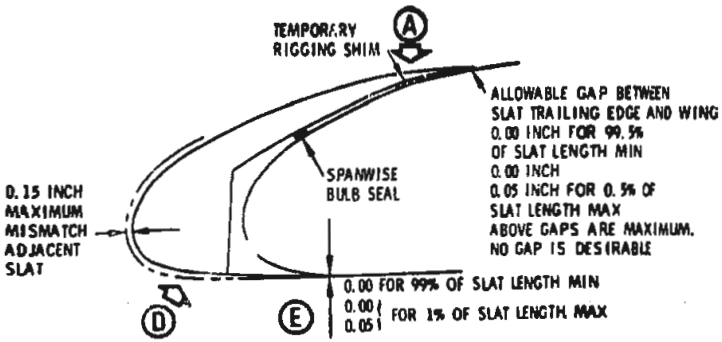
NOTE

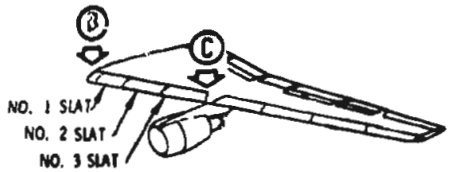
1 ON SOME AIRCRAFT, A "TAILORED" SHIM IS INSTALLED UNDER THE STRIKER PLATE TO INCREASE SEAL COMPRESSION ON INITIAL FACTORY INSTALLATION. THIS SHIM IS A PERMANENT PART OF WING FIXED LEADING EDGE AND MUST NOT BE REMOVED

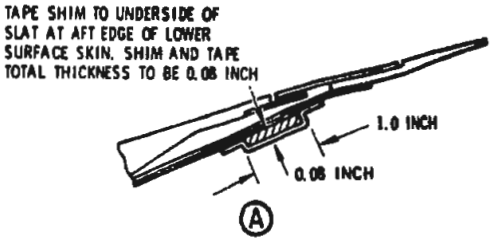
M1-0000-27-961

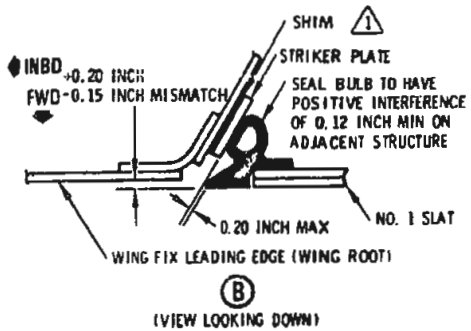
Slat Contour Requirments
Figure 403

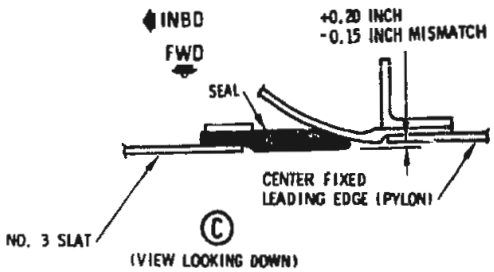
R EFFECTIVITY: 001-031 WITHOUT SB57-112
R
001B

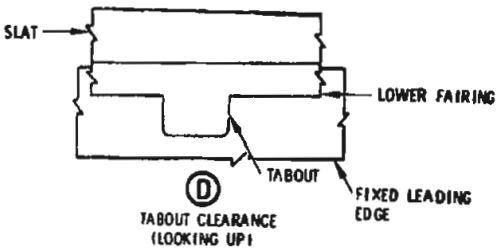

TEMPORARY RIGGING SHIM
A
ALLOWABLE GAP BETWEEN SLAT TRAILING EDGE AND WING
0.00 INCH FOR 99.5% OF SLAT LENGTH MIN
0.00 INCH
0.05 INCH FOR 0.5% OF SLAT LENGTH MAX
ABOVE GAPS ARE MAXIMUM. NO GAP IS DESIRABLE
SPANWISE BULB SEAL
0.15 INCH MAXIMUM MISMATCH ADJACENT SLAT
D
E
0.00 FOR 99% OF SLAT LENGTH MIN
0.00
0.05 FOR 1% OF SLAT LENGTH MAX

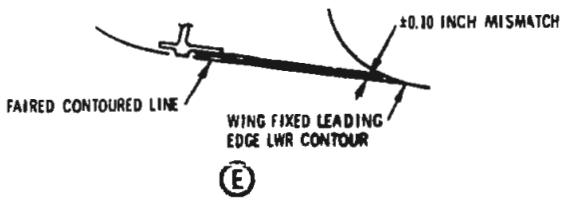



TAPE SHIM TO UNDERSIDE OF SLAT AT AFT EDGE OF LOWER SURFACE SKIN. SHIM AND TAPE TOTAL THICKNESS TO BE 0.08 INCH
1.0 INCH
0.08 INCH
A









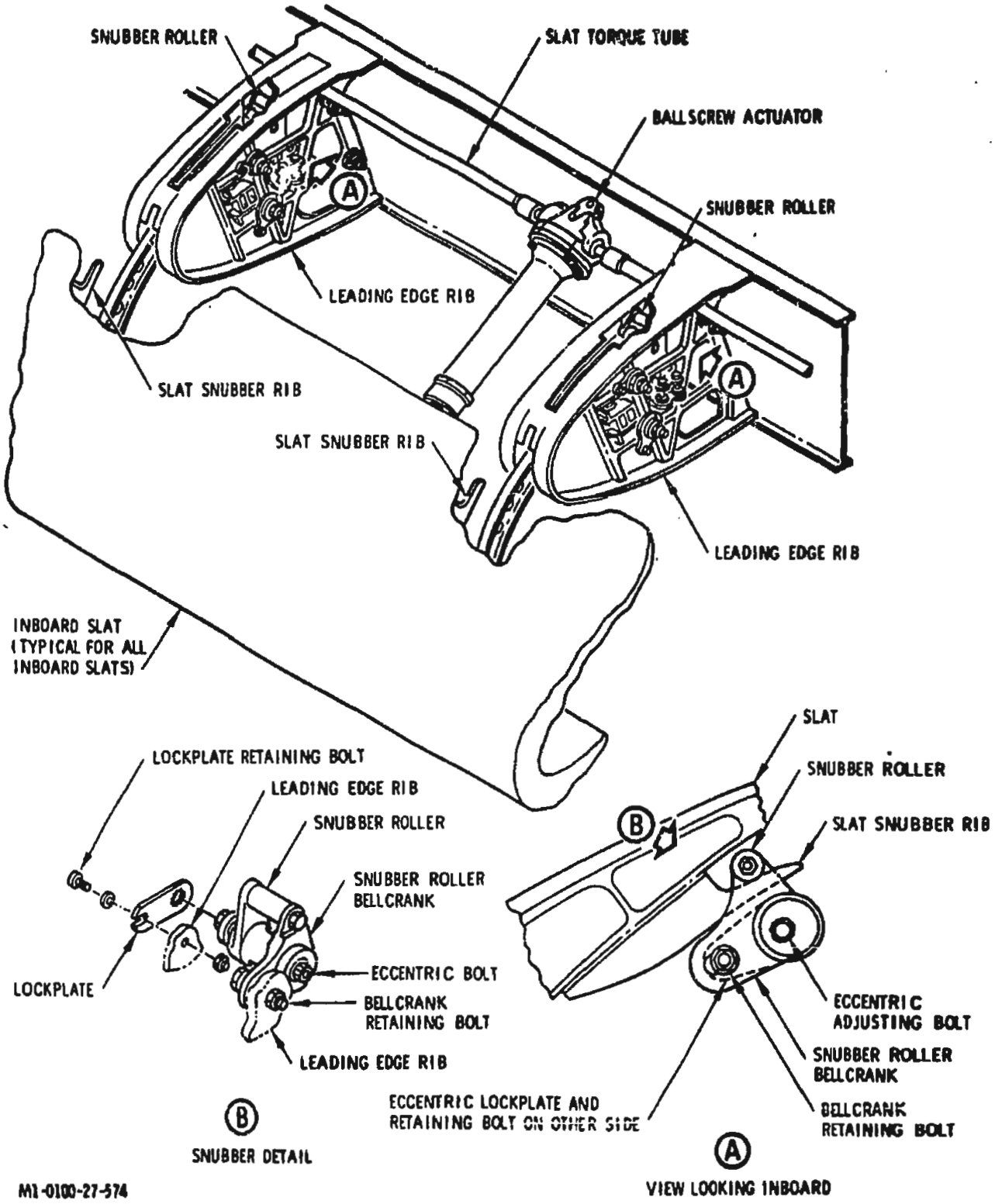
NOTE

1 ON SOME AIRCRAFT, A "TAILORED" SHIM IS INSTALLED UNDER THE STRIKER PLATE TO INCREASE SEAL COMPRESSION ON INITIAL FACTORY INSTALLATION. THIS SHIM IS A PERMANENT PART OF WING FIXED LEADING EDGE AND MUST NOT BE REMOVED

MI-0005-27-242

Slat Contour Requirements
Figure 403

R EFFECTIVITY: 001-031 WITH S857-112 AND 032-999
R
001B

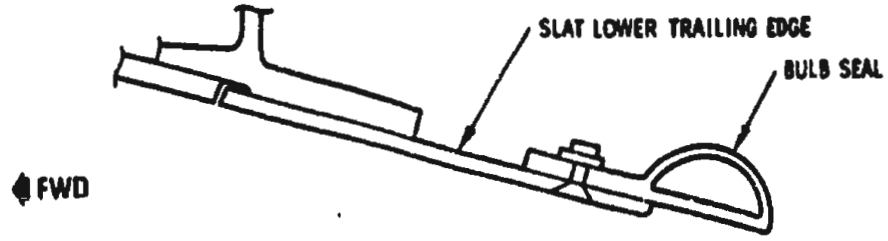


Slat Snubber Adjustment
Figure 404

INBOARD SLATS - INSPECTION AND CHECK

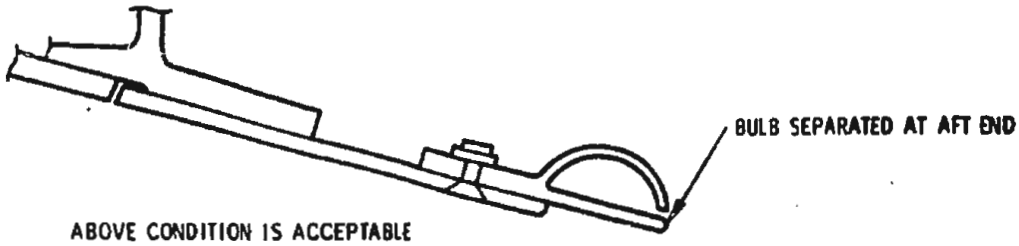
1. General

The slat lower trailing edge bulb seal can show considerable wear without seriously affecting the ability to seal the gap between the slat lower trailing edge and the wing leading edge. For wear limits on the bulb seal, see Figure 601.



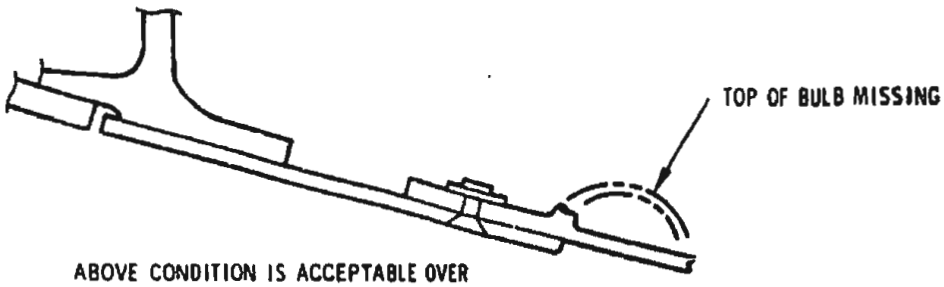
CONDITION A

NORMAL BULB SEAL



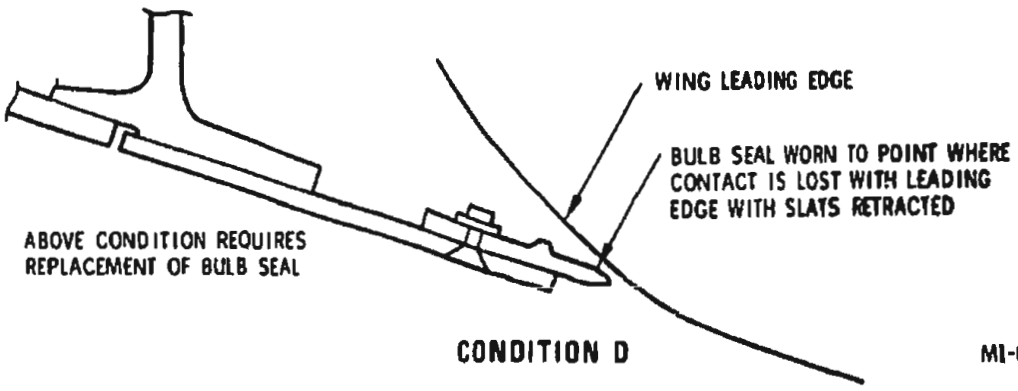
ABOVE CONDITION IS ACCEPTABLE OVER ENTIRE LENGTH OF ALL SLATS

CONDITION B



ABOVE CONDITION IS ACCEPTABLE OVER ENTIRE LENGTH OF ALL SLATS

CONDITION C


WING LEADING EDGE
BULB SEAL WORN TO POINT WHERE CONTACT IS LOST WITH LEADING EDGE WITH SLATS RETRACTED
ABOVE CONDITION REQUIRES REPLACEMENT OF BULB SEAL

CONDITION D

MI-0103-27-197

Slat Lower Trailing Edge Seal Wear Limits
Figure 601

OUTBOARD SLATS - REMOVAL AND INSTALLATION

1. Equipment and Materials

Sling, General Purpose, PN B715, or equivalent

Overhead Hoist or Crane

C
CR Tool Kit Nbr. 27-80-00-0044 for driving individual slats or sets of slats without hydraulic power.

Pull-Strips, stainless steel .016-inch thick, 6.0 inches wide and approximately 12 inches long (3 each). (Used to check slat upper trailing edge to wing leading edge contact.)

Slat Downstop Gage, G/ITEL 27-81-93, or equivalent

R Cotter Pin MS24465-302

Lock-wire 0.040-inch diameter, Fed Spec QQ-W-390, COND A, or equivalent

2. Referenced Procedures

12-23-20	Flap, Vane, and Spoiler Lubrication
27-81-00	Leading Edge Slat Control System - Adjustment and Test
27-81-09	Slat PDU Command Signal Regulator - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices
30-13-06	Wing Anti-ice Telescoping Duct - Removal and Installation
30-13-16	Duct Connector - Removal and Installation
30-13-30	Wing Anti-ice Self-Retracting Wire - Removal and Installation

3. Removal/Installation

R A. Removal

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(2) Operate slats to the fully extended position (Ref. 27-81-00).

(3) Remove inter-slat seals and slat-to-slat bumper fittings at both ends of slat (Ref. Fig. 402, Sheet 3).

(4) Measure and record the slat-to-track dimension at both tracks on slat to be removed (Ref. Fig. 402, Sheet 3). (This dimension will be used to adjust slat-to-track link eccentrics on replacement slat and will simplify rigging slat to contour.)

(5) Disconnect actuator from slat clevis fitting (Ref. Fig. 401).

CAUTION: DURING THE FOLLOWING OPERATION, THE ACTUATOR ROD END MUST BE HELD SO IT DOES NOT ROTATE OUT OF ADJUSTMENT, AND THE ACTUATOR MUST BE GUIDED TO PREVENT DAMAGE TO STRUCTURE.

(6) Carefully operate slats to retract disconnected
R actuator until it clears slat clevis by several inches.

R (7) After retraction, secure actuator rod end to structure to prevent disturbing actuator adjustment.

NOTE: Normal operation of slat is either full retract or full extend. To modulate slats between full
R up or full down, shut off hydraulic power when
R slats reach the desired position or use the LOCK
R switchlight on the SLAT MONITOR panel.

(8) Turn off hydraulic power and install warning tags on Flight Engineers/Second Officers HYDRAULIC SYSTEM panel, zone 215, and on the HYDRAULIC SERVICE PANEL, zone 147.

(9) Remove anti-icing duct connectors (Ref. 30-13-16).

(10) On No. 4 slat only:

(a) Disconnect wing anti-ice telescoping duct from slat (Ref. 30-13-06).

(b) Disconnect wing anti-ice self-retracting wire and telescoping conduit from slat (Ref. 30-13-30).

(11) Install sling lifting adapters on slat at the three 1/4-inch screw attach points.

NOTE: The three sling attach points incorporate 1/4-inch flush screws installed in nutplates. There are two attach points at the forward end of slat, one at each track rib, and one near trailing edge at the actuator rib.

Slat weighs approximately 140 pounds.

(12) Attach sling to hoist and operate hoist to take up slack.

(13) Disconnect the slat-to-track links at the slat end only (Ref. Fig. 401).

(14) Remove the bolt which attaches the slat to the track.

(15) Maneuver slat away from aircraft and lower to suitable support.

(16) Disconnect sling from sling adapters. Remove adapters from slat and install three flush screws in slat.

B. Installation

Installation of a slat panel includes adjustment of the slat panel to meet contour requirements. This involves the following (Ref. Fig. 402):

- Adjustment of the main rollers and track-to-slat link eccentrics to meet slat upper and lower trailing edge to fixed leading edge contour requirements. [(Main rollers and the slat-to-track eccentrics must be adjusted equally to provide parallel track operation: if not, slat skewing (one end of slat moving ahead of other) can result.]

- Adjustment of the ballscrew actuator length [within slat-retract rig tolerance of 4.0 (±0.20) inches] to meet slat-to-slat and slat-to-fixed leading edge contour requirements. (If slat-to-slat or slat-to-fixed leading edge contour cannot be brought into tolerance by adjusting ballscrew actuator length, then slat skewing can be cause of problem.)

Normally, when replacing a slat panel, the aft main rollers will not require adjustment other than regapping. The forward main rollers control the mismatch at the lower trailing edge (and slightly affect mismatch at the upper trailing edge). The slat-to-track link eccentrics control the mismatch at the upper trailing edge (and slightly affect mismatch at the lower trailing edge). Consequently, adjusting a slat to contour requires the trial and error adjustment of actuator length, forward main rollers, and track-to-slat eccentrics.

A temporary shim is installed on the underside of the slat trailing edge main structure during the rigging procedure. The shim ensures that the slat panel main structure does not contact the fixed leading edge structure. Slat panel contact of the fixed leading edge is permitted only at the slat lower and upper trailing edge seals.

(1) Prepare replacement slat for installation as follows:

R R (a) On aircraft 001-031 without SB57-112, remove lower surface tabouts at the actuator and the tracks (Ref. Fig. 401).

(b) Verify that proper bushings are installed at the track and actuator attach fittings. (If new bushings are not available, the bushings from the removed slat may be used.)

(c) Remove outboard bumper fitting.

(d) Install temporary rigging shim to underside of slat along aft edge of lower surface (Ref. Fig. 403).

(e) Install sling lifting adapters on slat at the three 1/4-inch bolt locations.

(2) Prepare fixed leading edge for slat installation as follows:

(a) Position the snubber roller out of the way on both ribs as follows (Ref. Fig. 402, Sheet 3):

Loosen the forward pivot, bolt, the roller bolt, and the serrated bolt; position snubber fitting in the full up position. Tighten the serrated bolt sufficiently to retain snubber fitting in the full up position.

(b) Adjust the slat retract stop bolts all the way in to provide maximum stop clearance and lock-wire stop bolt.

(c) Check slat extend stop adjustment. Verify the dimension from the center of the upper aft ground roller shaft to the face of the extend stop bolt (Ref. Fig. 402, Sheet 1). (Use slat downstop gage to check adjustment.)Adjust extend stop as required. Lock-wire stop bolt.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(d) Remove tags from hydraulic control panels. Turn on hydraulic systems A and C (Ref. 29-11-00).

CAUTION: DURING THE FOLLOWING OPERATION, THE ACTUATOR ROD END MUST BE HELD SO IT DOES NOT ROTATE OUT OF ADJUSTMENT, AND THE ACTUATOR MUST BE GUIDED TO PREVENT DAMAGE TO STRUCTURE.

(e) Carefully operate slats to full up to retract disconnected actuator completely.

(f) After retraction, secure actuator rod end to structure to prevent disturbing actuator adjustment.

(3) If actuator rod-end adjustment is lost or is suspect, accomplish following to adjust actuator rod-end to the slat retract rig dimension:

NOTE: The fully retracted rig position of slats is provided when the slat PDU is shut down by electrical actuation of the PDU shutoff valves. This can be checked as follows:

Open No. 1 and No. 2 asymmetry brake circuit breakers CB1-(J10) and CB2-(H22). When circuit breakers opened, the slat torque tubes must rotate approximately 1.5 revolutions in the retract direction before hydraulic shutdown by the PDU control valve. (If slat torque tube does not rotate approximately 1.5 revolutions, check PDU electrical shutdown rigging in accordance with installation procedures of 27-81-09, Slat PDU Command Signal
After checking for slat retract rig position, close circuit breakers CB1-(J10) and CB2-(H22), and position flap handle to 4-degree detent. When slats partially extend, position flap handle to 0-degree detent and allow slats to retract to rig position.

(a) With slat control system in the fully retracted rig position, turn off hydraulic power.

NOTE: When torque shaft is disconnected on outboard side of slat actuator gearbox, slat seal compression can cause disconnected slats to extend slightly. To ensure correct rigging, on first slat outboard of disconnected actuator, measure and record gap between inboard track and retract stop bolt.

(b) Disconnect torque shafts on both sides of slat actuator gearbox.

NOTE: When disconnecting torque shaft on outboard side of gearbox, note amount and direction torque shaft rotates.

(c) Turn gearbox spline shaft until the output ballscrew (rotating nut) contacts the internal retract stop.

R (d) On aircraft with 672152-103 actuators, with rotating nut held against the internal retract stop, rotate rod-end only to obtain the 0.150 (±0.050) inch dimension with grease fitting on top. [The 0.150 inch dimension is an initial adjustment only and will change when the actuator retract dimension (next step) is accomplished.](Ref. Fig. 402, Sheet 1.)

NOTE: If the 0.150 (±0.050) inch dimension cannot be obtained with the lube fitting on top, loosen the actuator rod end nut and reposition the rod end. Verify that locking washer tab is properly engaged in ballscrew slot. Retorque rod end nut 80 to 100 lb ft and lock-wire nut to tab locking washer.

R (d) On aircraft with any actuator except 672152-103, with rotating nut held against the internal retract stop, rotate rod-end only to obtain the 0.090 (±0.050) inch dimension with grease fitting on top. [The 0.150 inch dimension is an initial adjustment only and will change when the actuator retract dimension (next step) is accomplished.] (Ref. Fig. 402, Sheet 1).

NOTE: If the 0.090 (±0.050) inch dimension cannot be obtained with the lube fitting on top, loosen the actuator rod end nut and reposition the rod end. Verify that locking washer tab is properly engaged in ballscrew slot. Retorque rod end nut 80 to 100 lb ft and lock-wire nut to tab locking washer.

(e) Hold the rod-end with grease fitting on top and turn the gearbox spline shaft to obtain the 4.0 (±0.20) inch actuator retract rig dimension (Ref. Fig. 402, Sheet 1).

(f) Connect inboard torque shafts to actuator gearbox.

(g) Verify that slats outboard of disconnected actuator are still in the retract rig position as follows:

Manually rotate slat torque tube to position slat to dimension recorded in Step 3B(3)(a) NOTE. While maintaining slats in the retract rig position, connect torque tube to outboard side of actuator.

(4) Attach sling to hoist and lift slat clear of support. To facilitate installation, position slat in sling to approximate attitude of extended slat.

(5) Hoist slat into position for installation and install the slat-to-track attach bolts.

NOTE: On both inboard and outboard tracks of slats No. 5, 6, and 7, add additional washers, as required, under nut of the slat-to-track attach bolt to allow nut to be tightened and properly safetied with cotter pin.

(6) Install the slat-to-track links and check the slat-to-track dimension at both tracks (Ref. Fig. 402, Sheet 3). If necessary, adjust the link eccentrics to obtain the dimension recorded for the previously installed slat [Ref. Step 3A(4)].

NOTE: The slat-to-track dimension is a preliminary adjustment only so that the replacement slat is installed in approximately the same position as the removed slat.

(7) A change in shimming of the side rollers is normally not required when replacing a slat. If a check of the side rollers is desired, proceed as follows (Ref. Fig. 402, Sheet 2):

(a) Manually push the slat in to align the slat leading edge with adjacent slats or fixed leading edge. Take up hoist slack to prevent slat from falling to the extended position.

(b) Push slat in outboard direction until slat tracks contact outboard side rollers.

(c) With slats retracted, verify that both tracks are contacting both outboard rollers. If not, remove outboard roller assembly and add or remove shims as required (Ref. Fig. 402, Sheet 2).

NOTE: Due to possible track twist, contact on only the upper or lower side of track is acceptable. Do not taper the side roller shims.

If track contacts only one side roller assembly, remove or add shims to side roller assembly that will cause track to be centered between and parallel to the support ribs.

(d) With both tracks contacting both outboard rollers, verify 0.030 to 0.050 inch gap between inboard side rollers and the same part of track (upper or lower) that is in contact with the outboard side rollers. If not, remove affected inboard side roller assembly and add or remove shims as required.

(e) If side rollers were adjusted, check for smooth operation of side rollers by manually positioning slat panel through several full extend to fill retract cycles and provide hoist slack to allow manual positioning of slat.

(f) After checking operation of side rollers, manually position slat full up to align the leading edge with adjacent slats or fixed leading edge and take up on hoist slack.

(8) With slats in retracted position, use the eccentrics at the slat-to-track links to adjust slat to meet contour requirements of the slat upper and lower trailing edge (Ref. Fig. 403).

NOTE: Mismatch between slat lower trailing edge and wing leading edge can be affected by contour irregularities. To properly check mismatch, use the flat (wide) surface of a flexible steel 24 to 36 inch scale (a piece of 0.015 to 0.020 inch spring steel, 0.50 inch wide, can also be used). Lay flat side of steel scale across slat to wing gap and measure mismatch.

(a) If the slat is skewed (not parallel to fixed leading edge), adjust eccentrics separately.

NOTE: If interference exists, or if the slat cannot be adjusted to contour with the eccentrics, the main rollers will require adjustment. Connect the actuator to the slat as outlined in Steps (9) through (12), then readjust the main rollers as outlined in Step (14).

(9) Carefully slacken hoist and allow slat to fully extend. Remove sling from slat and plug the sling attach holes using the screws provided.

(10) With slat against the extend stops, check to verify that the end of each track extends aft of upper and lower aft rollers centerline a minimum of 0.12 inch

(Ref. Fig. 402, Sheet 1). If not, recheck extend stop setting per Step B2(c) and (d).

CAUTION: DURING THE FOLLOWING OPERATION, THE ACTUATOR ROD END MUST BE HELD SO IT DOES NOT ROTATE OUT OF ADJUSTMENT, AND THE ACTUATOR MUST BE GUIDED TO PREVENT DAMAGE TO STRUCTURE.

WARNING: DO NOT ATTEMPT TO FULLY EXTEND THE ACTUATOR AS A JAM MAY OCCUR CAUSING DAMAGE TO STRUCTURE. ALSO PERSONNEL INJURY CAN RESULT IF FINGERS ARE CAUGHT BETWEEN ROD END AND CLEVIS FITTING.

(11) Carefully operate the slat system to extend actuator rod end to within several inches of the clevis fitting on the slat.

(12) Manually push the slat in, to mate the actuator rod end with the slat clevis fitting. (The rod end must be carefully guided into the clevis fitting.) Install bolt, with threads inboard, washers, and nut. Tighten nut and install cotter pin.

(13) Recheck slat contour as follows (Ref. Fig. 403):

(a) Retract slats; check for interference and conformance to contour. (Check contour at slat upper and lower trailing edges, and at leading edge between adjacent slats or fixed wing structure).

(b) With slats fully retracted, verify the 4.0 (±0.20) inch actuator-retracted dimension.

NOTE: Actuator length can be adjusted within above tolerance to meet slat-to-slat and slat-to-fixed leading edge contour requirements as follows:

On first slat outboard of actuator to be disconnected, measure and record retract stop gap on inboard track, then disconnect torque tubes on both sides of actuator. Rotate actuator gearbox spline shaft to change actuator length, then reconnect torque tubes, making sure to rotate torque tube to position first slat outboard of disconnected actuator to dimension recorded above.

(14) If slat contour cannot be achieved using the slat-to-track link eccentrics, readjust the main rollers as follows (Ref. Fig. 402, Sheet 2):

(a) Remove eccentric locks, washers, and nuts from both sides of the upper and lower forward rollers.

NOTE: Normally it will not be necessary to adjust the aft rollers except for eliminating slat racking (non-parallel slat operation).

(b) Adjust the upper forward flight rollers fully up to provide maximum adjustment clearance.

(c) With the slats retracted, adjust the lower forward ground rollers to minimize mismatch between the slat lower trailing edge and the fixed leading edge.

NOTE: Inboard and outboard track rollers must be adjusted equal amounts to maintain parallel track operation.

(d) Adjust the slat-to-track link eccentrics, if necessary, to achieve slat contour (Ref. Fig. 403).

NOTE: It may be necessary to install the roller eccentric lockplates to maintain adjustment.

(e) Repeat Steps (c) and (d) as required to meet slat contour requirements.

(f) Verify that both inboard and outboard tracks are in contact with lower forward ground rollers and upper aft ground rollers. Adjust ground rollers as necessary.

(g) Install the eccentric locks, washers, and nuts at both the lower forward and upper aft ground rollers.

(h) Adjust the upper forward and lower aft flight rollers to provide a gap of 0.020 (±0.010) inch between upper forward flight roller and track and between the lower aft flight roller and track.

(i) Install the eccentric locks, washers, and nuts at the upper forward and lower aft flight rollers.

(j) Torque roller nuts (Ref. Table 401) and lock-wire.

Main Roller Torque Values (Lb In.)
Table 401

	SLAT NO.	UPPER FORWARD	LOWER FORWARD	UPPER AFT	LOWER AFT
	4 INB'D	700-750	350-400	200-250	475-525
	4 OUTB'D	475-525	200-250	150-200	350-400
	5 INB'D	700-750	200-250	150-200	475-525
	5 OUTB'D	700-750	150-200	150-200	475-525
R	6 INB'D	700-750	150-200	150-200	475-525
	6 OUTB'D	700-750	150-200	150-200	475-525
	7 INB'D	475-525	150-200	150-200	350-400
	7 OUTB'D	700-750	150-200	150-200	475-525

CAUTION: IF ANY AFT FLIGHT OR GROUND ROLLER IS ADJUSTED, CHECK FOR CORRECT TRACK EXTENSION AFT OF ROLLERS IN ACCORDANCE WITH STEP B(10).

(15) Extend slats and remove temporary rigging shim.

(16) Position a pull-strip at each track rib and at the actuator rib so that the pull-strips will be between the slat upper trailing edge and the wing leading edge. (Verify that the temporary rigging shim is removed.)

(17) Fully retract slats.

(18) With slats fully retracted, pull load to remove the pull-strips should be 10 to 60 pounds.

NOTE: If pull load is not 10 to 60 pounds, adjust the slat-to-track link eccentrics to meet the pull load.

(19) Verify that there are no gaps between the aluminum slat upper trailing edge and the wing leading edge.

NOTE: If there is, bend the trailing edge as required to remove any gaps.

If upper trailing edge is plastic or the 0.012 inch steel angle, do not bend.

R (20) On aircraft 001-031 without SB57-112, verify that the slat lower trailing edge seal seats against the fixed leading edge along the entire length of slat.

R (20) On aircraft 001-031 with SB57-112 and 032-999, bend slat lower trailing edge to match wing structure.

R (21) On aircraft 001-031 without SB57-112, install the tabouts at the track and actuator locations; verify that they clear the fixed leading edge by 0.08 (±0.020) inch and trim if necessary (Ref. Fig. 403).

R NOTE: Installation of tabouts removed from slat that was removed will ease rigging and should eliminate need to trim tabout.

R (21) On aircraft 001-031 with SB57-112 and 032-999, verify tabouts cover track and actuator cutouts and that they fit without gaps. Do not trim tabouts. Adjust the long tabout at the actuator rib on slats 6 and 7 as follows:

R (a) Fully retract slats and inspect tabouts for mismatch (gapping) or preload (concave appearance).

R (b) Extend slats and adjust turnbuckles; shorten to correct mismatch, lengthen to correct preload. If turnbuckle length is insufficient, shims may be installed between attach channel and tab.

R (c) Repeat Steps 3B(21)(a) and (b) until tabs are adjusted and safety turnbuckles. Final closure of small gaps may be achieved by crimping tab edges providing no preload is added.

(22) With slats fully retracted, adjust the snubber rollers at both fittings to just contact the slat snubber ribs as follows (Ref. Fig. 402, Sheet 3):

(a) Loosen the serrated locking bolt.

(b) Move roller down into contact with slat snubber rib and tighten all three bolts to lock roller in position.

(23) Install the slat-to-slat bumper fittings and adjust to a gap of 0.15 (±0.03) inch with the slats retracted (Ref. Fig. 402, Sheet 3). Maximum allowable wear on adjustable bumper fitting and fixed clevis fitting is

0.12 inch. When installing worn parts, adjust gap with reference to unworn areas.

(24) On No. 4 slat only:

(a) Connect wing anti-ice self-retracting wire and telescoping conduit (Ref. 30-13-30).

(b) Connect wing anti-ice telescoping duct (Ref. 30-13-06).

(25) Install the slat-to-slat anti-ice duct connectors (Ref. 30-13-16).

(26) With slats in the fully retracted rig position, verify that a gap exists on at least one retract stop on each slat.

(27) Extend slats and verify that the actuator extend dimension is 21.28 (±0.33) inches (Ref. Fig. 402, Sheet 1).

(28) With slats fully extended, check that the clearance between the track extend stop and track stop bolt is a minimum of 0.030 inch on each track.

NOTE: Stop bolt clearance is satisfactory if the total of both extend stop clearances is a minimum of 0.060 inch. One stop screw can be contacting the stop.

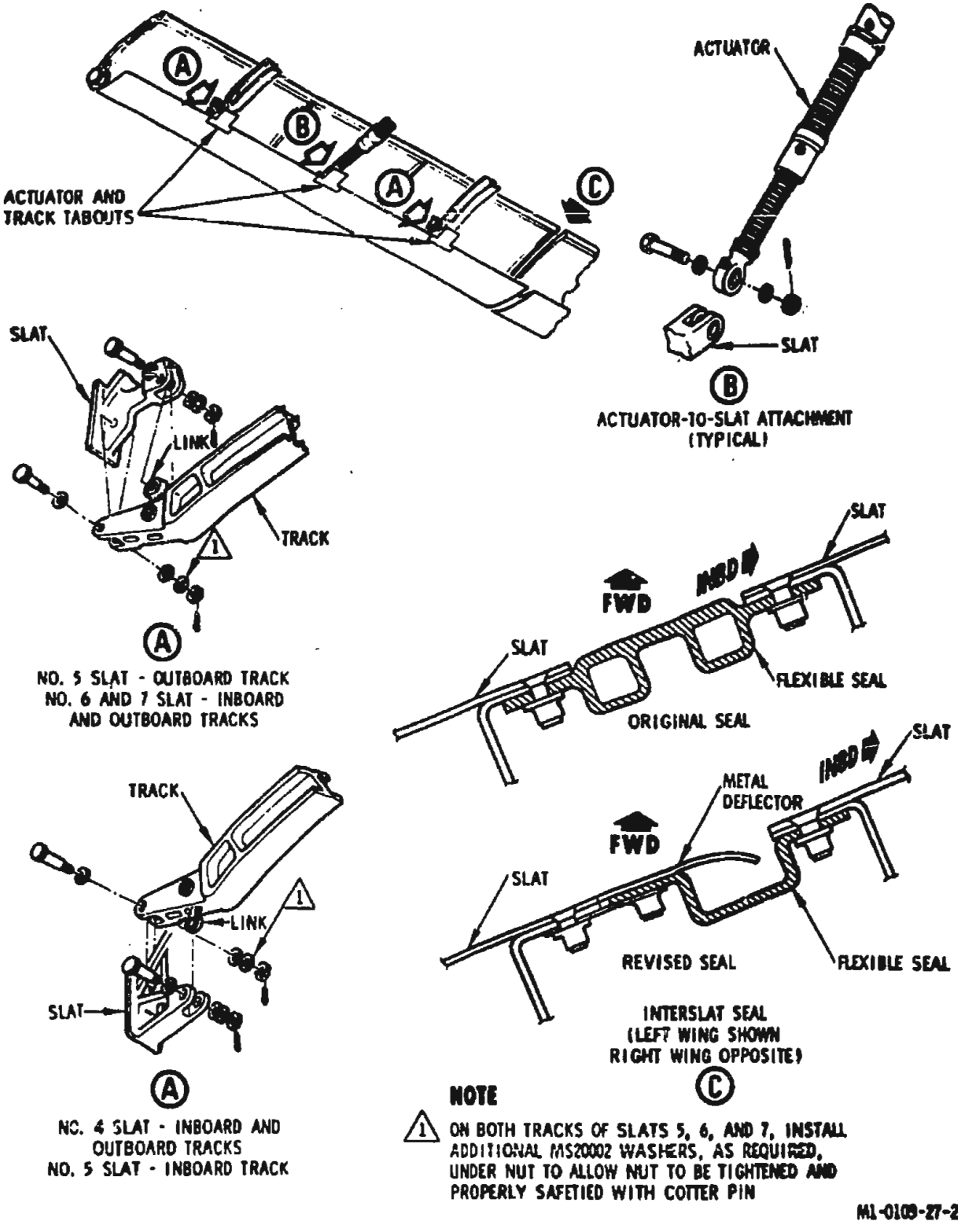
(29) Install inter-slat seals.

(30) Lubricate actuator rod end bearing (Ref. 12-23-00).

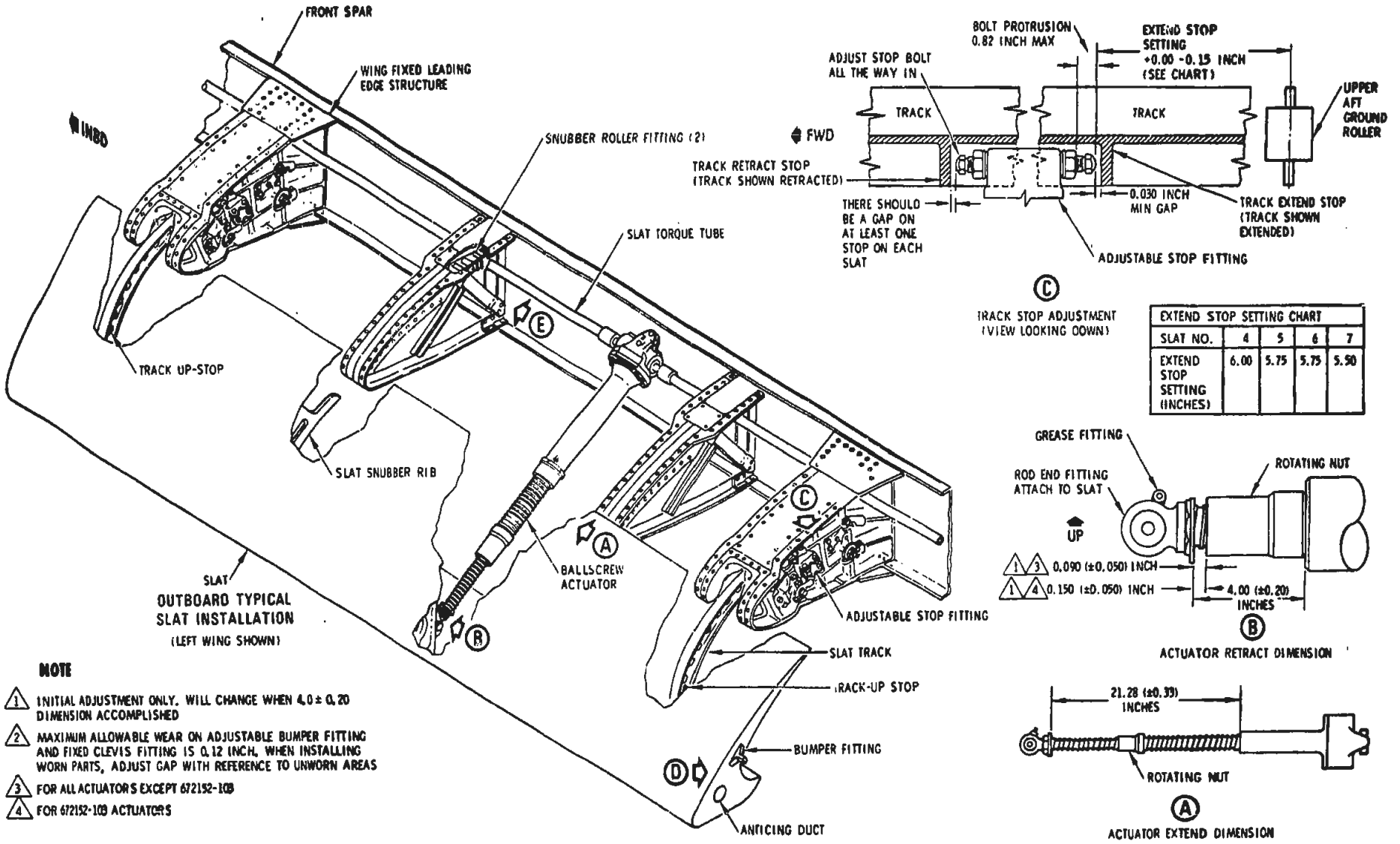
(31) Verify that all attachments are torqued and saftied.

(32) Cycle slats from full up to full down and back to full up for several cycles. Verify normal operation of slat system.

(33) Turn off hydraulic power if no longer required (Ref. 29-11-00).



Outboard Slat - Removal and Installation
Figure 401



EXTEND STOP SETTING CHART				
SLAT NO.	4	5	6	7
EXTEND STOP SETTING (INCHES)	6.00	5.75	5.75	5.50

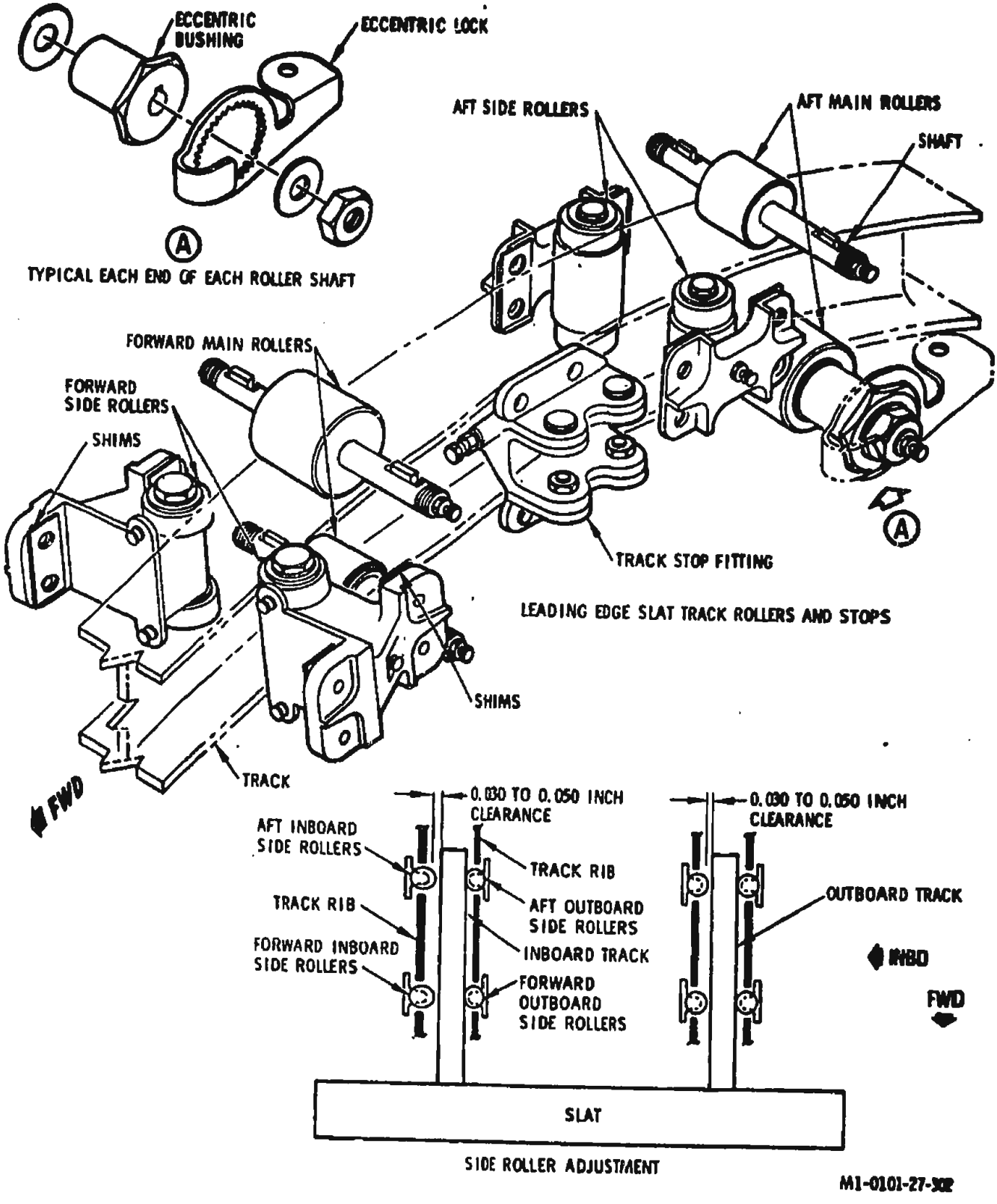
NOTE

1. INITIAL ADJUSTMENT ONLY. WILL CHANGE WHEN 4.0 ± 0.20 DIMENSION ACCOMPLISHED
2. MAXIMUM ALLOWABLE WEAR ON ADJUSTABLE BUMPER FITTING AND FIXED CLEVIS FITTING IS 0.12 INCH. WHEN INSTALLING WORN PARTS, ADJUST GAP WITH REFERENCE TO UNWORN AREAS
3. FOR ALL ACTUATORS EXCEPT 672152-109
4. FOR 672152-109 ACTUATORS

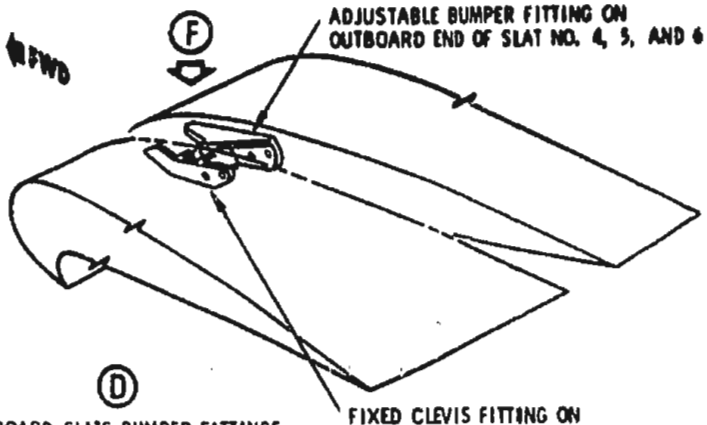
M1-0009-27-322

R Slat Rigging
R Figure 402 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



Slat Rigging
Figure 402 (Sheet 2)

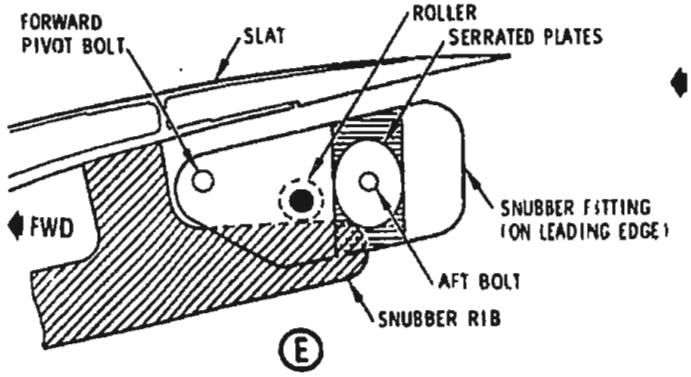


D

OUTBOARD SLATS BUMPER FITTINGS

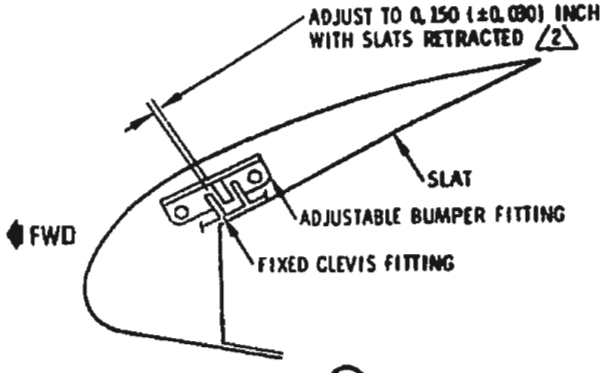
NOTE

2 MAXIMUM ALLOWABLE WEAR ON ADJUSTABLE BUMPER FITTING AND FIXED CLEVIS FITTING IS 0.12 INCH. WHEN INSTALLING WORN PARTS, ADJUST GAP WITH REFERENCE TO UNWORN AREAS.



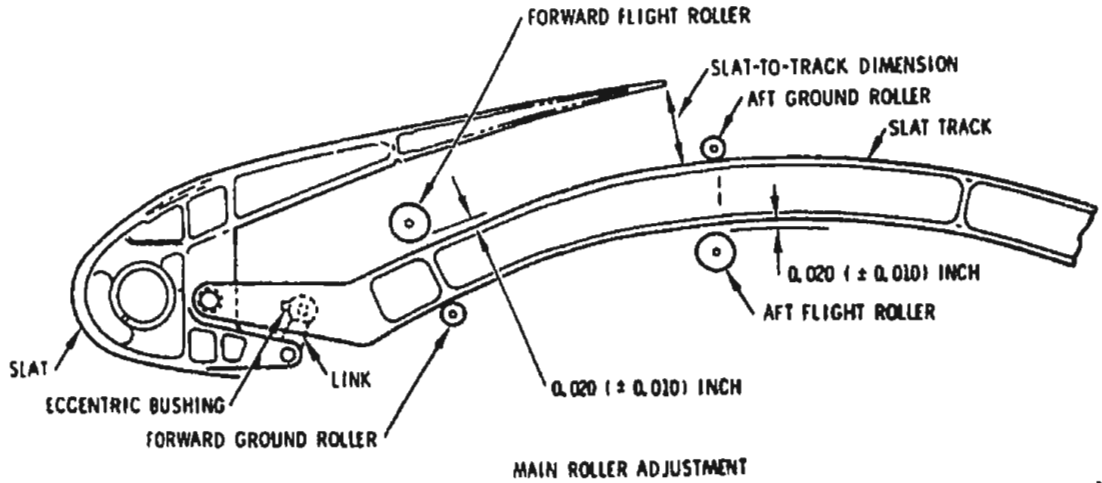
E

OUTBOARD SLAT SNUBBER ROLLER ADJUSTMENT



F

BUMPER FITTING ADJUSTMENT

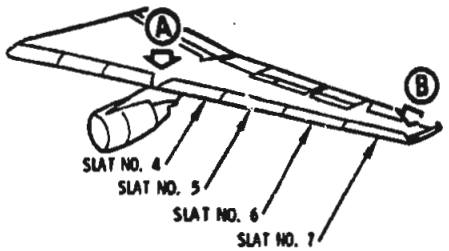


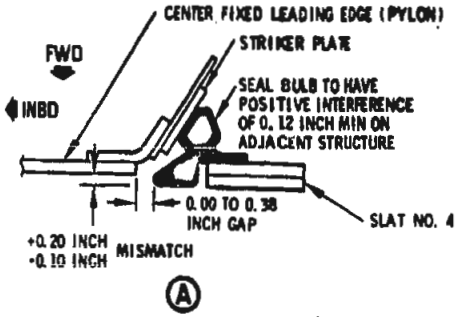
MAIN ROLLER ADJUSTMENT

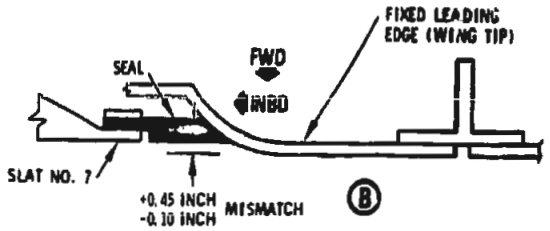
M1-0001-27-231

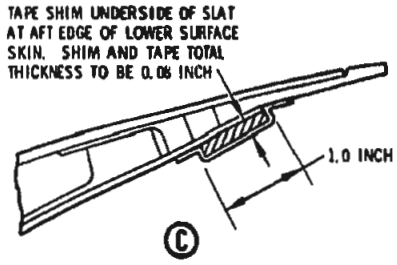
R R Slat Rigging
Figure 402 (Sheet 3)

R R 001B EFFECTIVITY: ALL

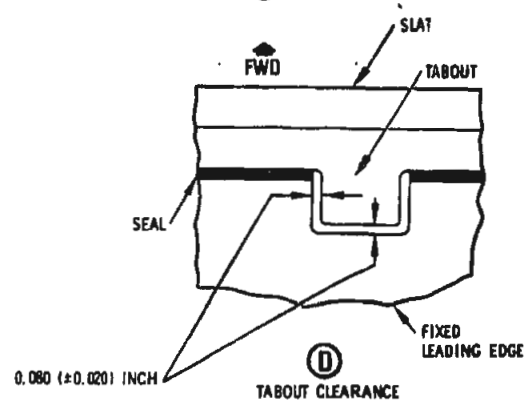




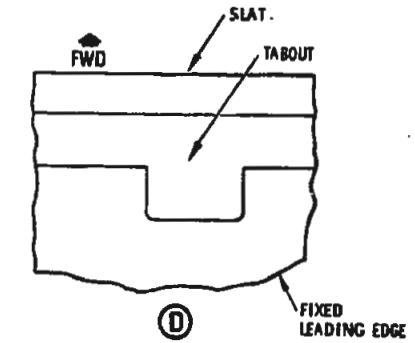




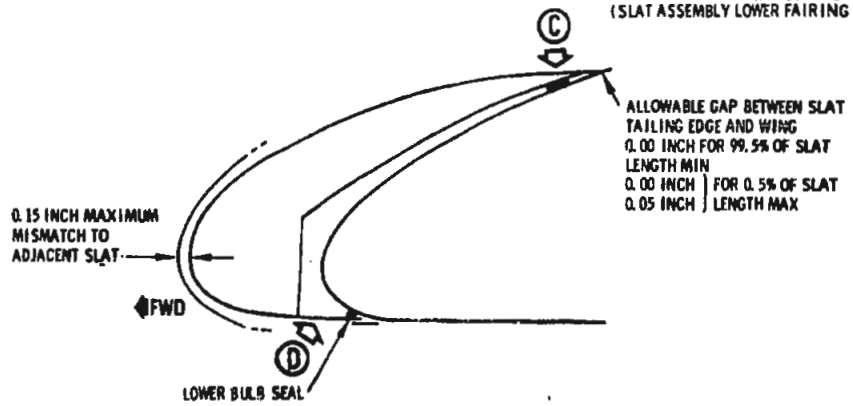
(TEMPORARY RIGGING SHIM INSTALLATION)

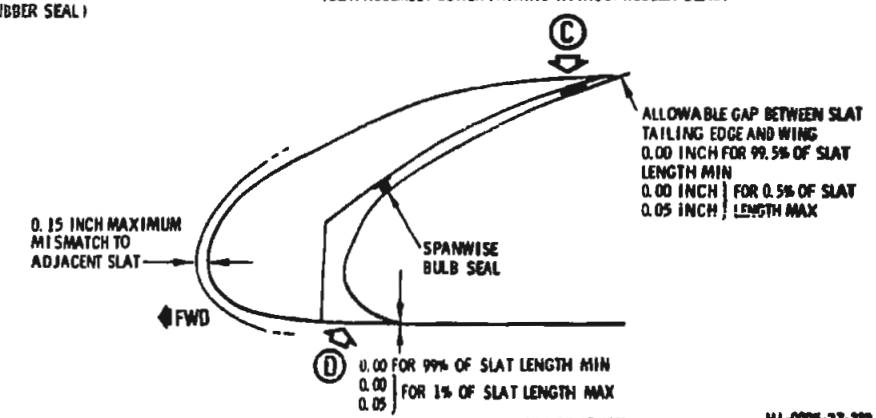


TABOUT CLEARANCE
(VIEW LOOKING UP)
(SLAT ASSEMBLY LOWER FAIRING WITH RUBBER SEAL)



TABOUT CLEARANCE
(VIEW LOOKING UP)
(SLAT ASSEMBLY LOWER FAIRING WITHOUT RUBBER SEAL)


C
ALLOWABLE GAP BETWEEN SLAT TAILING EDGE AND WING
0.00 INCH FOR 99.5% OF SLAT LENGTH MIN
0.00 INCH | FOR 0.5% OF SLAT
0.05 INCH | LENGTH MAX
0.15 INCH MAXIMUM MISMATCH TO ADJACENT SLAT
FWD
D
LOWER BULB SEAL
(SLAT ASSEMBLY, EARLY CONFIGURATION WITHOUT SB 57-112)

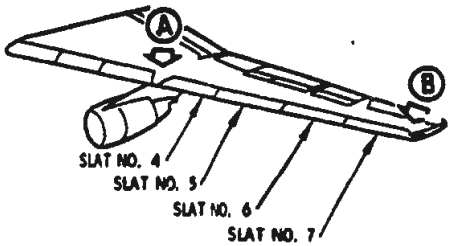

C
ALLOWABLE GAP BETWEEN SLAT TAILING EDGE AND WING
0.00 INCH FOR 99.5% OF SLAT LENGTH MIN
0.00 INCH | FOR 0.5% OF SLAT
0.05 INCH | LENGTH MAX
0.15 INCH MAXIMUM MISMATCH TO ADJACENT SLAT
SPANWISE BULB SEAL
FWD
D
0.00 FOR 99% OF SLAT LENGTH MIN
0.00 | FOR 1% OF SLAT LENGTH MAX
0.05
(SLAT ASSEMBLY, LATTER CONFIGURATION WITH SB 57-112)

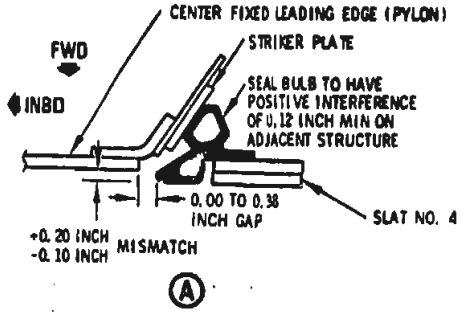
MI-0005-27-232

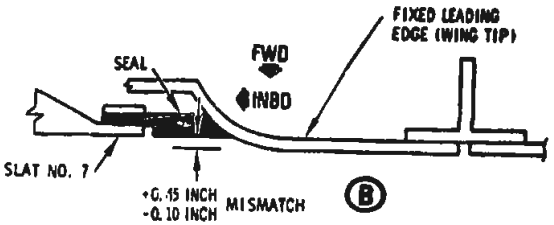
R Slat Contour Requirements
R Figure 403

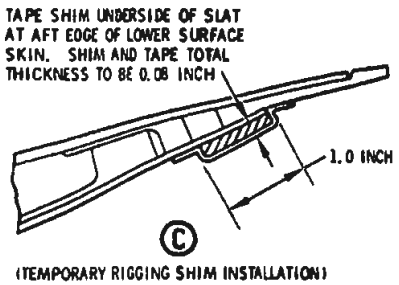
EFFECTIVITY: 001-031

001B

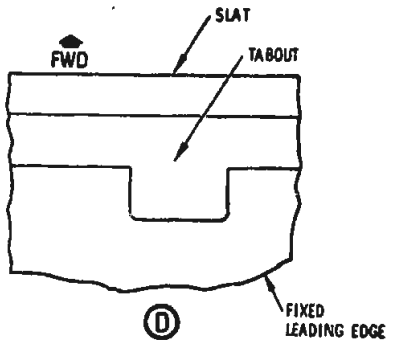




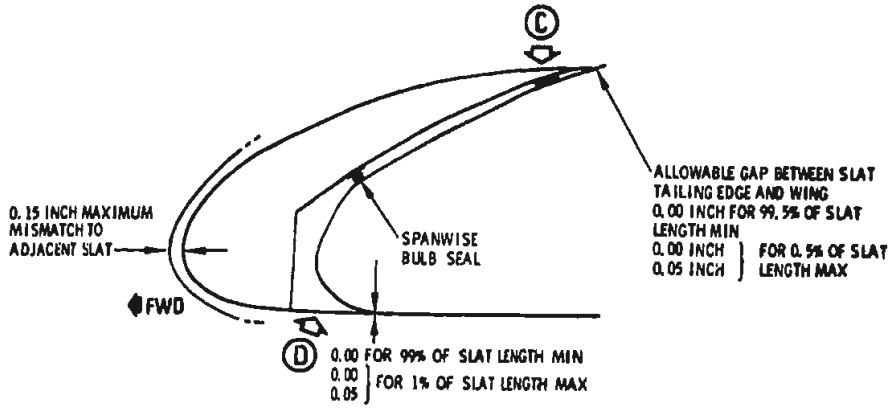




(TEMPORARY RIGGING SHIM INSTALLATION)



TABOUT CLEARANCE
(VIEW LOOKING UP)



M1-0000-27-1104

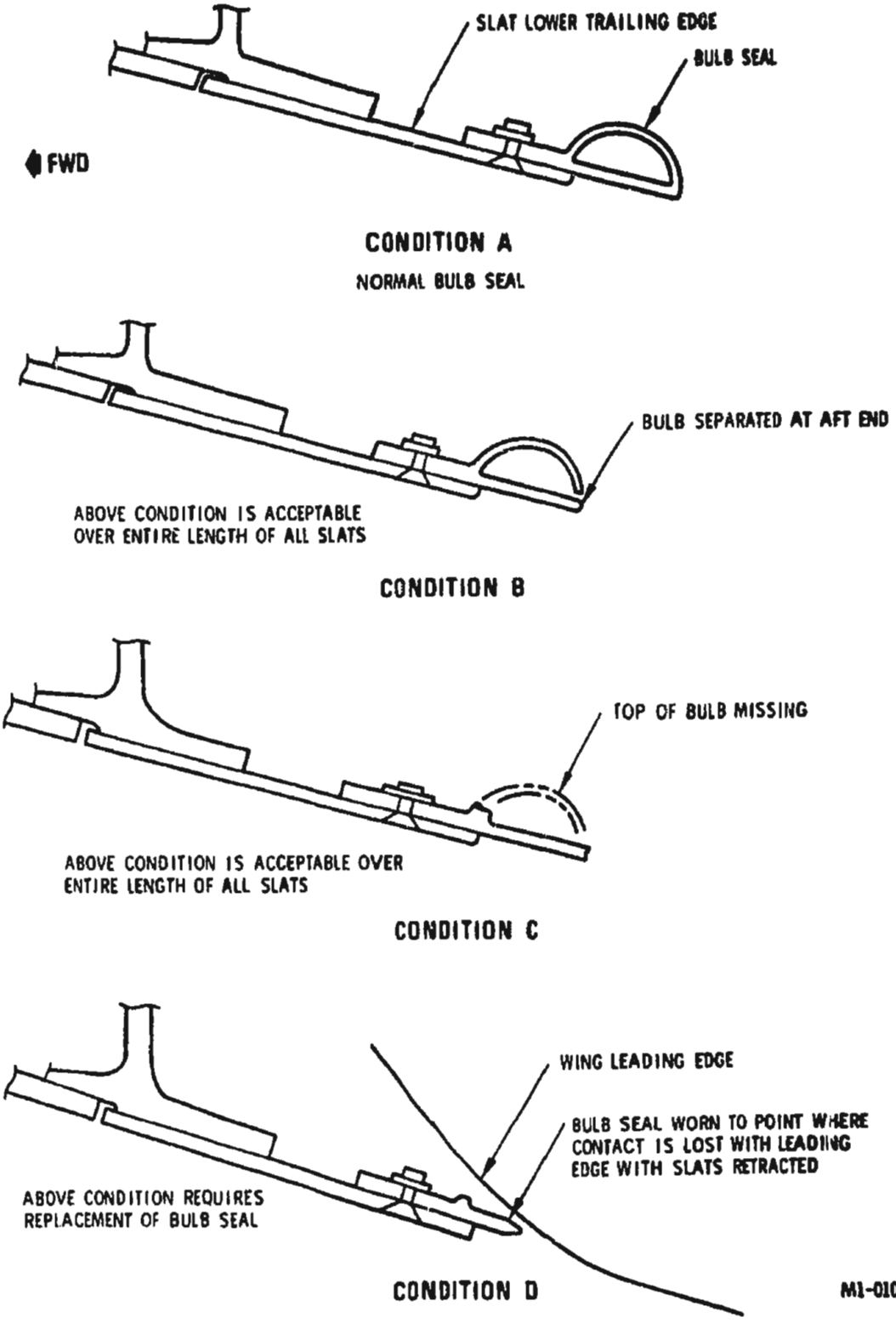
R Slat Contour Requirements
R Figure 403

R EFFECTIVITY: 032-999
R
0018

OUTBOARD SLATS - INSPECTION AND CHECK

1. General

The slat lower trailing edge bulb seal can show considerable wear without seriously affecting the ability to seal the gap between the slat lower trailing edge and the wing leading edge. For wear limits on the bulb seal, see Figure 601.



Slat Lower Trailing Edge Seal Wear Limits
Figure 601

INBOARD SLAT TRACK - REMOVAL AND INSTALLATION

1. Referenced Procedures

27-81-23 Inboard Slat - Removal and Installation

27-81-32 Rollers, Upper and Lower, Slat Track - Removal and Installation

2. Removal/Installation

A. Removal

(1) Remove slat (Ref. 27-81-23).

R (2) On aircraft 001-014,
R remove bolts, nuts, washers, and spacer securing track
R stop fitting assembly to track stop brackets (Ref. Fig.
R 401). Remove track stop fitting assembly.

R NOTE: Do not remove track stop brackets from track
R ribs.

R (2) On aircraft 015-999,
R remove bolts, nuts and washers securing track stop
R fitting and remove track stop fitting (Ref. Fig. 401).

(3) Remove track from track ribs.

(4) Remove bolt, nut, washer, and cotter pin from track stops on track. Remove track stops.

(5) Remove bolt, washers, shims, bushings, nut, and cotter pin securing link to track. Remove link from track.

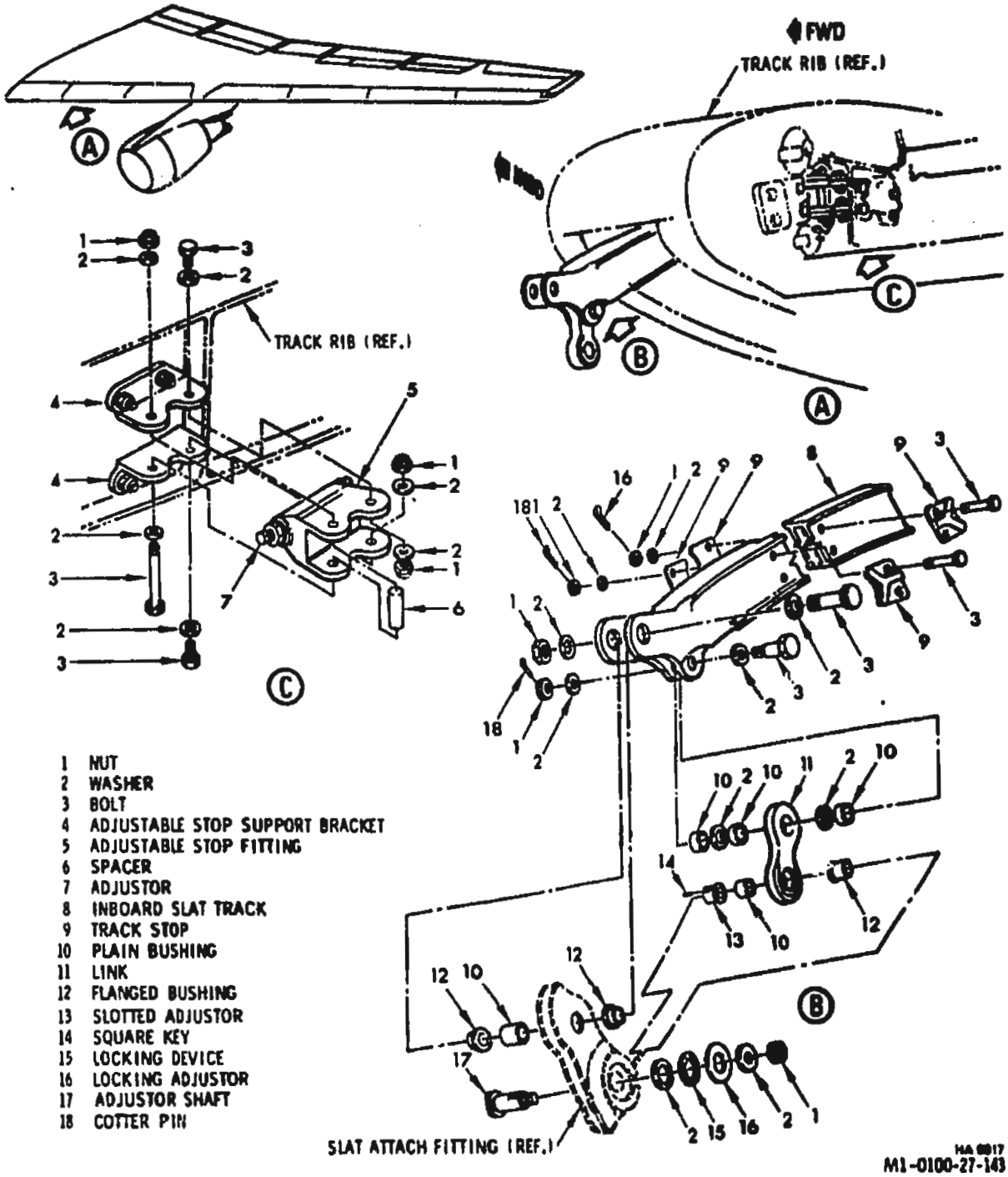
B. Installation

(1) Position link on track at aft or lower bolt attachment hole. Install bolt, washers, shims, bushings, nut, and cotter pin (Ref. Fig. 401).

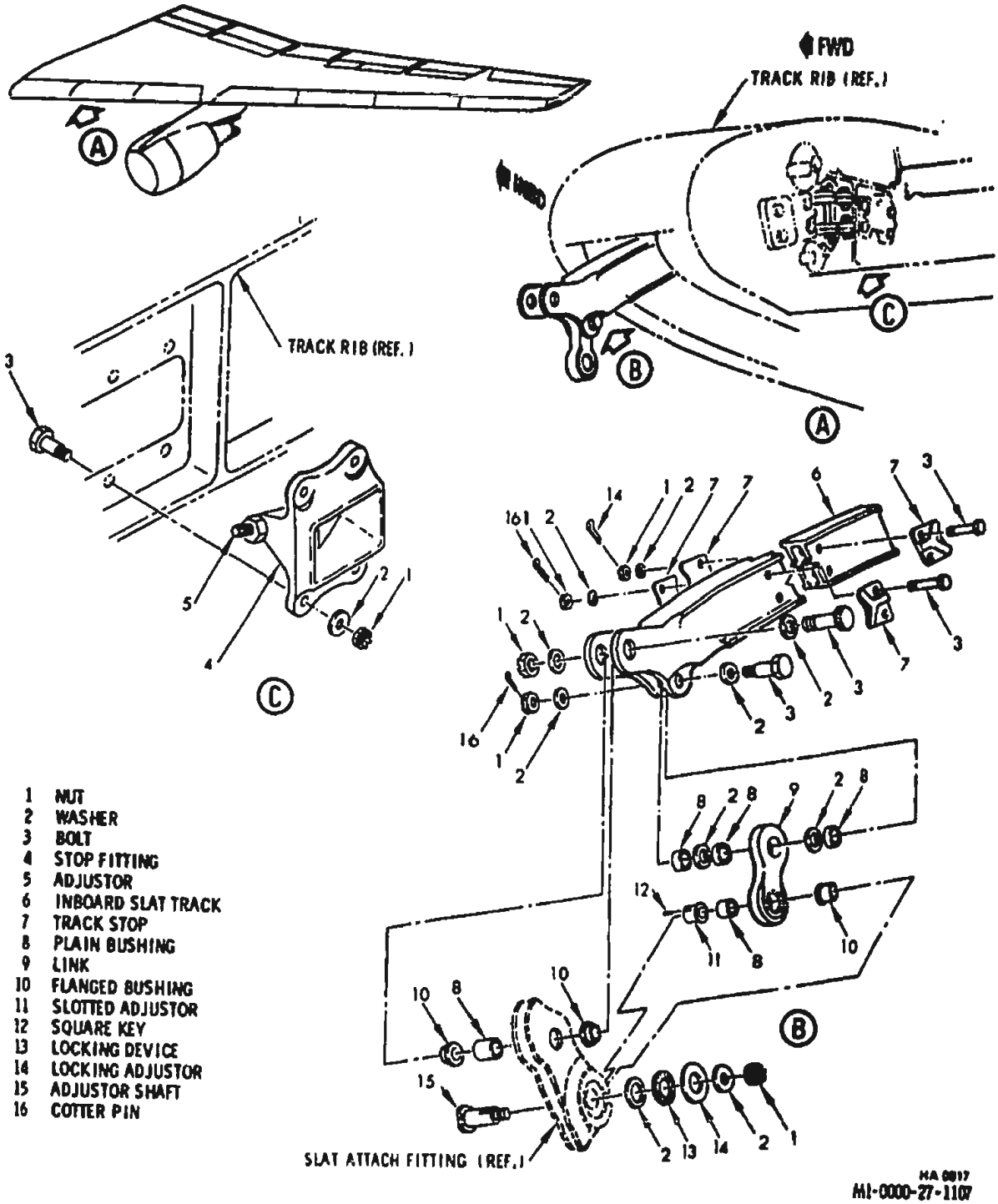
NOTE: Orient link as shown on Fig. 401.

(2) Position track stops on track. Install bolts, washers, nuts, and cotter pins.

(3) Insert track into track ribs between rollers and carefully push track toward retracted position.



Inboard Slat Track - Removal and Installation
Figure 401



R Inboard Slat Track - Removal and Installation
R Figure 401

R EFFECTIVITY: 015-999

NOTE: If track binds upon insertion, adjust upper forward main roller up and the lower aft main roller down (Ref. 27-81-32).

R (4) On aircraft 001-014,
R while holding track between the retracted and extended
R positions, position track stop fitting assembly between
R track stop brackets. Install bolts, washers, nuts, and
R spacer.

R (4) On aircraft 015-999,
R while holding track between the retracted and extended
R positions, install track stop fitting with bolts,
R washers and nuts.

(5) Install slat (Ref. 27-81-23).

OUTBOARD SLAT TRACK - REMOVAL AND INSTALLATION

1. Referenced Procedures

27-81-26 Outboard Slat - Removal and Installation

27-81-32 Rollers, Upper and Lower, Slat Track - Removal and Installation

2. Removal/Installation

A. Removal

(1) Remove slat (Ref. 27-81-26).

R (2) On aircraft 001-014,
R remove bolts, nuts, washers, and spacer securing track
R stop fitting assembly to track stop brackets (Ref. Fig.
R 401). Remove track stop fitting assembly.

R NOTE: Do not remove track stop brackets.

R (2) On aircraft 015-999,
R remove bolts, nuts and washers securing track stop
R fitting and remove track stop fitting (Ref. Fig. 401).

(3) Remove track from track ribs.

(4) Remove shaft, adjustors, key, shims, bushing, lock, washer, nut, and cotter pin securing link to track. Remove link from track.

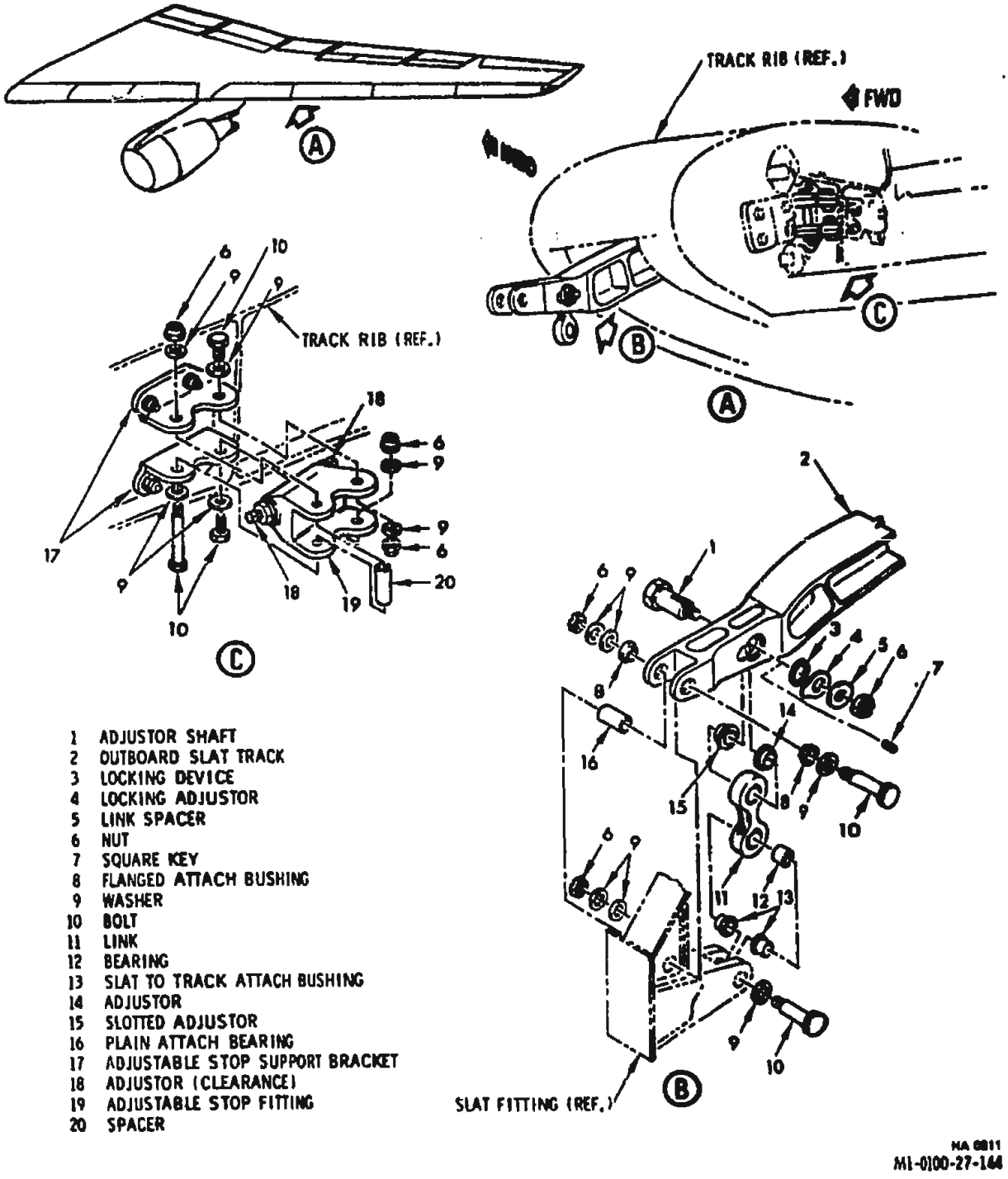
B. Installation

(1) Position link on track at aft bolt attachment hole. Install shaft, adjustors, key, shims, bushing, lock, washer, and nut (Ref. Fig. 401). Torque nut 50 lb in. and install cotter pin.

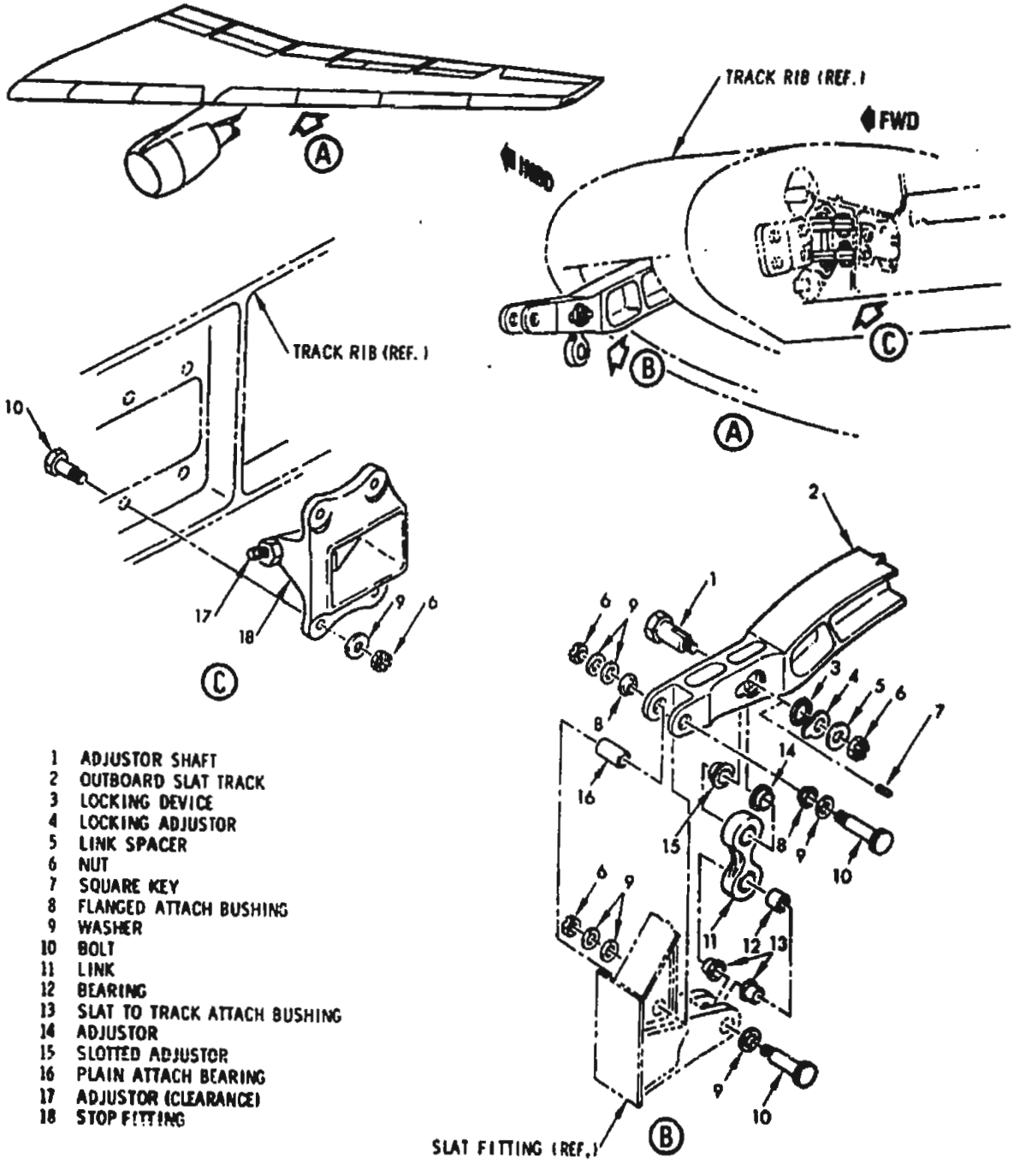
(2) Insert track into track ribs between rollers and carefully push track toward the retracted position.

NOTE: If track binds upon insertion, adjust the upper forward main roller up and the lower aft main roller down (Ref. 27-81-32).

R (3) On aircraft 001-014,
R while holding track between the retracted and extended
R positions, position track stop fitting assembly between



Inboard Slat Track - Removal and Installation
Figure 401



1 ADJUSTOR SHAFT
2 OUTBOARD SLAT TRACK
3 LOCKING DEVICE
4 LOCKING ADJUSTOR
5 LINK SPACER
6 NUT
7 SQUARE KEY
8 FLANGED ATTACH BUSHING
9 WASHER
10 BOLT
11 LINK
12 BEARING
13 SLAT TO TRACK ATTACH BUSHING
14 ADJUSTOR
15 SLOTTED ADJUSTOR
16 PLAIN ATTACH BEARING
17 ADJUSTOR (CLEARANCE)
18 STOP FITTING

HA 0811
M1-0000-27-1108

R Inboard Slat Track - Removal and Installation
R Figure 401

R EFFECTIVITY: 015-999

001B

R track stop brackets. Install bolts, washers, nuts, and
R spacer.

R (3) On aircraft 015-999,
R while holding track between the retracted and extended
R positions, install track stop fitting with bolts,
R washers and nuts.

(4) Install slat (Ref. 27-81-26).

SLAT TRACK UPPER AND LOWER MAIN ROLLERS - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

Lubricant, MIL-C-16173, Grade I, or equivalent

Wrench Set, Leading Edge Slat, BC48, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-01	Wing Leading Edge Slat Lubrication
27-81-23	Inboard Slats - Removal and Installation
27-81-26	Outboard Slats - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

R WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Turn off hydraulic systems A and C (Ref. 29-11-00).

R (2) Install warning tags on Flight Engineer/Second Officers
R Hydraulic System Panel, zone 215, and on Hydraulic
R Service Panel, zone 147.

(3) Remove applicable wing leading edge, front spar, and slat drive access panels (Ref. 6-40-00) to gain access to both sides of main roller.

(4) If the lower forward or upper aft roller is to be removed, support the slat.

(5) Remove roller lockbolts, roller locks, retaining nuts, and retainers each side of roller (Ref. Fig. 401).

NOTE: Record the orientation of the keyway in the eccentric bushings for reinstallation.

(6) Remove roller shaft, eccentric bushings (using wrench set), sleeves, bearings, washers, and keys. Use care not to lose keys.

B. Installation

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

R (1) Verify hydraulic systems A and C are shut off and
R Hydraulic Panels are tagged.

R (2) Lubricate eccentric bushings, roller shaft, and retainers (Ref. 12-23-01).

R (3) Install roller shaft, eccentric bushings, sleeves, bearings, washers, and keys (Ref. Fig. 401). Install necessary quantity of shim washers to meet dimensional requirements (Ref. Fig. 401).

R (4) Adjust the eccentric bushings to orientate the keyways as recorded in Step 3A(5). Adjust by rotating hexagon flange of eccentric bushing, using wrench set.

R (5) Check slat contour and adjust main rollers as required (Ref. 27-81-23, Inboard Slats, or 27-81-26, Outboard Slats).

R (6) Install roller locks, roller lockbolts, retainers, and retaining nuts. Torque nuts (Ref. Table 401) and lock-wire.

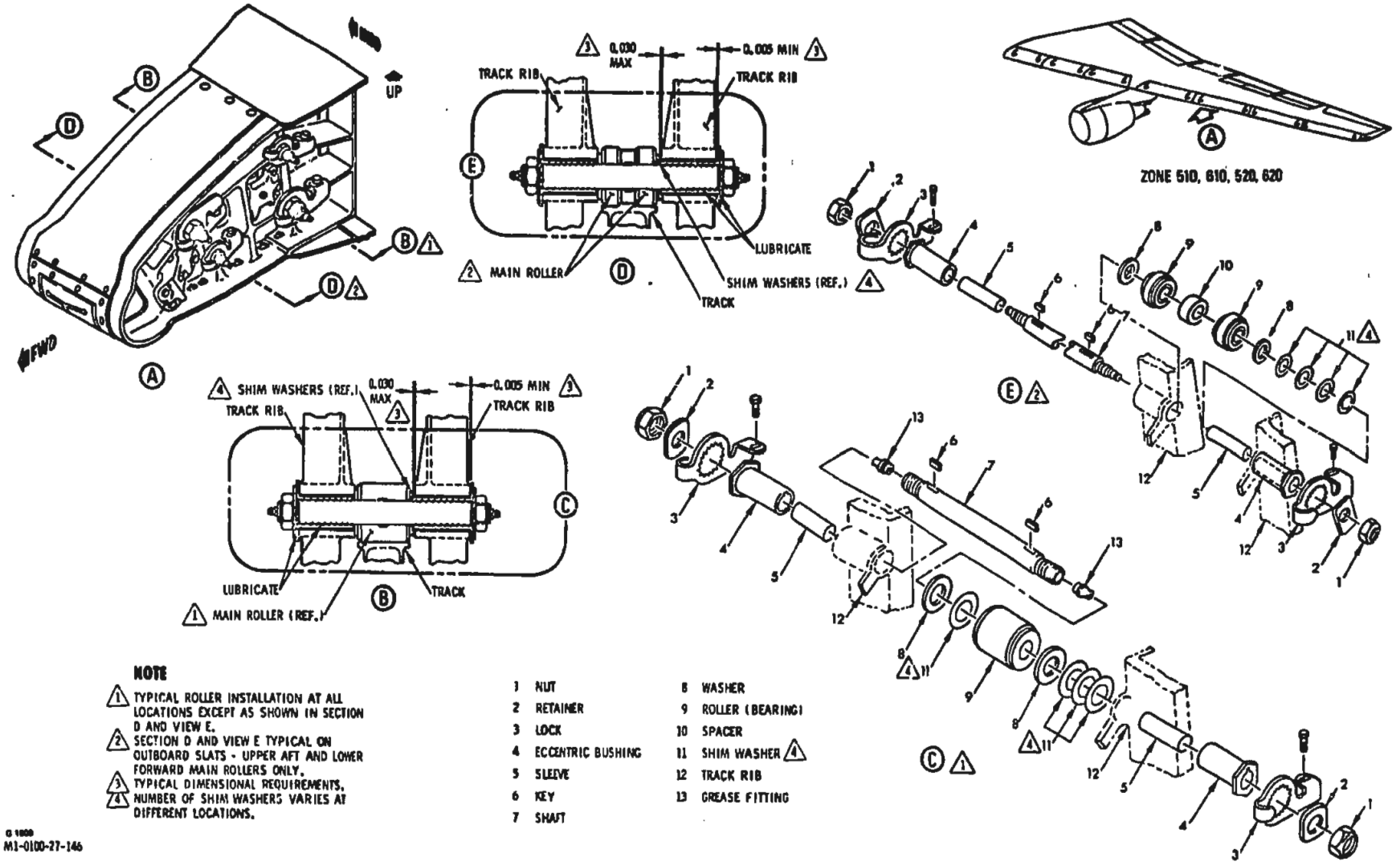
R (7) Lubricate roller (Ref. 12-23-01).

R (8) Remove tags from hydraulic control panels.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.



NOTE

1. TYPICAL ROLLER INSTALLATION AT ALL LOCATIONS EXCEPT AS SHOWN IN SECTION D AND VIEW E.
2. SECTION D AND VIEW E TYPICAL ON OUTBOARD SLATS - UPPER AFT AND LOWER FORWARD MAIN ROLLERS ONLY.
3. TYPICAL DIMENSIONAL REQUIREMENTS.
4. NUMBER OF SHIM WASHERS VARIES AT DIFFERENT LOCATIONS.

1	NUT	8	WASHER
2	RETAINER	9	ROLLER (BEARING)
3	LOCK	10	SPACER
4	ECCENTRIC BUSHING	11	SHIM WASHER (4)
5	SLEEVE	12	TRACK RIB
6	KEY	13	GREASE FITTING
7	SHAFT		

© 1970
M1-0100-27-146

Slat Track Upper and Lower Main Rollers - Removal and Installation
Figure 401

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(10) Cycle the slats from full up to full down and back to full up for several cycles. Verify normal operation of slats. Visually verify that track operating in replacement rollers operates smoothly without binding.

(11) Turn off hydraulic power (Ref. 29-11-00).

(12) Close access panels (Ref. 6-40-00).

Main Roller Torque Values (Lb-In.)
Table 401

SLAT NO.	UPPER FORWARD	LOWER FORWARD	UPPER AFT	LOWER AFT
1, 2 AND 3 (ALL)	475-525	200-250	200-250	475-525
4 INBOARD	700-750	350-400	200-250	475-525
4 OUTBOARD	475-525	200-250	150-200	350-400
5 INBOARD	700-750	200-250	150-200	475-525
5 OUTBOARD	700-750	150-200	150-200	475-525
R 6 INBOARD	700-750	150-200	150-200	475-525
6 OUTBOARD	700-750	150-200	150-200	475-525
7 INBOARD	475-525	150-200	150-200	350-400

R Main Roller Torque Values (Lb-In.) (Cont)
R Table 401

SLAT NO.	UPPER FORWARD	LOWER FORWARD	UPPER AFT	LOWER AFT
7 OUTBOARD	700-750	150-200	150-200	475-525

SLAT TRACK SIDE ROLLERS - REMOVAL AND INSTALLATION

1. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
12-23-01	Wing Leading Edge Slat Actuator Lubrication
29-11-00	Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Verify that hydraulic systems A and C are turned off (Ref. 29-11-00).

(2) Install warning tags on Flight Engineer/Second Officers Hydraulic system panel, zone 215, and on Hydraulic Service Panel, zone 147.

(3) Remove applicable wing leading edge front spar and slat drive access panels (Ref. 6-40-00), and gain access to side roller.

(4) Remove bolts and attaching hardware securing side roller fitting to track rib. Remove side roller from aircraft. Note and save laminated shims and spacers (if installed) between the roller fitting and the attaching rib.

B. Installation

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

R (1) On the inboard slat track ribs,
R install side roller on rib with bolts, nuts, washers,
R and shims. Use shims that were installed on roller
R that was removed.

R On the outboard slat track ribs,
R install side rollers on rib with bolts, washers,

R R spacers, and shims. Use shims that were installed on roller that was removed.

NOTE: Spacers and shims are positioned between the side roller fitting and rib.

R R R R (2) Force track against opposite side roller. Verify gap between replacement side roller and track is 0.030 to 0.050 inch. If not, adjust laminated shimming thickness.

NOTE: Contact at both upper and lower sides of track is desirable, however, contact at only the upper or lower side of track is acceptable, depending on track twist. Do not taper the side roller R shims or attempt to correct track twist.

(3) Lubricate side roller (Ref. 12-23-01).

(4) Check slats for operation as outlined in Paragraph D.

C. Side Roller Rigging Adjustment

(1) Check side roller adjustment for inboard track on all slats as follows:

NOTE: Side roller adjustment must be accomplished with the slats fully retracted.

(a) Check dimension A (Ref. Fig. 401) on the outboard side rollers of the inboard track. (Dimension A is measured between rib face and outboard surface of track.)If the side rollers require adjustment, adjust thickness of laminated shims between rollers and rib.

NOTE: Contact at both the upper and lower side of track is desirable, however, contact at only the upper or lower side of track is acceptable, depending on track twist.

(b) With the inboard track against the outboard side rollers, verify 0.030 to 0.050 inch gap between the inboard side rollers and inboard track. [Measure clearance from the same part of track (upper or lower) that is in contact with outboard rollers.]If the inboard side rollers require adjustment, adjust shim thickness.

NOTE: Do not taper the side roller shims.

(2) Check side roller adjustment for outboard track as follows:

(a) On the inboard slats (1 thru 3):

With inboard track against the outboard side rollers, verify that the outboard track is just contacting the outboard side rollers.

(b) On the outboard slats (4 thru 7):

With inboard track against the outboard side rollers, verify that the outboard track is just contacting the outboard side rollers and that the gap between the outboard track and outboard rib face meets requirement of dimension A (Ref. Fig. 401).

(c) If the outboard side rollers require adjustment, adjust shim thickness.

NOTE: Contact at only the upper or lower side of track is acceptable depending on track twist.

(d) With the outboard track against the outboard side rollers, verify a 0.030 to 0.050 inch gap between the outboard track and the inboard side rollers. [Measure clearance from same port of track (upper or lower) that is in contact with the outboard rollers.]If the inboard side rollers require adjustment, adjust shim thickness.

(3) On the inboard slats only, check clearance between slat track and stop fitting assembly as follows (Ref. Fig. 401, View A).

(a) With track held against the outboard rollers, verify 0.020- to 0.050-inch clearance between the slat track and stop fitting assembly (stop body, bolt head, or tab washer).

(b) If clearance is incorrect, add or adjust laminated shim between track stop fitting and rib.

D. Slat Operational Check

(1) Remove tags from hydraulic control panels.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

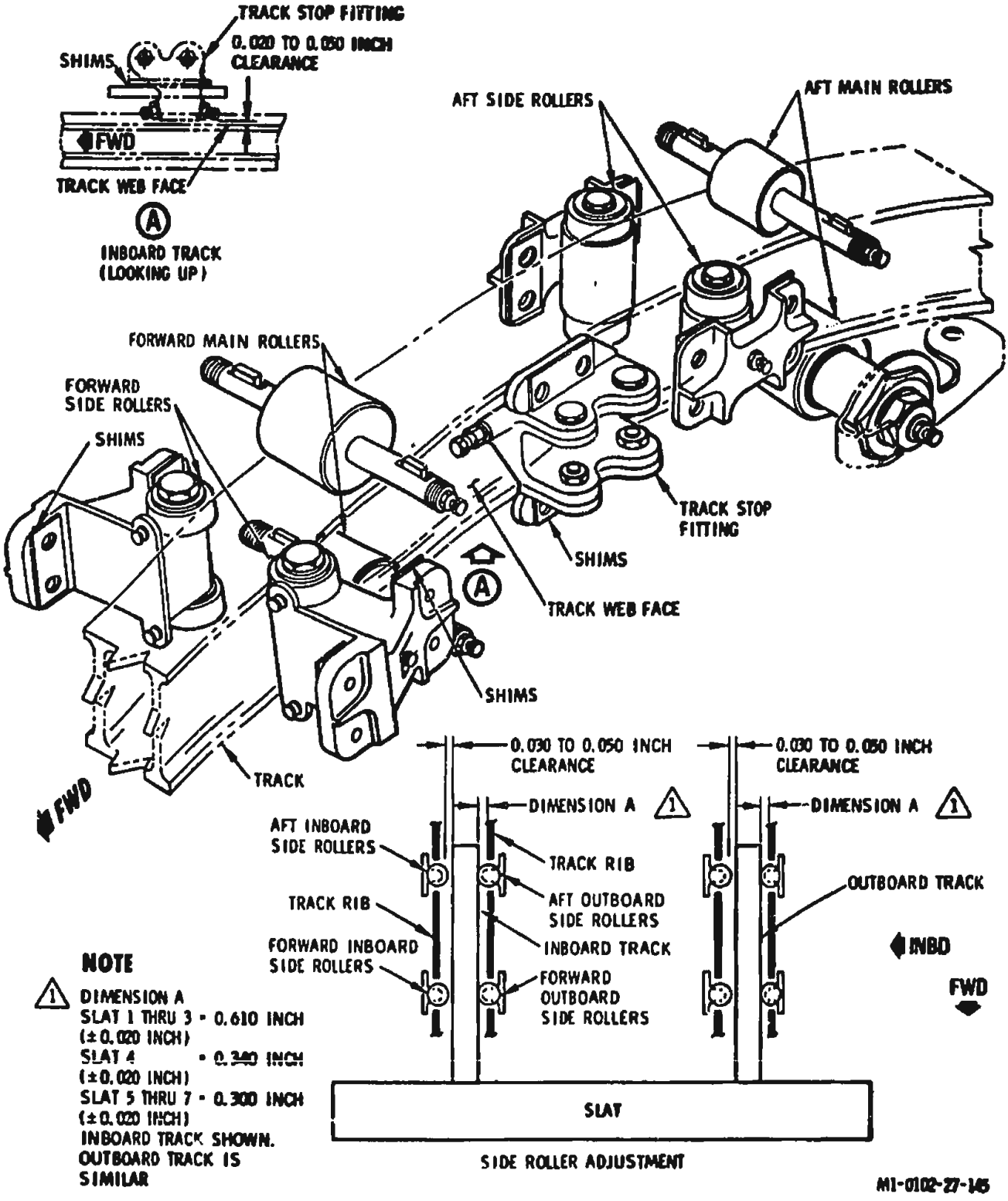
(2) Turn on hydraulic system A or C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(3) Operate slats by positioning flap handle between the 0- and 4-degree detents for several cycles. Check for smooth operation of slat tracks and rollers.

(4) Turn off hydraulic power (Ref. 29-11-00).

(5) Close access doors.



R R Slat Track Side Roller Adjustment
Figure 401

R EFFECTIVITY: ALL
R R
001B

SLAT ASYMMETRY COMPARATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
27-81-00	Slat Control System - Fault Isolation
29-11-00	Hydraulic Power Systems - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that FLAP CONTROLS circuit breakers NO. 2 ASYM BK - LE SLAT (J10), and LOCK LIGHT - LE SLAT (J12) are
R open and tagged. check 27-81-00 (Ref. Fig. 104).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breaker NO. 1 ASYM BRAKE - LE SLAT (H22) is open and tagged.

(2) In the mid electrical service center, zone 137, disconnect electrical connectors from the slat
R asymmetry comparator. The comparator is located on the
R right side of the aft bulkhead (Ref. Fig. 401).

(3) Remove screws attaching comparator to structure.

(4) Remove comparator from aircraft.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Place comparator in normal mounting position.

(3) Install screws attaching comparator to structure.

(4) Connect electrical connectors to comparator.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Turn on electrical power (Ref. 24-41-00).

R (7) Check SLAT ASYM DET FAULT light as follows:

(a) Open circuit breaker NO. 1 ASYM BRAKE - LE SLAT (CB2-H22). Verify that SLAT ASYM DET FAULT light on FE/SO annunciator panel comes on.

(b) If light does not come on, check light circuit (Ref. 27-81-00, SCHEM 2). If light circuit OK, replace asymmetry comparator.

(c) Close circuit breaker; light must go off.

(d) Perform Steps (a) through (c) with circuit breaker NO. 2 ASYM BK - LE SLAT (CB1-J10).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CAUTION: PRIOR TO GROUND OPERATION OF WING FLAPS, OBSERVE FOLLOWING TO PREVENT SPOILER SELECTOR ACTUATOR STALL: AILERONS FAIRED ±10 DEGREES; SPEEDBRAKE LEVER WITHIN 2 INCHES OF FULL FORWARD.

(8) Turn on hydraulic system A and C (Ref. 29-11-00).

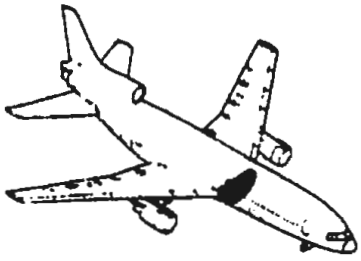
NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(9) Cycle slats by positioning flap handle from 0 to 4 degree flaps and then back to 0. Repeat at least two
R times to verify normal slat system operation.

(10) Verify that SLAT ASYM DET FAULT light on FE/SO annunciator panel does not come on. If light comes on, check 27-81-00 (Ref. Fig. 104).

(11) Turn off hydraulic power (Ref. 29-11-00).

(12) Turn off electrical power (Ref. 24-41-00).



FAULT ISOLATION PROCEDURE

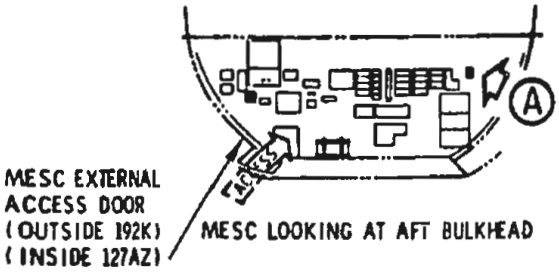
1. EXTEND THE FLAPS AND SLATS. IF A FAULT ISOLATION CHAN IND LIGHT FLASHES ON AND OFF WHILE THEY ARE IN MOTION, NOTE THE FLASHING CHANNEL AND RESET THE COMPARATOR BY CYCLING THE CIRCUIT BREAKERS IN ACCORDANCE WITH THE MAINTENANCE MANUAL. IF NO LIGHTS FLASH OR IF THE ASYM DET FAULT LIGHT COMES BACK ON AFTER RESET, SEE STEP 5A.

CAUTION:
DEPRESSING OR RELEASING THE TROUBLE TEST SWITCH WHILE THE FLAPS OR SLATS ARE MOVING MAY CAUSE THE SYSTEM TO LOCK UP.

2. DEPRESS AND HOLD THE LEFT WING TROUBLE TEST SWITCH AND RETRACT THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE LEFT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
3. DEPRESS AND HOLD THE RIGHT WING TROUBLE TEST SWITCH AND EXTEND THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE RIGHT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
4. IF 1ON STEP 2 AND 3 THE SAME CHAN IND LIGHT AS STEP 1 FLASHES, REPLACE THE ASYMMETRY COMPARATOR.
5. IF NO CHAN IND LIGHTS FLASH INDICATING NORMAL COMPARATOR AND TRANSDUCERS, OR IF RESETTING THE CIRCUIT BREAKERS DO NOT CLEAR ASYM DET FAULT LIGHT, REFER TO MAINTENANCE MANUAL CHAPTER 27-81 FLAPS (OR 27-51 SLATS), FAULT ISOLATION SECTION FOR ISOLATION TO SHUT OFF VALVES, BRAKE SOLENOIDS, 28 VOLT SUPPLIES, OR COMPARATOR.

NOTE: IF THE FLAP/SLAT SYSTEMS AND THE ASYMMETRY COMPARATOR INDICATIONS ARE NORMAL BUT THE COCKPIT INDICATION IS ABNORMAL, REFER TO THE ILCO TEST IN THE MAINTENANCE MANUAL CHAPTER 33-17-00, PAGE 801.

(DECAL FOR -115 COMPARATOR)



FAULT ISOLATION PROCEDURE

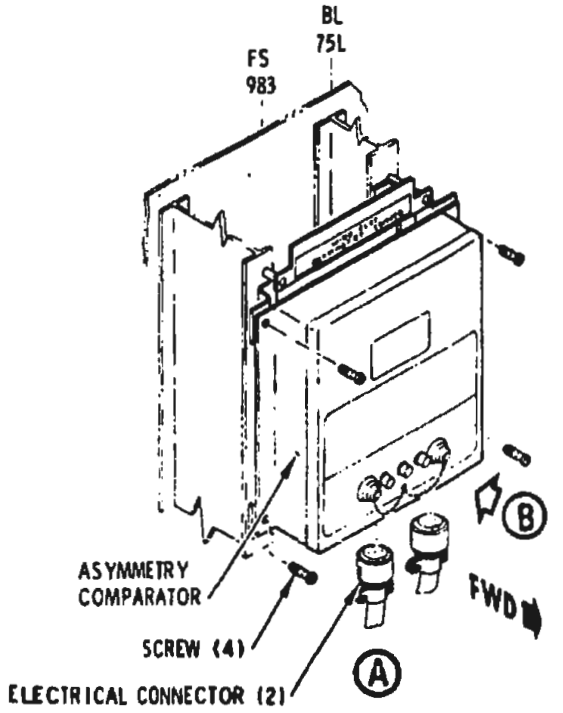
WITH FLAPS/SLATS MOVING, FULLY DEPRESS LEFT WING TROUBLE TEST SWITCH, WHILE CHAN IND IS OFF AND HOLD FOR AT LEAST FIVE SECONDS. RELEASE ONLY WHEN CHAN IND OFF. REPEAT WITH RIGHT WING TROUBLE TEST SWITCH.

CAUTION: PRESSING EITHER TROUBLE TEST SWITCH WHILE THE CHAN IND IS ON WILL CAUSE ASYMMETRY LOCKUP

IF THE LIGHTED CHAN IND EXTINGUISHES AND ANOTHER CHAN IND ILLUMINATES FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THE SWITCH CAUSING THE CHANGE.

IF CHAN IND DOES NOT CHANGE POSITION FOR EITHER TROUBLE TEST SWITCH DEPRESSION, REPLACE THE COMPARATOR 672836.

(DECAL FOR -111 COMPARATOR)



FAULT ISOLATION PROCEDURE

WITH FLAPS / SLATS MOVING, PRESS AND HOLD LEFT WING THEN RIGHT WING TEST SWITCH FOR AT LEAST FIVE SECONDS EACH.

IF CHANNEL INDICATOR CHANGES POSITION FOR EITHER SWITCH DEPRESSION, REPLACE WING TRANSDUCER 672834 ASSOCIATED WITH THAT SWITCH CAUSING CHANGE.

ALL OTHER COMBINATIONS OF FAILURES INDICATE A FAULTY COMPARATOR 672836

(DECAL SHOWN FOR -109 COMPARATOR)

B

M1-0003-27-350

R Slat Asymmetry Comparator - Removal and Installation
R Figure 401

SLAT ASYMMETRY BRAKE - REMOVAL AND INSTALLATION

1. Equipment and Materials

SCREW, NAS 1351-3H-6P, or equivalent

Lubricant, MIL-G-23827, Grease, Aircraft General, or equivalent

Sealing Compound, MIL-S-8660B (Dow Corning DC4), or equivalent

Cleaner, TT-M-261B (Methyl-Ethyl-Ketone), or equivalent

MS24665-134 Cotter Pin

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.020-inch diameter, or equivalent

Laminated Shim, LS 5909C010-0010, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
31-31-00	Digital Flight Data Recorder System - (DFDR) - Fault Isolation
27-81-00	Leading Edge Slat System - Adjustment and Test
27-82-01	Slat Position Transmitter - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices
31-31-00	Digital Flight Data Recorder (DFDR) System - Adjustment and Test

3. Removal/Installation

CR CR NOTE: AD 85-23-01 applies. Only P/N 720007H or later brakes are to be installed on TWA aircraft.

A. Removal (Ref. Fig. 401)

R (1) Retract slats fully by positioning flap handle to 0-degree detent (Ref. 27-81-00).

(2) Open and tag following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: NO. 2 ASYM BK LE SLAT (J10)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: NO. 1 ASYM BRAKE LE SLAT (H22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215: POSN IND LE SLAT (K17)

(3) Shut off hydraulic systems A and C (Ref. 29-11-00).

(4) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(5) Open access panel 521TB to gain access to asymmetry brake in outboard leading edge (Ref. 6-40-00).

(6) Remove rotary transducer from bottom of brake.

NOTE: Do not disconnect electrical connector.

(7) Remove three bolts and disengage spline coupling sleeve at torque tube coupling inboard of brake.

(8) Disconnect brake solenoid and slat position transmitter electrical connectors.

(9) Remove bolt, shim and nut securing outboard side of brake to front spar clevis.

(a) Retain shim.

(10) Remove bolts (two places) securing inboard side of brake to front spar bracket.

(11) Remove asymmetry brake with slat position transmitter from aircraft.

(12) Remove bolt, nut, and fixed spline from brake.

(13) Remove slat position transmitter from brake by removing attaching screws.

B. Installation (Ref. Fig. 401)

WARNING: VERIFY HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Verify circuit breakers opened in Step 3A(2) are open and tagged.

(2) Apply a light film of MIL-G-23827 grease to slat position transmitter gear teeth.

(a) Verify preformed packing is installed on transmitter base.

(b) Rotate transmitter gear until mechanical detent is felt (slat full-up position).

(c) Position transmitter on brake with slotted mounting holes centered over screw mounting holes in brake; verify transmitter gear does not rotate when meshed with brake assembly gear.

(d) Install washers and screws and lock-wire.

NOTE: If tri-wing screws are used to mount the position transmitter, replace with NAS1351-3H-6P screws (socket-head cap screws), or equivalent.

(3) Butter-lubricate all splined surfaces with MIL-G-23827 grease.

(4) Align mounting holes and engage fixed spline and brake input shaft.

(a) Install bolt and nut.

(b) Torque nut 10 to 12 lb in. and install cotter pin.

(5) Position brake on aircraft and install bolts (two places) securing inboard side of brake to front spar bracket.

(a) Lock-wire bolts to bracket.

CAUTION: IMPROPER BOLT OR SHIM INSTALLATION MAY PRELOAD BRACKET AND LEAD TO BRACKET FAILURE. DO NOT ATTEMPT TO INSTALL OUTBOARD BOLT UNTIL INBOARD BOLTS ARE INSTALLED, TORQUED AND LOCK-WIRED.

(6) Measure gap between brake and front spar lug at outboard side of brake.

(a) Select and install a shim to fill gap. Maximum gap allowable is 0.002 inch.

R R NOTE: If shim has to be replaced, a new hole of 5/16 inch diameter must be drilled.

(b) Install bolt and nut.

(7) Connect brake solenoid and slat position transmitter electrical connector.

(8) Remove tags and close circuit breakers opened in Step 3A(2).

(9) Turn on electrical power (Ref. 24-41-00).

(10) Adjust slat transmitter (Ref. 31-31, Fault Isolation, Table 102, DFDR signal code 96-15). (Adjust transmitter by rotating input shaft of brake Use preferred check using DFDR test equipment or alternate check using slat monitor panel (Ref. 27-82-01, Removal and Installation).

C (11) Deleted

(12) Align mounting holes and engage spline coupling sleeve and fixed spline.

(a) Install bolts.

(b) Torque bolts 15 to 20 lb in. and lock-wire.

(c) Verify slat position pointer still indicates 0 degrees.

(13) Check brake operation as follows:

(a) Rotate rotary transducer shaft in either direction.

C C C C (b) Verify that both left and right asymmetry brakes have actuated (pop-out indicator extended approx 1/2 in). L.E. SLAT LOCK light on FE/SO annunciator panel will come on.

C C C C (c) Reset slat comparator by opening following circuit breakers for 5 seconds and then closing: NO. 2 ASYM BK - LE SLAT (CB1-J10), and NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

C C C C (d) Reset both asymmetry brakes (use wrench to rotate hex bolt on reset device to depress pop-out indicator). Requires approximately 320 inch/pounds force to reset.

(14) On rotary transducer 672834-111 and 113 only) completely fill rotary transducer mounting cavity with MIL-S-8660B sealing compound (Ref. Fig. 401).

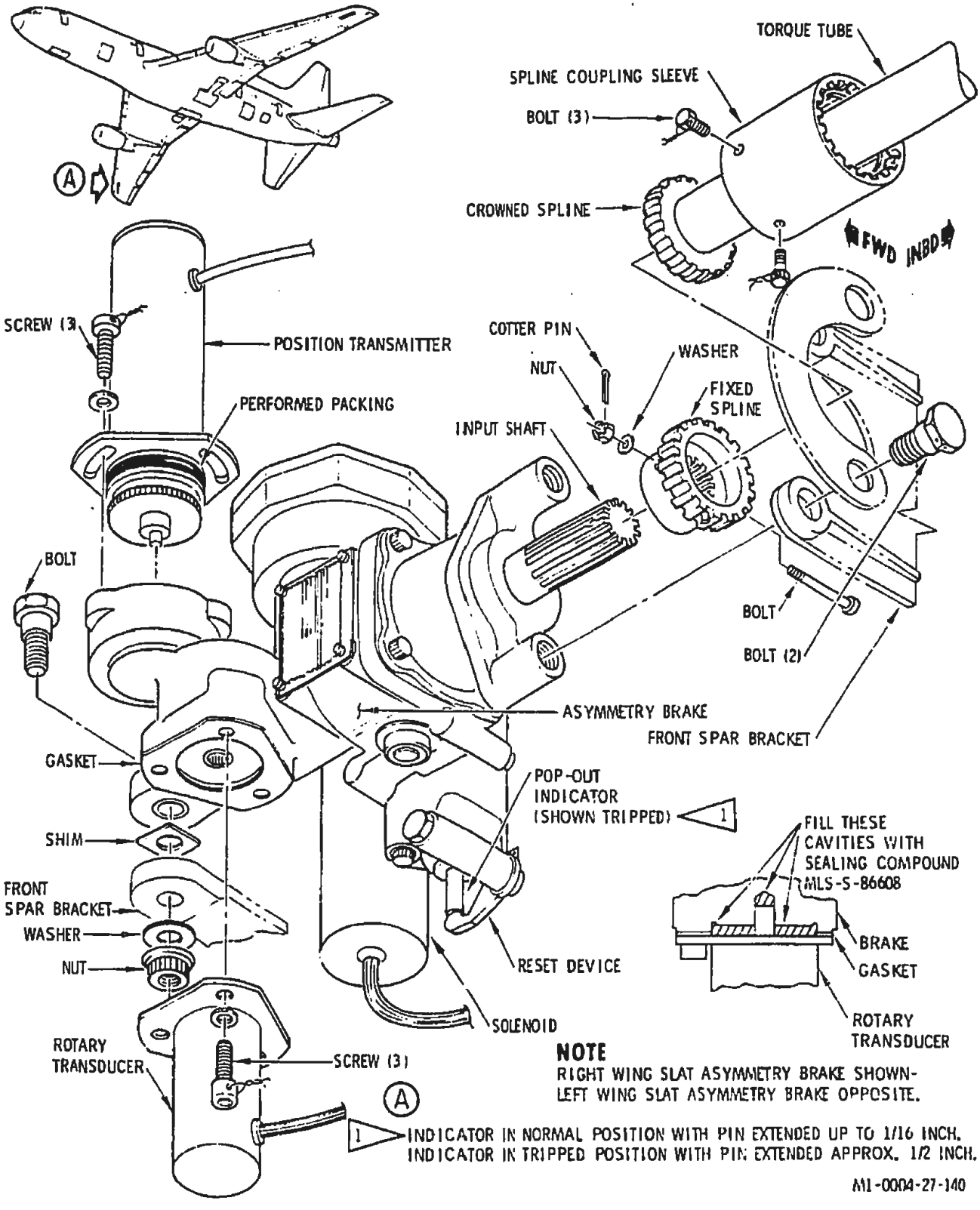
NOTE: If the latest (oil-filled) rotary transducer (672834-115, 117 or 119) is being installed on an asymmetry brake that contains sealing compound in the rotary transducer mounting cavity, completely remove the sealing compound. Use cotton tip swabs and TT-M-261B cleaner. (A light coating of sealing compound remaining on surfaces is acceptable.)

(15) Position rotary transducer on brake, with gasket installed between transducer and brake, and install mounting screws.

(a) Lock-wire screws.

NOTE: If tri-wing screws are used to mount the rotary transducer, replace with NAS1351-3H-6P screws (socket-head capscrew), or equivalent.

(16) Remove tags from hydraulic control panels.



CR
CR

Asymmetry Brake - Removal and Installation
Figure 401

SLAT ASYMMETRY BRAKE - ADJUSTMENT AND TEST

1. General

C This procedure contains the functional test for P/N 720007H Asymmetry Brakes.

C AD 85-23-01 applies. Paragraph 4.A., Functional Test, 1500
C Pound-inches Minimum Holding Torque, is the repeating functional
C test for P/N 720007H asymmetry brakes.

An operational test of the Slat Asymmetry Detector System is covered in Maintenance Manual section 27-81-00, Adjustment and Test, Paragraph 4.C.

2. Equipment and Materials

CR Slat Asymmetry Brake Adapter - G/ITEL 27-81-75 (TWA Tool No.
CR 27-86-08-0006)

Torque wrench, 3000 pound-inch or equivalent

Lubricant, MIL-G-23827, Grease, Aircraft General, or equivalent

3. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-81-00	Leading Edge Slat System - Adjustment and Test
27-81-37	Slat Asymmetry Brake - Removal and Installation
27-82-01	Slat Position Transmitter - Removal and Installation
29-11-00	Hydraulic Power System - Maintenance Practices
31-31-00	New Digital Flight Data Recorder (DFDR) System - Adjustment and Test

C 4. Adjustment/Test

C A. Functional Test, 1500 Pound-inches Minimum Holding Torque -
C Slat Asymmetry Brake.

(1) Verify that hydraulic systems A and C are shut off and hydraulic control panels tagged.

(2) Open access panel under each slat asymmetry brake:

521TB, left wing; 621TB, right wing (Ref. 6-40-00).

(3) Turn on electrical power (Ref. 24-41-00).

(4) Verify that following circuit breakers are closed:

NO. 2 ASYM BK - LE SLAT (CB1-J10) and NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

(5) Remove rotary transducer from bottom of either asymmetry brake. Do not disconnect electrical connector.

(6) Rotate rotary transducer shaft in either direction until asymmetry brakes trip. Verify that both asymmetry brakes have tripped (pop-out indicator on brakes will pop out).

(7) Install rotary transducer on asymmetry brake.

NOTE: No timing is required.

(8) Disconnect torque tube from left asymmetry brake, as follows (Ref. 27-81-37, Fig. 401):

(a) Remove three bolts from spline coupling sleeve and slide sleeve inboard to disengage from splines.

(b) Position torque tube out of the way.

R (9) Prepare torque wrench/adapter assembly as follows:

R (a) Install torque wrench adapter on 3000 or
R equivalent pound-inch torque wrench.

R (b) Calculate the torque correction factor for the
R torque wrench/adapter combination in accordance
R with instructions on Figure 501.

R (c) Multiply the torque correction factor times 1500
R pound-inches and record as the torque wrench
R reading required for Step 4A(12).

R (d) Multiply the torque correction factor times 2400
R pound-inches and record as the torque wrench
R reading required for Step 4A(13).

R (10) Install torque wrench adapter on asymmetry brake input
R shaft. (11) With torque wrench in place, rotate torque shaft a minimum of 30 degrees in direction to be measured. Reduce torque to zero.

R (12) Slowly increase torque until shaft rotates or until
R torque calculated in Step 4A(9)(c) is reached. This
R will result in 1500 pound-inches being applied to the
R input shaft. Hold torque for 5 seconds. If shaft
R rotates, replace asymmetry brake immediately.

R (13) Slowly increase torque until shaft rotates or until
R torque calculated in Step 4A(9)(d) is reached. This
R will result in a maximum of 2400 pound-inches being
R applied to the input shaft. Do not exceed 2400
R pound-inches applied to the input shaft. If shaft does
R not rotate, replace asymmetry brake immediately.

R (14) Note torque wrench reading obtained just before shaft
R started to rotate in Step 4A(12) or 4A(13). Calculate
R torque qpplied to the input shaft in accordance with
R instructions on Figure 501. Record true maximum
R torque, date, asymmetry brake part number, asymmetry
R brake serial number, aircraft serial number and
R aircraft flight hours. (15) Remove torque wrench and adapter.

(16) Butter lube all mating surfaces with grease.

R (17) Repeat Steps (8) and (10) through (16) for right asymmetry brake.

(18) Reset asymmetry brakes as follows:

(a) Open following circuit breakers for 5 seconds and then close: NO. 2 ASYM BK - LE SLAT (CB1-J10) and NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

(b) Reset both asymmetry brakes (use wrench to rotate hex bolt on reset device to depress pop-out indicator).

(19) On right asymmetry brake,
adjust slat transmitter to zero by rotating input shaft of asymmetry brake. Determine zero setting in accordance with Maintenance Manual 31-31-00 Adjustment and Test, Table 501, DFDR signal code 96-15. If DFDR test equipment is not available, use FE/SO Slat Monitor panel slat position indicator to determine zero.

(19) On left asymmetry brake,
adjust slat transmitter to zero by rotating input shaft

of asymmetry brake. Determine zero setting with FE/SO Slat Monitor panel slat position indicator.

(20) Recouple splines coupling sleeves to crowned and fixed splines and install bolts in spline coupling sleeves and lock-wire bolts.

(21) Perform Slat Asymmetry Brake Operational Check, Paragraph 4.C.

C. Slat Asymmetry Brake Operational Check

(1) Verify that following circuit breakers are closed:

(a) On pilots overhead circuit breaker panel CB1, zone 210:

FLAP CONTROLS

NO. 2 ASYM BK - LE SLAT (J10) and TE FLAP (J11)

LOCK LIGHT - LE SLAT (J12) and TE FLAP (J13)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE - TE FLAP (H21) and LE SLAT (H22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel:

POSN IND - TE FLAP (K16) and LE SLAT (K17).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Remove tags from hydraulic control panels. Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(3) Cycle slats (by operating flap control handle from zero to 4-degree detent) from full up to full down and back to full up. Verify the following:

(a) Slat operation is normal.

(b) Slat indicator pointers follow slat operation (Ref. 27-81-00).

(c) SLAT ASYM DET FAULT light on FE/SO annunciator panel does not come on.

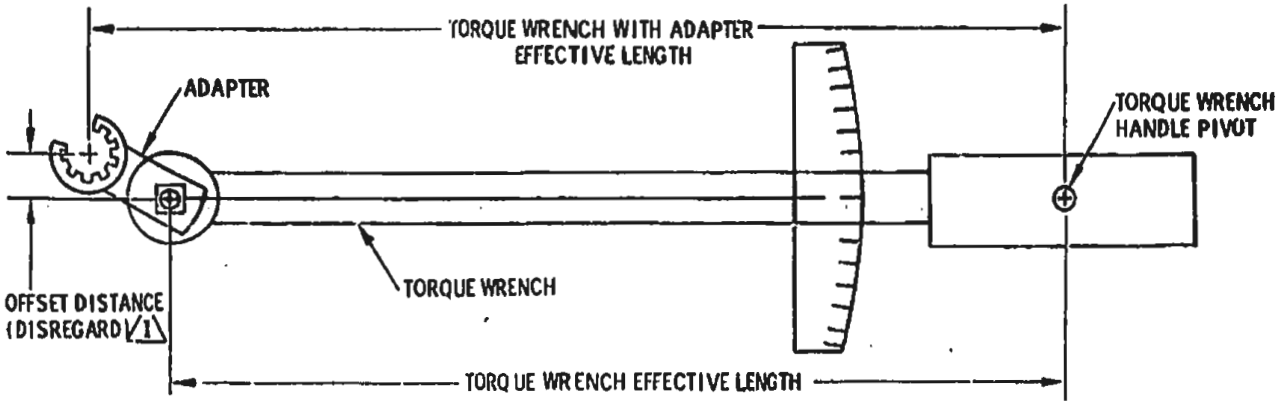
(4) Turn off electrical power if no longer required (Ref. 24-41-00).

(5) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(6) Close access doors under asymmetry brakes.

CALCULATE TORQUE CORRECTION FACTOR [(REF. STEP 4A(9)(b)] AS FOLLOWS:

(1) MEASURE TORQUE WRENCH EFFECTIVE LENGTH.
(2) MEASURE TORQUE WRENCH WITH ADAPTER EFFECTIVE LENGTH.
(3) DIVIDE TORQUE WRENCH EFFECTIVE LENGTH BY TORQUE WRENCH WITH ADAPTER EFFECTIVE LENGTH.



TORQUE WRENCH EFFECTIVE LENGTH ____ = [ ] / TORQUE WRENCH WITH ADAPTER EFFECTIVE LENGTH = [ ] = [ ] CORRECTION FACTOR

CALCULATE TORQUE WRENCH READINGS [(REF. STEPS 4A(9)(c) AND 4A(9)(d)] AS FOLLOWS:

(1) MULTIPLY CORRECTION FACTOR TIMES DESIRED TORQUE.

CORRECTION FACTOR FROM ABOVE		DESIRED TORQUE AT INPUT SHAFT		USE TORQUE WRENCH READING
CORRECTION FACTOR [ ]	X	1500 POUND-INCHES	=	[ ] POUND-INCHES
CORRECTION FACTOR [ ]	X	2400 POUND-INCHES	=	[ ] POUND-INCHES

CALCULATE TRUE MAXIMUM TORQUE [(REF. STEP 4A(14)] AS FOLLOWS:

(1) DIVIDE TORQUE WRENCH READING BY CORRECTION FACTOR.

TORQUE WRENCH READING JUST PRIOR TO SHAFT ROTATION = [ ] / CORRECTION FACTOR = [ ] = [ ] TRUE MAXIMUM TORQUE

NOTE

/1\ ALTHOUGH THE OFFSET DISTANCE SHOULD BE AS SMALL AS POSSIBLE, IT DOES NOT AFFECT THE CORRECTION FACTOR.

M1-0000-27-1244

R Asymmetry Brake Troque Correction Factor Work Sheet
R Figure 501

R EFFECTIVITY: ALL

SLAT ASYMMETRY ROTARY TRANSDUCER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

Sealing Compound, MIL-S-8660B (DOW CORNING DC4), or equivalent

Cleaner, TT-M-261B (Methyl-Ethyl Ketone), or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-81-00	Leading Edge Slat System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal (Ref. Fig. 401)

R WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF
R (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE
R HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Verify that hydraulic systems A and C are shut off (Ref. 29-11-00).

R (2) Install warning tags on Flight Engineer/Second Officers
R Hydraulic Service Panel, zone 215, and on Hydraulic
R Service Panel, zone 147.

(3) On Flight Engineer/Second Officers aft circuit breaker panel CB3, Zone 215, verify that circuit breaker POSN IND - LE SLAT (K17) is open.

(4) Open the following applicable access panel (Ref. 6-40-00):

For left slat asymmetry rotary transducer: 521TB

For right slat asymmetry rotary transducer: 621TB

(5) Disconnect transducer electrical cable connector.

(6) Remove screws and washers securing transducer to brake, and remove transducer (Ref. Fig. 401).

B. Installation (Ref. Fig. 401)

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Connect rotary transducer electrical connector.

(2) Verify that following circuit breakers are closed: NO. 2 ASYM BK - LE SLAT (CB1-J10), LOCK LIGHT - LE SLAT (CB1-J12), and NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

(3) Turn on electrical power (Ref. 24-41-00).

(4) Check rotary transducer as follows:

(a) Turn shaft of rotary transducer in either direction.

(b) Verify that both left and right asymmetry brakes have actuated (pop-out) indicator extended, and that FLAP/SLAT LOCK light on FE/SO annunciator panel comes on.

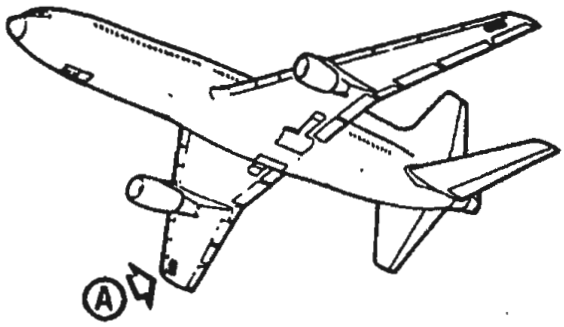
(5) Reset asymmetry comparator by opening following circuit breakers for 5 seconds and then closing: NO. 2 ASYM BK - LE SLAT (CB1-J10), and NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

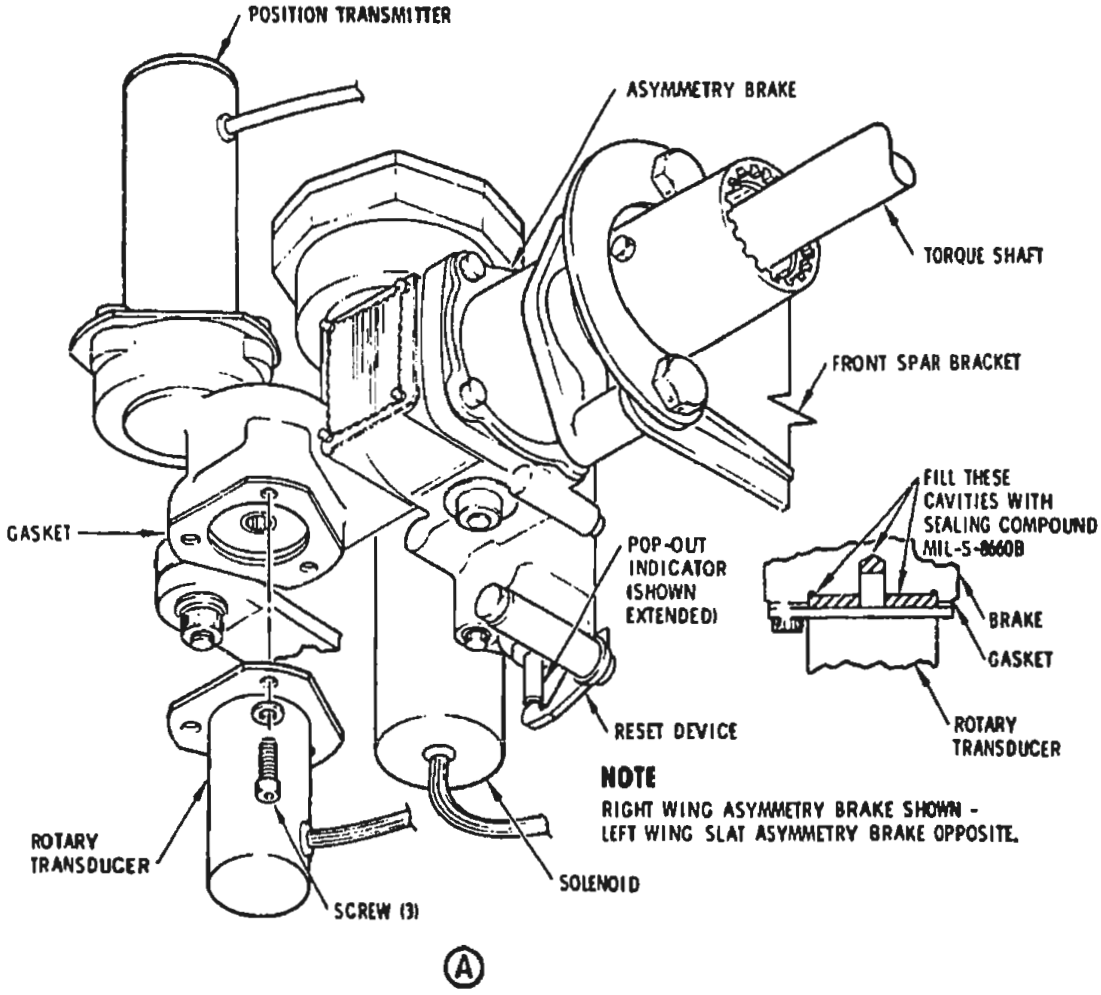
CAUTION: DO NOT EXCEED 30 LB-FT TORQUE ON ASYMMETRY BRAKE RESET DEVICE.

(6) Reset both asymmetry brakes by rotating bolt head on reset lever to depress pop-out indicator.

(7) Completely fill rotary transducer mounting cavity on brake with MIL-S-8660B sealing compound. Position transducer on asymmetry brake assembly, and insert transducer shaft into splined hole in brake assembly. Verify that gasket is installed between transducer and brake.

NOTE: If the latest (oil-filled) rotary transducer (672834-115 or 117) is being installed on an asymmetry brake that contains sealing compound in the rotary transducer mounting cavity, completely remove the sealing compound. Use cotton tip swabs and TT-M-261B cleaner. (A





MI-0001-27-367

Slat Asymmetry Rotary Transducer - Removal and Installation
Figure 401

light coating of sealing compound remaining on surfaces is acceptable.)

(8) Secure transducer with washers and screws. Lock-wire screws.

NOTE: If tri-wing screws are used to mount the rotary transducer, replace with socket-head capscrew.

R

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Remove warning tags from hydraulic control panels.

(10) Turn on hydraulic system C (Ref. 29-11-00).

(11) Cycle slats by positioning flap handle to 4 degrees and then back to 0. Verify that slat operation is normal. Verify that SLAT ASYM DET FAULT light on FE/SO annunciator panel does not come on.

(12) Turn off hydraulic system C if no longer required (Ref. 29-11-00).

(13) Turn off electrical power if no longer required (Ref. 24-41-00).

(14) Close access panels.

SLAT PDU HYDRAULIC SYSTEM C ISOLATION VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

   One-gallon container (for catching oil)

   Hydraulic line protective plugs

   Hydraulic fitting protective Caps

2. Referenced Procedures

6-40-00	External Access Doors and Panels
12-13-01	Hydraulic Reservoir Air Bleed Check
20-29-01	Fluid Lines and Fittings - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

   WARNING: VERIFY THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

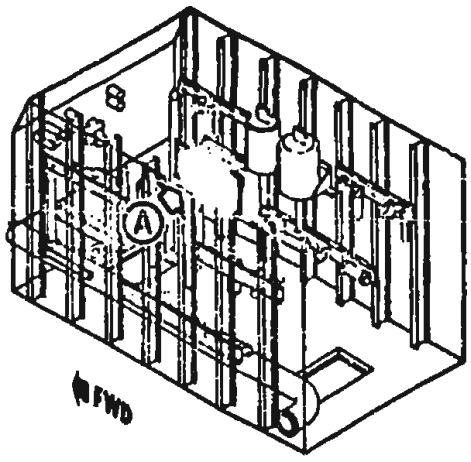
   A. Removal (Ref. Fig. 401)

      (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breaker NO. 1 ASYM BRAKE - LE SLAT (H22) is opened and tagged.

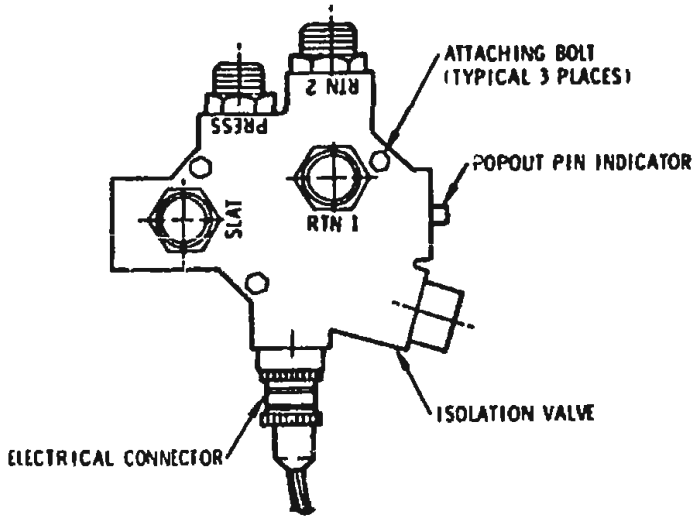
      (2) Open access door 147AB to hydraulic service center (Ref. 6-40-00).

      (3) Locate isolation valve on forward right side of hydraulic service center. Disconnect electrical connector from isolation valve (Ref. Fig. 401).

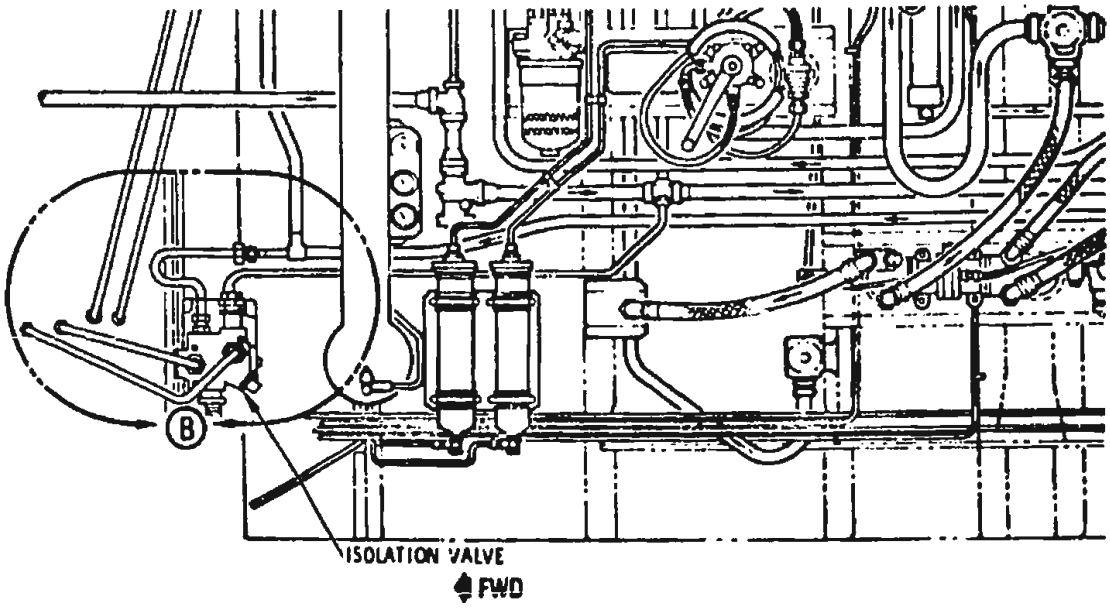
      (4) Place container under isolation valve. Disconnect four hydraulic lines to valve.



HYDRAULIC SERVICE CENTER



(B)
ISOLATION VALVE



(A)
RIGHT SIDE OF HYDRAULIC SERVICE CENTER

M1-0100-27-392

Slat PDU Hydraulic System C Isolation Valve
Removal and Installation
Figure 401

(5) Remove three bolts securing valve to bracket. Remove isolation valve.

(6) Install protective caps and plugs on valve and hydraulic lines.

B. Installation (Ref. Fig. 401)

(1) Install isolation valve on bracket with three bolts and washers. The valve is positioned with the electrical connector pointing down.

(2) Remove hydraulic line protective plugs. Connect four hydraulic lines to the isolation valve. Torque hydraulic line nuts (Ref. 20-29-01).

(3) Install electrical harness connector to isolation valve.

(4) Remove tag and close circuit breaker opened in Step A(1).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on electrical power (Ref. 24-41-00).

(6) Remove tags from hydraulic control panels.

(7) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at

3000 psi may be used to pressurize the A and C hydraulic systems.

(8) Bleed slat system by cycling slats from full up to full down and back to full up. Cycle slats by positioning flap handle from zero to the 4-degree detent and back to zero. Bleed until slat operation is smooth.

NOTE: After bleeding slats PDU, bleed associated hydraulic system reservoir (Ref. 12-13-01).

(9) Check operation of isolation valve as follows:

(a) Turn off hydraulic system A.

(b) With only C hydraulic system pressure available, cycle slats from full up to full down and back to full up. Verify normal operation of isolation valve: when slats are full up or full down, popout indicator pin on isolation valve must protrude to indicate that valve is shut off (deenergized). When slats are in transit, popout indicator pin must be flush with valve cover to indicate that valve is open (energized).

(10) Check isolation valve hydraulic connections for leakage.

(11) Turn off hydraulic power if no longer required.

(12) Turn off electrical power if no longer required.

(13) Close access door to hydraulic service center.

SLAT CONTROL START-UP SWITCH ASSEMBLY - REMOVAL AND INSTALLATION

R 1. General

R The Slat Control Start-up Switch Assembly includes a switch and
R an actuator. The actuator is a roller and lever assembly that
R transfers motion from the flap/slat programmer cam to the
R switch. Defective switches or actuators can be replaced
R separately.

R There are two switches and two actuators mounted side by side.
R One switch assembly is mounted on each side of the bracket.

R 2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Removal/Installation

A. Removal

R (1) Verify following circuit breakers are open and tagged:

R (a) On Pilots overhead circuit breaker panel CB1, zone 210:

R NO. 2 ASYM BK - LE SLAT (J10)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

R NO. 1 ASYM BRAKE - LE SLAT (H22)

R WARNING: VERIFY FLAP HANDLE IS TAGGED IN THE FULL UP
R POSITION TO PREVENT MOVEMENT DURING REMOVAL
R AND REPLACEMENT PROCEDURE.

R (2) Tag flap handle in flight station to prevent
R movement during maintenance procedures.

R (3) Gain access to mid electrical service center (MESC).
R Locate slat start-up switch assembly on bottom of flap/slat programmer which is mounted to the ceiling structure (Ref. Fig. 401).

R R R (4) If start-up switches or switch actuator assemblies are to be replaced, tag and disconnect the start-up switch wires.

NOTE: On earlier aircraft, the switch wires are soldered to the switch terminals. The switch wires run to a terminal board on the MESC aft bulkhead (FS 983) and just to the left of the switches. On later aircraft, the start-up switches incorporate poke-home connectors.

R R (5) Remove the two screws holding both start-up switches to the switch bracket. Remove switches and actuators.

B. Installation

R R (1) Verify circuit breakers opened in Step 3A(1) are still open and tagged.

R R R WARNING: VERIFY FLAP HANDLE IS TAGGED IN THE FULL UP POSITION TO PREVENT MOVEMENT DURING REMOVAL AND REPLACEMENT PROCEDURE.

R (2) Install replacement switch and/or actuator (with actuator rollers pointing forward) on switch bracket with two screws, washers, and nuts. (Note that both start-up switches are attached to bracket with same two screws.)

R R (3) If start-up switch wires were disconnected in Step 3A(4) connect switch wires.

(4) Remove tag from flap handle.

R (5) Cycle flap handle from zero to four degrees and back to zero. Visually verify slat start-up switches are deactivated (off cam) when flap handle is at zero and that switches are actuated by cam when flap handle is moved from zero to four degrees.

(6) Check switch operation as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on electrical power (Ref. 24-41-00).

(b) Close circuit breaker NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

(c) Turn on hydraulic system A and C (Ref. 29-11-00).

(d) Position flap control handle to the four-degree detent. Verify slats fully extend.

(e) Position flap control handle to the zero-degree detent. Verify slats fully retract.

(f) Open circuit breaker NO. 1 ASYM BRAKE - LE SLAT (CB2-H22). Close circuit breaker NO. 2 ASYM BK - LE SLAT (CB1-J10).

(g) Position flap control handle to the four-degree detent. Verify slats fully extend.

(h) Position flap control handle to the zero-degree detent. Verify slats fully retract.

NOTE: If slats fail to extend, raise switches towards slat cable quadrant cam by removing a shim between switch bracket and flap/slat programmer. After shimming check that actuator is not hard against switch case. Recheck switch by opening circuit breaker NO. 2 ASYM BK - LE SLAT (CB1-J10) and performing Steps 3B(b) through 3B(h).

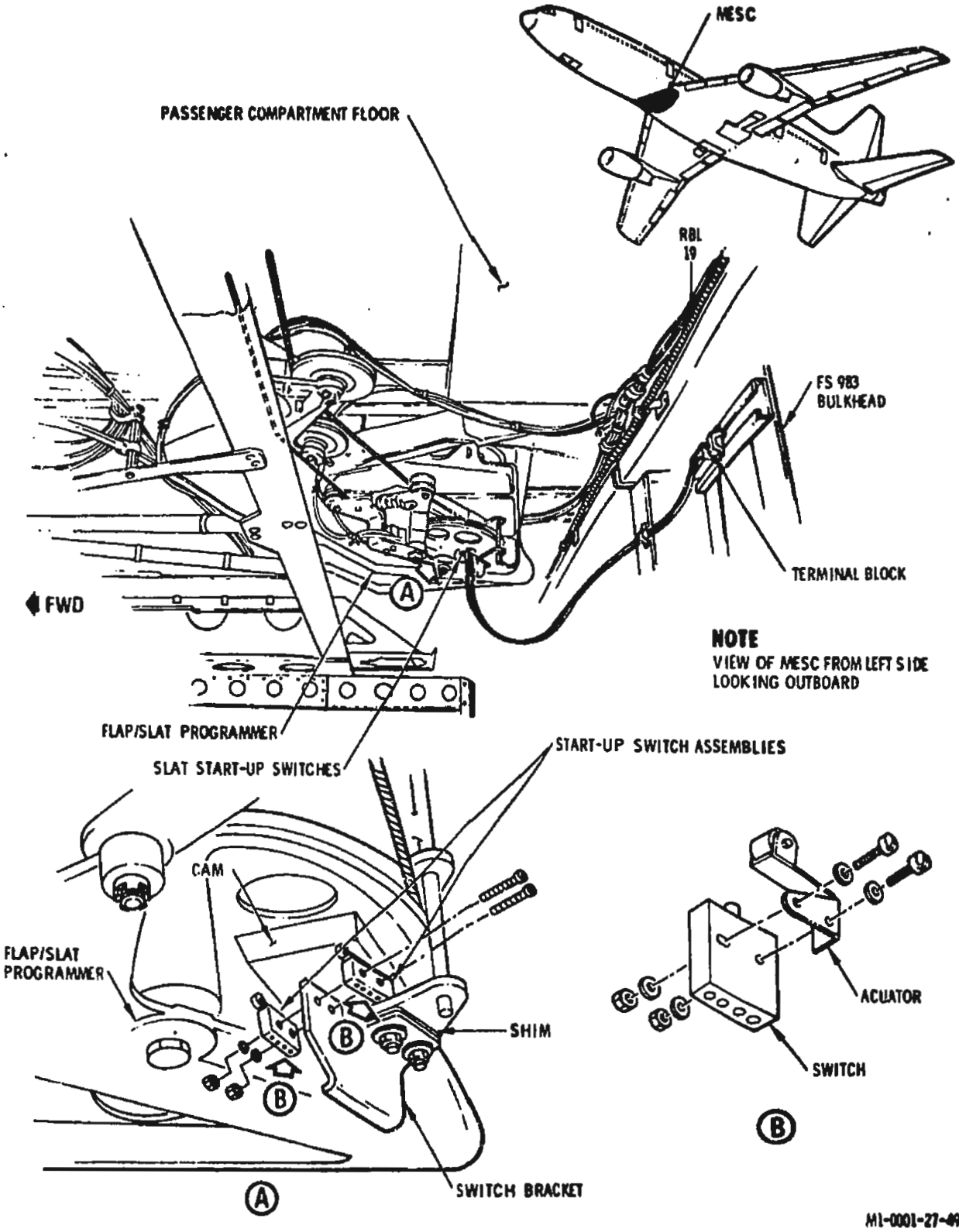
CR
CR

(i) Close circuit breaker NO. 1 ASYM BRAKE - LE SLAT (CB2-H22).

(j) Turn off hydraulic power (Ref. 29-11-00).

(k) Turn off electrical power (Ref. 24-41-00).

(7) Close access door to MESC.



Slat Control Start-up Switch - Removal and Installation
Figure 401

R SLAT PDU SHUTOFF AND RESTRICTING VALVE - REMOVAL AND INSTALLATION

R 1. Equipment and Materials

R Drip pan, 1 gallon capacity

R Lock-wire, Fed Spec QQ-W-390, Cond A, 0-032 inch diameter or
R equivalent

R Hydraulic Fluid, LAC Spec C-34-1224 Type IV, or equivalent

R 2. Referenced Procedures

R	6-40-00	Exterior Access Door and Panels
R	12-13-01	Hydraulic Bootstrap Reservoir - Servicing
R	29-11-00	Hydraulic Power - Maintenance Practices

R 3. Removal/Installation

R A. Removal

R WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT
R OFF. ENSURE FE/SO HYDRAULIC SYSTEM PANEL, ZONE
R 215, AND HYDRAULIC SERVICE PANEL, ZONE 147, ARE
R PLACARDED.

R (1) Depressurize hydraulic systems A and C and tag FE/SO
R Hydraulic System Panel, Zone 215, and Hydraulic Service
R Panel, Zone 147 (Ref. 29-11-00).

R (2) Open access panel 511AB to gain access to Slat PDU
R (Ref. 6-40-00).

R (3) Place drip pan under Slat PDU to catch hydraulic fluid.

R (4) Remove Shutoff and Restricting Valve from Slat PDU
R (Ref. Fig. 401).

R B. Installation

R (1) Wet O-rings and ring seals with hydraulic fluid.

R (2) Install Shutoff and Restricting Valve in Slat PDU (Ref.
R Fig. 401).

R (3) Torque Shutoff and Restricting Valve 180 to 240 in lbs.
R and lock-wire.

R (4) Remove tags from hydraulic control panels installed in
R Step 3A(1).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY
R DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (5) Turn on hydraulic systems A and C (Ref. 29-11-00).

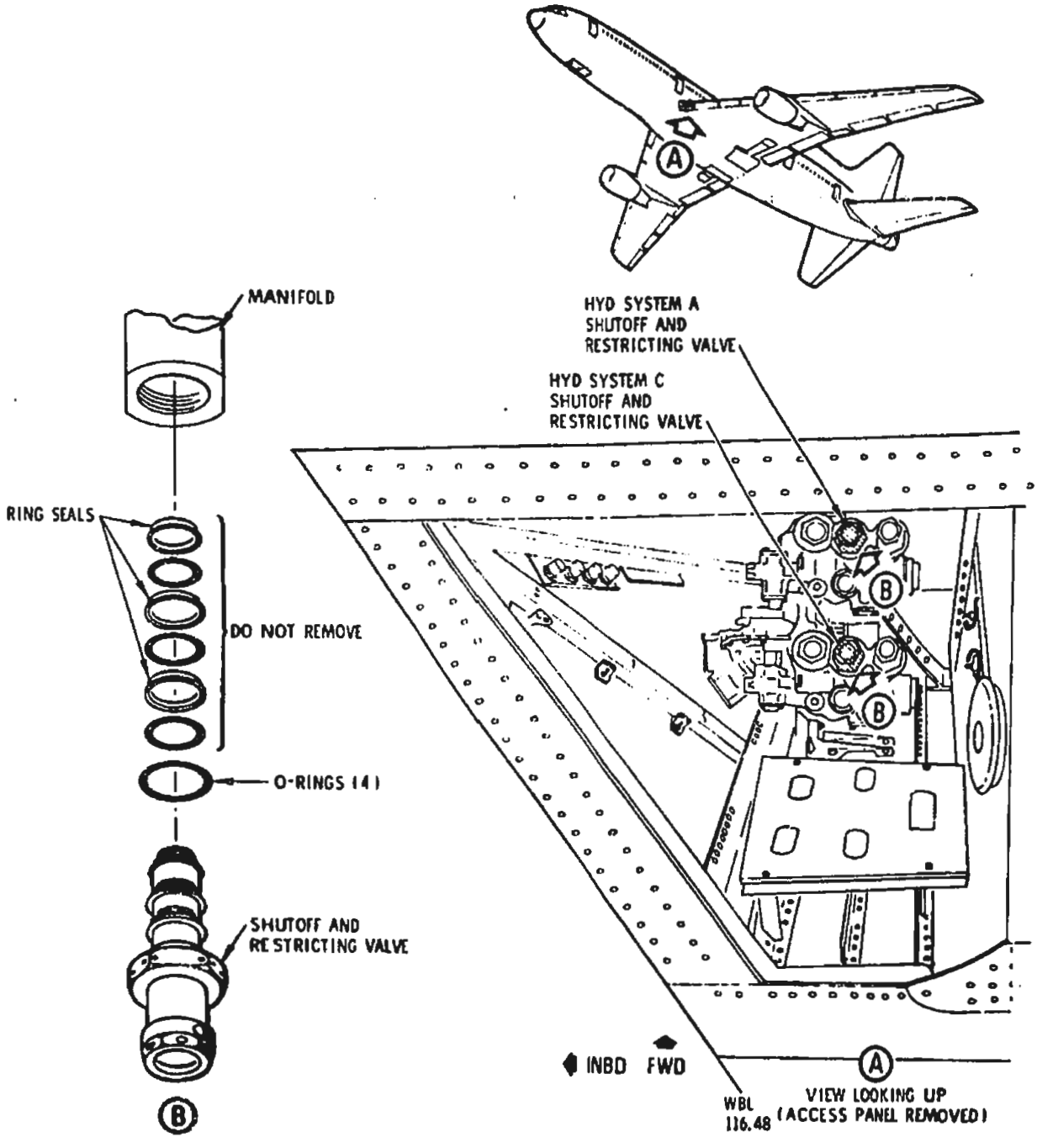
R NOTE: Operating flaps and slats with electric pumps
R can cause "jerky" operation, trip the overspeed
R governor in either or both brakes and give
R invalid results. To perform a valid test of the
R slat actuation system, pressurize the B and C
R hydraulic system using ATM pumps and the A
R hydraulic system using the PTU. Alternately,
R two ground sources each capable of 25 GPM at
R 3000 psi may be used to pressurize the A and C
R hydraulic systems.

R (6) Bleed Slat PDU by cycling Pilots flap control lever in
R Flight Station, zone 210, from 0-degree to 4-degree
R position and back to 0-degree position. Bleed until
R Slat PDU operates smoothly. Visually determine that
R Shutoff Valve is not leaking.

R NOTE: After bleeding slat system, perform AIR CHECK of
R associated hydraulic reservoir. (See Reservoir
R Service Instruction Placard, Ref. 12-13-01).

R (7) Turn off hydraulic power (Ref. 29-11-00).

R (8) Install and secure access panel opened in Step 3A(2).



M1-0000-27-103

R Shutoff and Restricting Valve - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

R R SLAT PDU HYDRAULIC SYSTEM C ISOLATION VALVE RELAY REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 24-41-00 External Power/Ground Service System - Maintenance Practices

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 2. Removal/Installation

R A. Removal (Ref. Fig. 401)

R (1) On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker NO. 1 ASYM BRAKE LE SLAT (H22).

R (2) Enter the mid electrical service center (MESC). On the aft bulkhead (FS 983), right relay panel, locate the SLAT HYD C SHUTOFF relay.

R (3) Remove screws and remove the hydraulic system C shutoff relay.

R B. Installation (Ref. Fig. 401)

R (1) Install the hydraulic system C shutoff relay on the MESC relay panel.

R (2) Close circuit breaker opened in Step A(1).

R (3) Check relay as follows:

R (a) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(b) Turn on only hydraulic system C (Ref. 29-11-00).

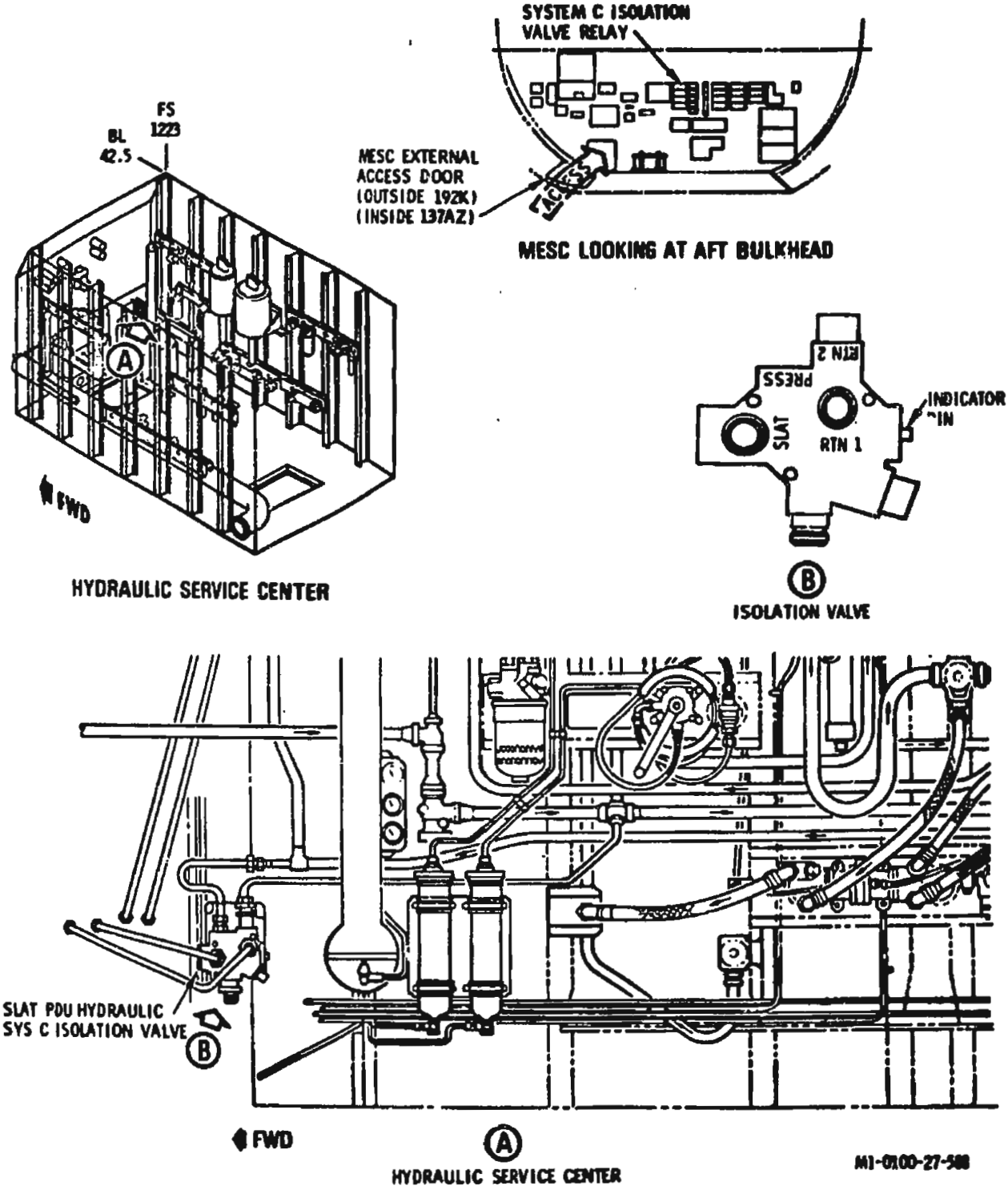
NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the C hydraulic system using ATM pump. Alternately, a ground source capable of 25 gpm at 3000 psi may be used to pressurize the C hydraulic system.

(c) Operate flap handle from the 0-degree detent to the 4-degree detent and back to the 0-degree detent to cycle the slats. Normal operation of the slats verifies that relay is deenergized closed to energize the shutoff valve open.

(d) Gain access to hydraulic service center. Locate system C isolation shutoff valve on the forward lower end of the right bulkhead. With slats fully retracted (or extended), verify that the indicator pin on the shutoff valve is extended. This verifies that the relay has energized open to deenergize the shutoff valve to the closed position.

(e) Shut off hydraulic power (Ref. 29-11-00).

(f) Shut off electrical power if no longer required (Ref. 24-41-00).



R Slat PDU Hydraulic System C Isolation Valve Relay
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL

R
R
001B

FE/SO ANNUNCIATOR PANEL FLAP/SLAT LOCK LIGHT MAINTENANCE PRACTICES

1. General

The FLAP/SLAT LOCK annunciator light on the FE/SO annunciator panel comes on when the flap or slat asymmetry brakes are set. The flap position indicator and/or the slat position indicator may be used to determine which set of brakes are set.

NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MMEL.

2. Deactivation

A. Verify operation of the FLAP ASYM DET FAULT light, SLAT ASYM DET FAULT light, 14 slat position indicating lights, LE TRANS and LE EXT lights, and the slat degree gauge as follows:

(1) Verify that the following circuit breakers are closed:

(a) On the pilot's overhead circuit breaker panel CB1, zone 210:

NO. 2 ASYM BK - LE SLAT (J10) and TE FLAP (J11)

LOCK LIGHT - LE SLAT (J12) and TE FLAP (J13)

PROX SW PWR - NO. 1 (L10)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215:

NO. 1 ASYM BRAKE - TE FLAP (H21) and LE SLAT (H22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215:

PROXIMITY SWITCH-2 AND 3 (H3, H4)

POSN IND - TE FLAP (K16)

POSN IND - LE SLAT (K17)

LE SLAT EXTEND LT (K18)

(2) Turn on electrical power (Ref. MM 24-41-00).

CAUTION: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREE.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A and C (Ref. MM 29-11-00).

NOTE: Operating flaps and slats with AC pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 GPM at 3000 psi may be used to pressurize the A and C hydraulic systems.

(4) Verify that flap handle is at 0 degree.

(5) Test cable break detector on the flaps and slats forward control cables (forward cable loop) as follows:

(a) Move flap handle to the 4-degree position. The flaps and slats must start to extend. (Rotation of the slat torque tube in the mid-electrical service center (MESC) indicates slat operation).

(b) As soon as the slats start to extend, squeeze and hold the flap and slat cables just forward of the flap/slat cable break detector (in the MESC) to actuate the cable break detector switches (Ref. MM 27-51-04, Fig. 501). Verify that the flaps and slats stop moving and FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light on the FE/SO annunciator panel come on. Maintain squeeze pressure on cable.

(c) Shut off hydraulic system C.

(d) Open circuit breaker CB1-J10, NO. 2 ASYM BK LE SLAT. The flaps and slats must not move.

(e) Open circuit breaker CB2-H22, NO. 1 ASYM BRAKE LE SLAT. The flaps must start to move and the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light must go out. As soon as flap motion is verified, close CB2-H22. The flaps must stop and the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light must come on.

(f) Close circuit breaker CB1-J10.

(g) Open CB2-H22. Flaps and slats must not move.

(h) Open CB1-J10; the slats and flaps must start to move and the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light must go out. As soon as slat and flap motion is verified, close CB1-J10. Slat and flap motion must stop and FLAP ASYM DET FAULT and SLAT ASYM DET FAULT light must come on.

(i) Close circuit breaker CB2-H22.

(j) Turn on hydraulic system C and turn off hydraulic system A. Maintain squeeze pressure on cables to activate cable break detector switches.

(k) Repeat Steps 2A(5)(d) through 2A(5)(j).

(l) Release the flap/slat cables to deactivate the cable break detector switches.

(m) Position flap handle to the 0-degree position. The flaps and slats must retract to their full up position. Verify that the FLAP ASYM DET FAULT light and SLAT ASYM DET FAULT light on the FE/SO annunciator panel go out.

(6) Position flap handle to the 4-degree detent. Verify following:

(a) LE TRANS light on flap position indicator comes on while slats are moving.

(b) Slat position indicator pointers on FE/SO slat monitor panel follows slat movement.

(c) LE TRANS light on flap position indicator goes off and LE EXT light comes on when slats fully extend.

(d) The 14 slat position indicating lights on FE/SO monitor panel come on when slats fully extend.

(e) Both tapes of the flap position indicator move to the 4-degree range mark limits.

(7) With flaps at 0 degree perform and/or verify the following:

(a) Latch in Slat Lock switch on FE/SO Slat Monitor Panel; 1 LOCK and 2 LOCK lights come on.

(b) Select flaps 4 degrees; flaps extend to 4 degrees.

(c) Green slat segment lights remain off.

(d) Unlatch Slat Lock switch; 1 LOCK and 2 LOCK lights go off. Slats extend to 30 degrees, and green slat segment lights (14) come on when slats reach 30 degrees.

(8) Move flap handle successively through each detent position (allow flaps to stop at each selected position) and verify that both tapes of the flap position indicator move to the selected position.

(9) Return flap handle to UP position through each successive detent position (allow flaps to stop at each selected position). Verify both tapes of the flap position indicator move to the selected position.

NOTE: If the flap position indicator tape positions are out of tolerance, check adjustment of flap position transmitters (Ref. MM 27-52-01).

(10) When flaps and slats are fully retracted, verify following:

(a) Both tapes of the flap position indicator return to 0-position.

(b) Both slat monitor lights on flap position indicator are off.

(c) The 14 slat position indicating lights are off.

(d) Slat position indicator pointers return to 0-position.

(11) Turn off hydraulic power (Ref. MM 29-11-00).

(12) Turn off electrical power (Ref. MM 24-41-00).

(13) Make appropriate entry in airplane log book.

(14) Install inoperative component placard in Flight Station.

LEADING EDGE SLAT POSITION INDICATING SYSTEM DESCRIPTION AND OPERATION

1. General

The leading edge slat position indicating system (Ref. Fig. 1) is comprised of two slat position transmitters and a dual pointer slat position indicator. One position transmitter is mounted on, and driven by the asymmetry brake in each wing. The transmitters translate the angular travel of the slat torque tube drive train into a voltage to operate the slat position indicator. The position indicator is mounted in the slat monitor panel on the Flight Engineer/Second Officer console. The left wing transmitter drives the indicator pointer marked L; the right wing transmitter drives the pointer marked R.

In addition to the position indicator on the Flight Engineer/Second Officer console, slat system indicating lights are provided for the pilots on the flap position indicator (Ref. 27-52-00). An amber L. E. TRANS light indicates that the slats are in transit and a green L. E. EXT light indicates full extension (Ref. 27-81-00, Fig. 3).

The operation of the indicating lights and switches on the slat monitor panel is covered in 27-81-00.

2. Slat Position Transmitter

A. Description

R The slat position transmitter is a synchro transmitter. A
R 115V to 26V transformer in the indicator supplies excitation
R to the rotor of the synchro.

3. Slat Position Indicator

A. Description

The slat position indicator includes two synchro torque receivers mounted in tandem and driving two concentric pointers. The front synchro has a hollow shaft which provides clearance for a smaller diameter shaft from the rear synchro. An OFF warning flag is operated by a rotary solenoid device which moves the flag out of view when power is applied to the indicator. When the indicator is deenergized, the OFF flag moves into view through the window
R in the dial face. A dc power supply in the indicator
R provides power for the flag solenoid.

4. Slat Proximity Switch Sensor

A. Description

The leading edge slat proximity switch sensors actuate solid state switches which operate the slat monitor panel indicator lights and the slat logic system. The slat logic system controls the operation of the LE EXT light on the flap position indicator, and the LE transit light control relay (Ref. 27-81-00, Fig. 3). The switches are contained in the proximity switch card box in the midelectrical service center, zone 137. (Ref. 27-81-00, Fig. 107 for schematic of the complete slat extend proximity switch system.)

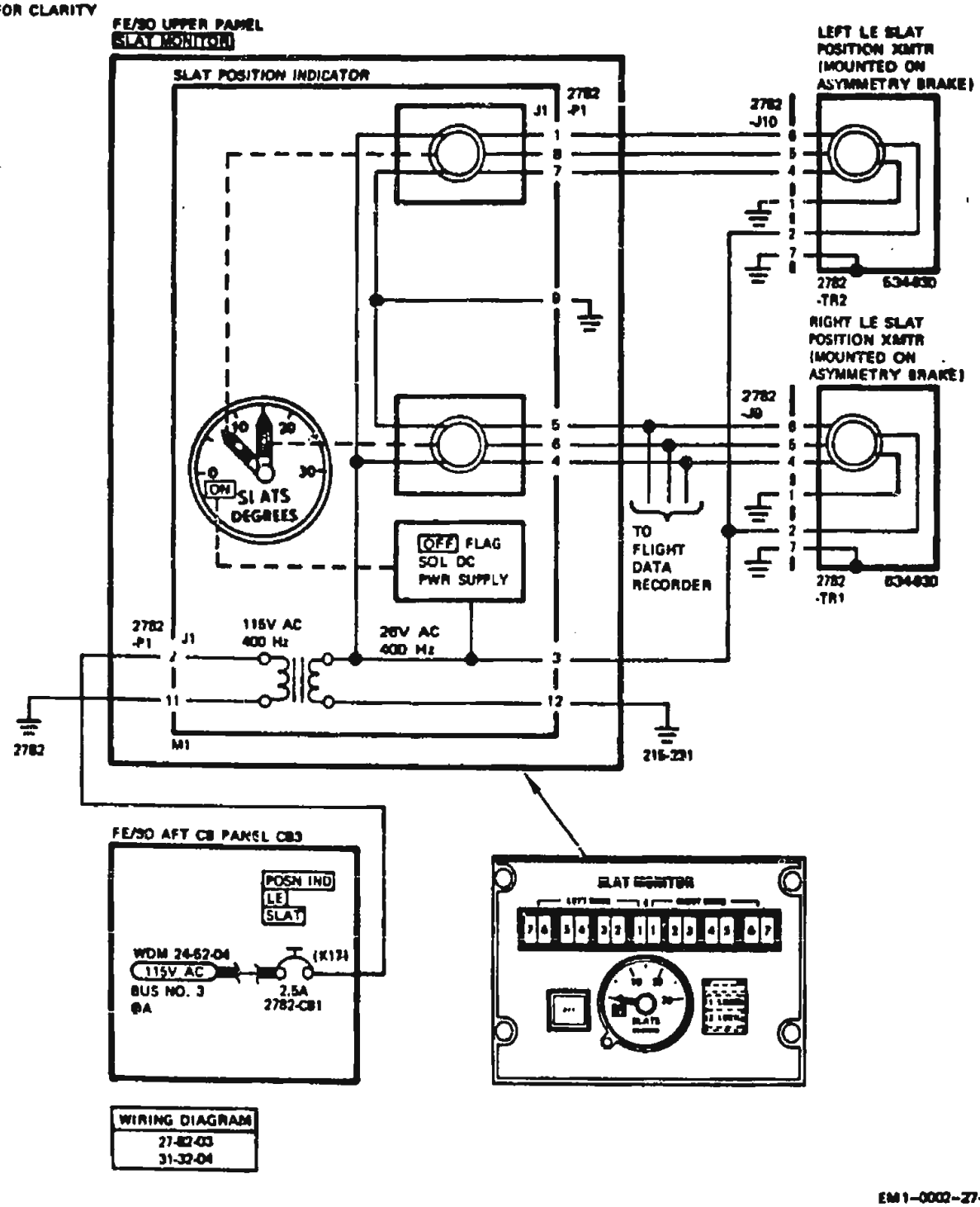
The proximity switch sensors are stationary and are installed in the wing fixed leading edge on the inboard track ribs of each slat. The sensor targets are steel and are installed on the slat inboard tracks. They are positioned so they come into proximity with the sensors as the slats approach the fully extended position. The sensor actuates the switch circuit when the target is 0.275 to 0.325 inch from the sensor.

B. Operation

The sensor is connected to the switch so that it forms two sections of a bridge circuit. One section is a coil; the other is a temperature compensating resistor. Regulated dc power is converted to ac power by an oscillator on the switch card and applied across the bridge. Current flow through the sensor coil produces a magnetic field around the sensing surface. When the target comes into proximity with the sensing surface, the magnetic field is varied and a voltage is produced across the coil. This unbalances the bridge circuit. The resulting signal triggers solid state circuitry and the proximity switch is actuated, indicating full extension of the slat. As the target moves away from the sensor, the bridge returns to a balanced condition and the proximity switch returns to its original condition.

NOTE

POINTERS NORMALLY MOVE TOGETHER. SHOWN SEPARATED FOR CLARITY



WIRING DIAGRAM
27-82-03
31-32-04

EM1-0002-27-288

R R Leading Edge Slat Position Indicating System
Figure 1

LEADING EDGE SLAT POSITION INDICATING SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 27 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

TABLE 101

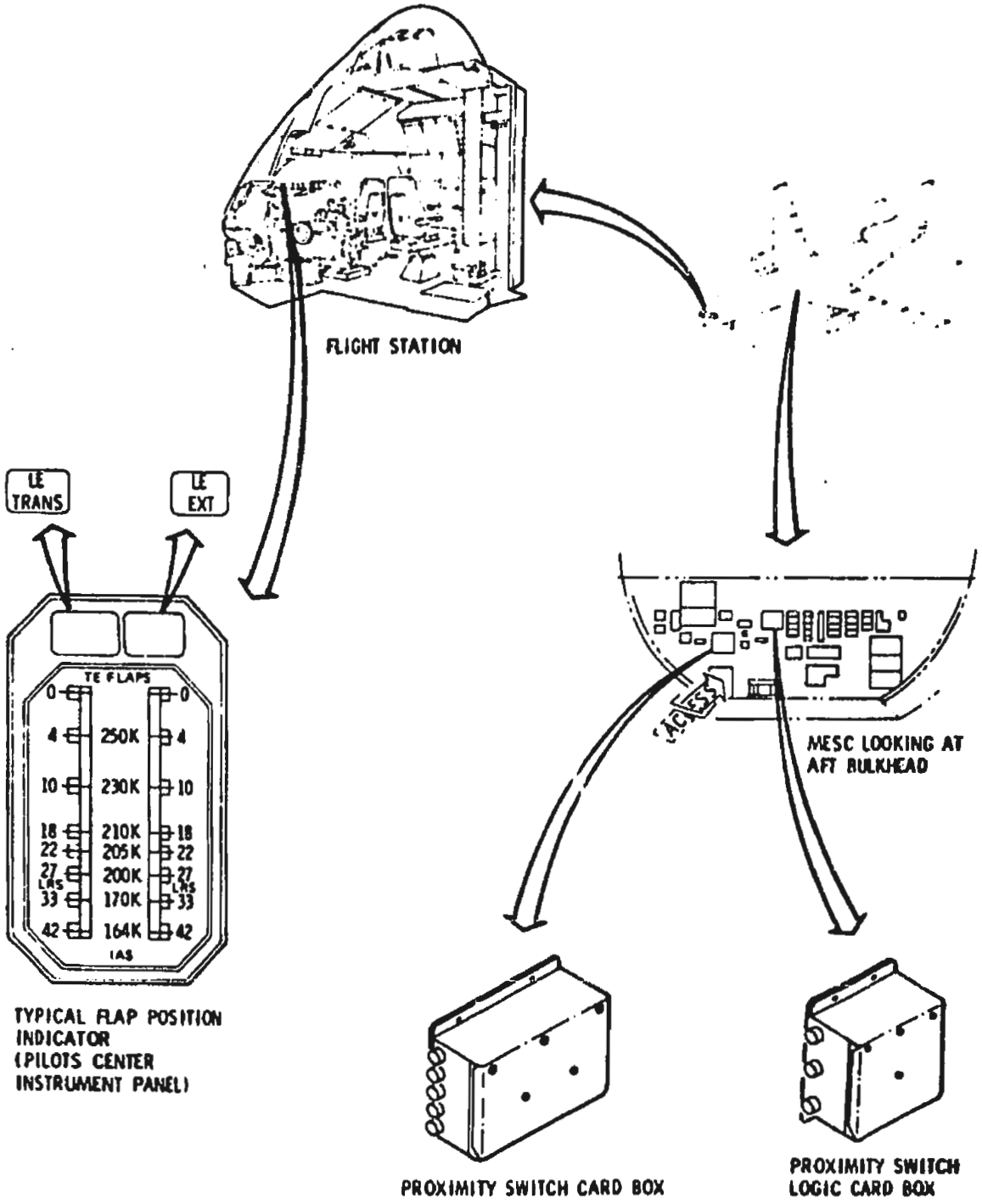
	FIGURE	TITLE
	101	Slat Position Indicating System Location Index
	102	Slat Position Indicating System Locator Diagram
R R	103	LE TRANS Light on Flap Position Indicator Does Not Come On
R	104	LE EXT Light on Flap Position Indicator Does Not Come On
	105	Slat Position Indicating System Malfunction
	SCHEM 1	LE SLAT Position Indicating System Electrical Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
BOX – IND LIGHTS CONTROL (ILCB)	1	FESC/112AB, 211CB	33–17–04
BOX – PROXIMITY LOGIC	1	MESC/192K, 192EA	31–22–02
BOX – PROXIMITY SWITCH CARD	1	MESC/192K, 192EA	31–22–01
CIRCUIT BREAKERS: POSN IND LE SLAT 2782-CB1	1	FLT STA/CB3-K17	
INDICATOR – SLAT POSITION	1	FLT STA/842, 843	27–82–04
RELAY – LE TRANSIT LT CONT	1	MSEC/192K	33–21–01
SENSOR – SLAT PROXIMITY	14	AT EACH SLAT PANEL INBOARD TRACK	27–82–03
SWITCHPACK – SLAT PDU	2	ON PDU/511BT	27–81–08
TRANSMITTER – SLAT POSITION	2	ON ASYM BK/521TB, 621TB	27–82–01

M1–0000–27–871

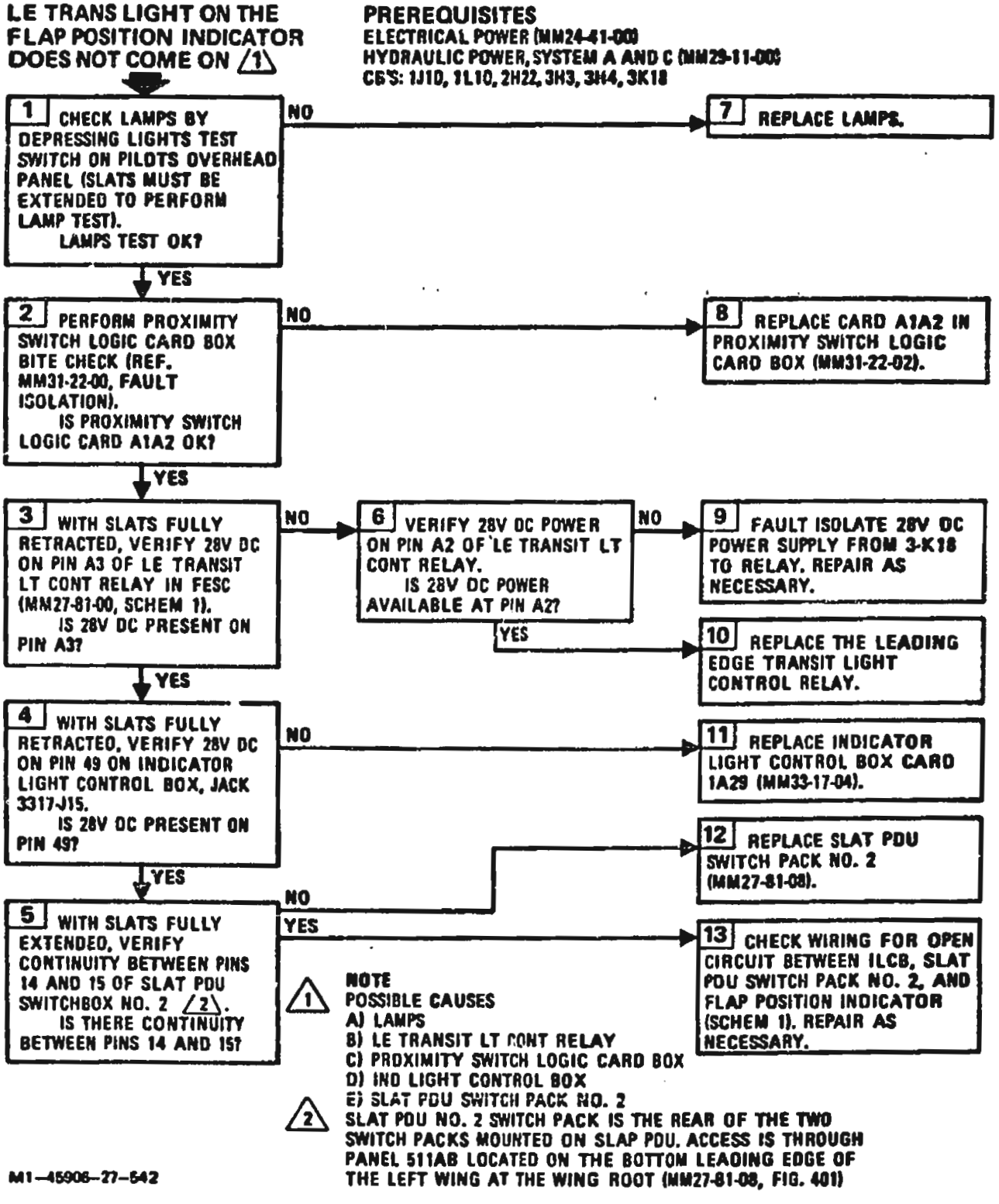
R Slat Position Indicating System Location Index
R Figure 101

R EFFECTIVITY: ALL
R
001B



R R Slat Position Indicating System Locator Diagram
Figure 102

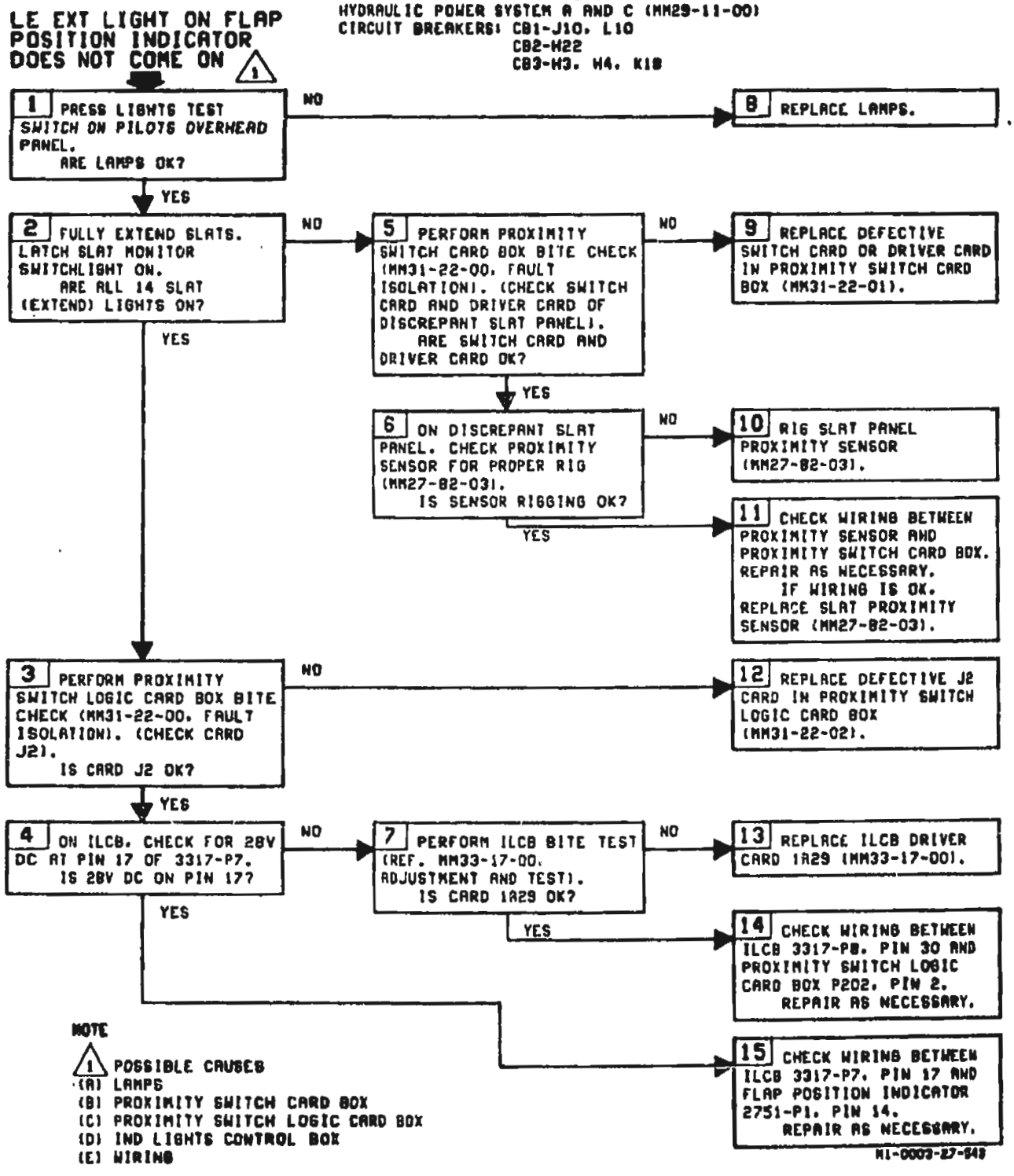
R R 001B EFFECTIVITY: ALL


LE TRANS LIGHT ON THE FLAP POSITION INDICATOR DOES NOT COME ON /1\
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER, SYSTEM A AND C (MM29-11-00)
CB'S: 1J10, 1L10, 2H22, 3H3, 3H4, 3K18
1 CHECK LAMPS BY DEPRESSING LIGHTS TEST SWITCH ON PILOTS OVERHEAD PANEL (SLATS MUST BE EXTENDED TO PERFORM LAMP TEST). LAMPS TEST OK?
NO
7 REPLACE LAMPS.
YES
2 PERFORM PROXIMITY SWITCH LOGIC CARD BOX BITE CHECK (REF. MM31-22-00, FAULT ISOLATION). IS PROXIMITY SWITCH LOGIC CARD A1A2 OK?
NO
8 REPLACE CARD A1A2 IN PROXIMITY SWITCH LOGIC CARD BOX (MM31-22-02).
YES
3 WITH SLATS FULLY RETRACTED, VERIFY 28V DC ON PIN A3 OF LE TRANSIT LT CONT RELAY IN FESC (MM27-81-00, SCHEM 1). IS 28V DC PRESENT ON PIN A3?
NO
6 VERIFY 28V DC POWER ON PIN A2 OF LE TRANSIT LT CONT RELAY. IS 28V DC POWER AVAILABLE AT PIN A2?
NO
9 FAULT ISOLATE 28V DC POWER SUPPLY FROM 3-K18 TO RELAY. REPAIR AS NECESSARY.
YES
10 REPLACE THE LEADING EDGE TRANSIT LIGHT CONTROL RELAY.
YES
4 WITH SLATS FULLY RETRACTED, VERIFY 28V DC ON PIN 49 ON INDICATOR LIGHT CONTROL BOX, JACK 3317-J15. IS 28V DC PRESENT ON PIN 49?
NO
11 REPLACE INDICATOR LIGHT CONTROL BOX CARD 1A29 (MM33-17-04).
YES
5 WITH SLATS FULLY EXTENDED, VERIFY CONTINUITY BETWEEN PINS 14 AND 15 OF SLAT PDU SWITCHBOX NO. 2 /2\. IS THERE CONTINUITY BETWEEN PINS 14 AND 15?
NO
12 REPLACE SLAT PDU SWITCH PACK NO. 2 (MM27-81-08).
YES
13 CHECK WIRING FOR OPEN CIRCUIT BETWEEN ILCB, SLAT PDU SWITCH PACK NO. 2, AND FLAP POSITION INDICATOR (SCHEM 1). REPAIR AS NECESSARY.
/1\ NOTE
POSSIBLE CAUSES
A) LAMPS
B) LE TRANSIT LT CONT RELAY
C) PROXIMITY SWITCH LOGIC CARD BOX
D) IND LIGHT CONTROL BOX
E) SLAT PDU SWITCH PACK NO. 2
/2\ SLAT PDU NO. 2 SWITCH PACK IS THE REAR OF THE TWO SWITCH PACKS MOUNTED ON SLAP PDU. ACCESS IS THROUGH PANEL 511AB LOCATED ON THE BOTTOM LEADING EDGE OF THE LEFT WING AT THE WING ROOT (MM27-81-08, FIG. 401)
M1-45906-27-542

R LE TRANS Light On Flap Position Indicator
R Does Not Come On
R Figure 103

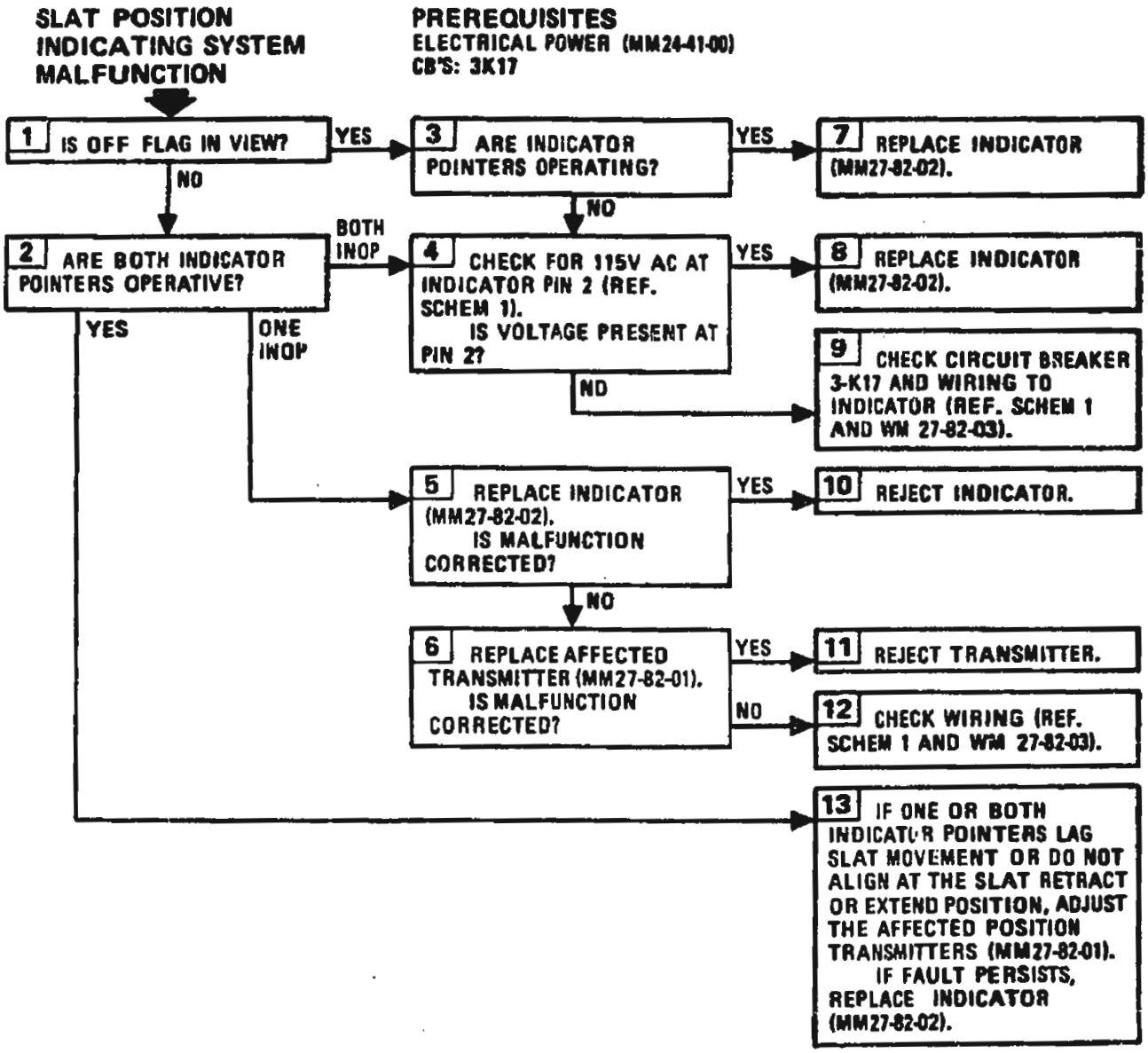
PREREQUISITES

ELECTRICAL POWER (MM24-41-00)
HYDRAULIC POWER SYSTEM A AND C (MM29-11-00)
CIRCUIT BREAKERS: CB1-J10, L10
CB2-H22
CB3-H3, H4, K18


LE EXT LIGHT ON FLAP POSITION INDICATOR DOES NOT COME ON (1)
1 PRESS LIGHTS TEST SWITCH ON PILOTS OVERHEAD PANEL. ARE LAMPS OK?
NO
8 REPLACE LAMPS.
YES
2 FULLY EXTEND SLATS. LATCH SLAT MONITOR SWITCHLIGHT ON. ARE ALL 14 SLAT (EXTEND) LIGHTS ON?
NO
5 PERFORM PROXIMITY SWITCH CARD BOX BITE CHECK (MM31-22-00, FAULT ISOLATION). (CHECK SWITCH CARD AND DRIVER CARD OF DISCREPANT SLAT PANEL). ARE SWITCH CARD AND DRIVER CARD OK?
NO
9 REPLACE DEFECTIVE SWITCH CARD OR DRIVER CARD IN PROXIMITY SWITCH CARD BOX (MM31-22-01).
YES
YES
6 ON DISCREPANT SLAT PANEL, CHECK PROXIMITY SENSOR FOR PROPER RIG (MM27-82-03). IS SENSOR RIGGING OK?
NO
10 RIG SLAT PANEL PROXIMITY SENSOR (MM27-82-03).
YES
11 CHECK WIRING BETWEEN PROXIMITY SENSOR AND PROXIMITY SWITCH CARD BOX. REPAIR AS NECESSARY. IF WIRING IS OK, REPLACE SLAT PROXIMITY SENSOR (MM27-82-03).
3 PERFORM PROXIMITY SWITCH LOGIC CARD BOX BITE CHECK (MM31-22-00, FAULT ISOLATION). (CHECK CARD J2). IS CARD J2 OK?
NO
12 REPLACE DEFECTIVE J2 CARD IN PROXIMITY SWITCH LOGIC CARD BOX (MM31-22-02).
YES
4 ON ILCB, CHECK FOR 28V DC AT PIN 17 OF 3317-P7. IS 28V DC ON PIN 17?
NO
7 PERFORM ILCB BITE TEST (REF. MM33-17-00, ADJUSTMENT AND TEST). IS CARD 1A29 OK?
NO
13 REPLACE ILCB DRIVER CARD 1A29 (MM33-17-00).
YES
YES
14 CHECK WIRING BETWEEN ILCB 3317-P8, PIN 30 AND PROXIMITY SWITCH LOGIC CARD BOX P202, PIN 2. REPAIR AS NECESSARY.
15 CHECK WIRING BETWEEN ILCB 3317-P7, PIN 17 AND FLAP POSITION INDICATOR 2751-P1, PIN 14. REPAIR AS NECESSARY.
NOTE
(1) POSSIBLE CAUSES
(A) LAMPS
(B) PROXIMITY SWITCH CARD BOX
(C) PROXIMITY SWITCH LOGIC CARD BOX
(D) IND LIGHTS CONTROL BOX
(E) WIRING
M1-0003-27-048

R LE EXT Light on Flap Position Indicator
R Does Not Come On
R Figure 104

EFFECTIVITY: ALL

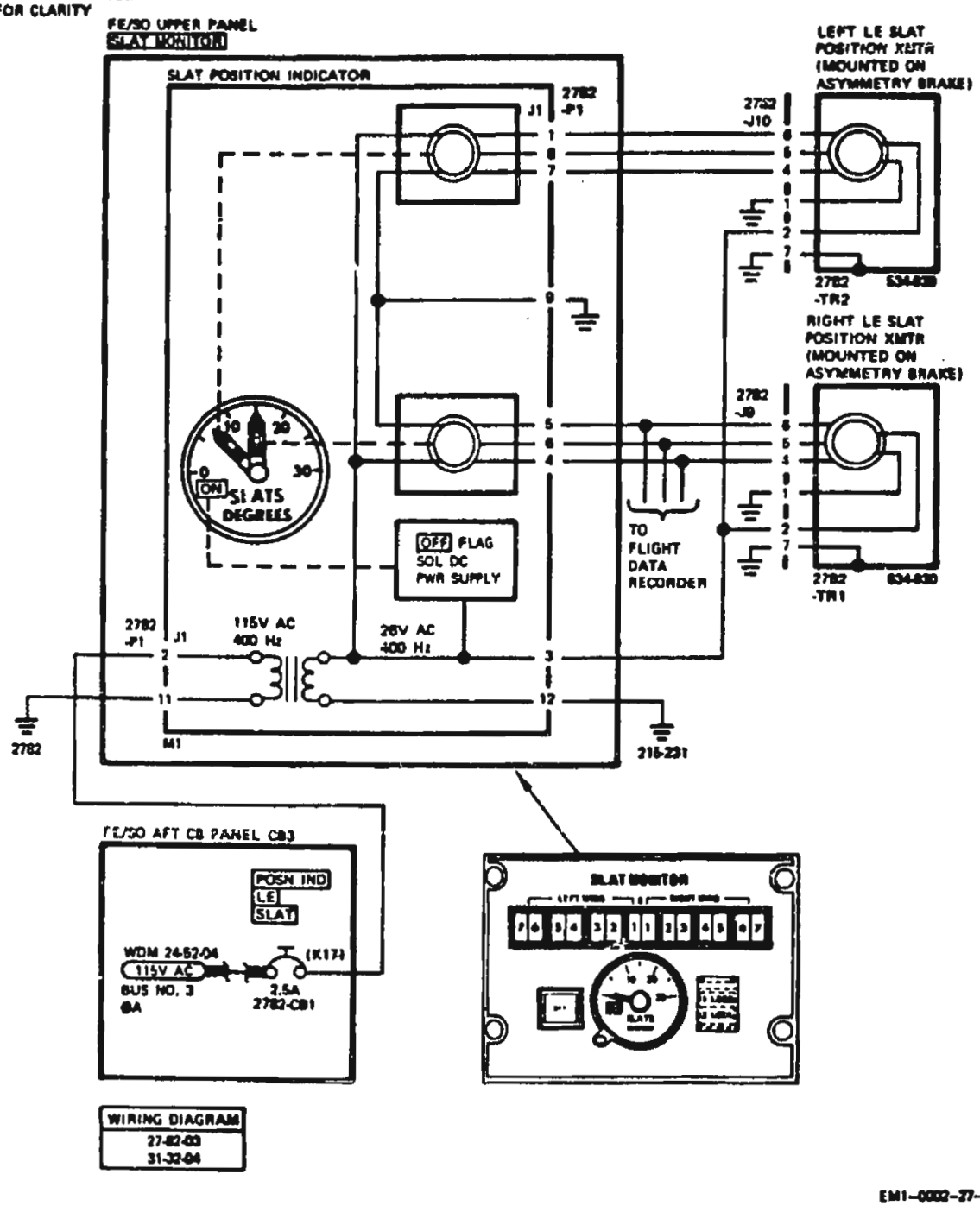

SLAT POSITION INDICATING SYSTEM MALFUNCTION
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: 3K17
1 IS OFF FLAG IN VIEW?
YES
NO
2 ARE BOTH INDICATOR POINTERS OPERATIVE?
BOTH INOP
YES
ONE INOP
3 ARE INDICATOR POINTERS OPERATING?
YES
NO
4 CHECK FOR 115V AC AT INDICATOR PIN 2 (REF. SCHEM 1). IS VOLTAGE PRESENT AT PIN 2?
YES
NO
5 REPLACE INDICATOR (MM27-82-02). IS MALFUNCTION CORRECTED?
YES
NO
6 REPLACE AFFECTED TRANSMITTER (MM27-82-01). IS MALFUNCTION CORRECTED?
YES
NO
7 REPLACE INDICATOR (MM27-82-02).
8 REPLACE INDICATOR (MM27-82-02).
9 CHECK CIRCUIT BREAKER 3-K17 AND WIRING TO INDICATOR (REF. SCHEM 1 AND WM 27-82-03).
10 REJECT INDICATOR.
11 REJECT TRANSMITTER.
12 CHECK WIRING (REF. SCHEM 1 AND WM 27-82-03).
13 IF ONE OR BOTH INDICATOR POINTERS LAG SLAT MOVEMENT OR DO NOT ALIGN AT THE SLAT RETRACT OR EXTEND POSITION, ADJUST THE AFFECTED POSITION TRANSMITTERS (MM27-82-01). IF FAULT PERSISTS, REPLACE INDICATOR (MM27-82-02).

M1-0107-27-566

R R Slat Position Indicating System Malfunction
Figure 105

NOTE

POINTERS NORMALLY MOVE TOGETHER, SHOWN SEPARATED FOR CLARITY



WIRING DIAGRAM
27-82-03
31-32-04

EM1-0002-27-2B

R R LE Slat Position Indicating System Electrical Schematic
SCHEM 1

EFFECTIVITY: ALL

0018

SLAT POSITION TRANSMITTER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

NAS1351-3H-6P Socket-Head Cap Screws, or equivalent

Grease, MIL-G-23827 (aircraft and instrument), or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
27-81-00	Leading Edge Slat System - Adjustment and Test
27-82-00	Leading Edge Slat Position Indicating System - Fault Isolation
29-11-00	Hydraulic Power System - Maintenance
R 31-31-01	Digital Flight Data Recorder (DFDR) - Adjustment and Test

3. Removal/Installation

A. Removal

(1) Retract slats fully by positioning flap handle to 0 degree detent (Ref. 27-81-00).

(2) Shut off hydraulic systems A and C (Ref. 29-11-00).

(3) Install warning tags on Flight Engineer/Second Officers hydraulic system panel, zone 215, and on hydraulic service panel, zone 147.

(4) Open and tag the following circuit breakers:

(a) On pilots overhead circuit breaker panel CB1, zone 210: No. 2 ASYM BK LE SLAT (J10)

(b) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: NO. 1 ASYM BRAKE LE SLAT (H22)

(c) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215: POSN IND LE SLAT (K17)

(5) Open the following access panel, as applicable:

R For left slat position transmitter: 521TB (Ref.
R 6-40-00)

R For right slat position transmitter: 621TB (Ref.
R 6-40-00)

NOTE: To remove the slat position transmitter from the aircraft, the asymmetry brake assembly must first be removed from the aircraft; the transmitter is then removed from the asymmetry brake.

(6) Disconnect the three asymmetry brake electrical connectors from the structure-mounted receptacles.

(7) Remove three bolts and disengage spline coupling sleeve at the torque tube coupling just inboard of brake.

R (a) Slide coupling inboard and disengage it from asymmetry brake.

(8) Remove bolt, shim and nut securing outboard side of brake to the front spar bracket.

(9) Remove two bolts securing inboard end of brake to the front spar bracket.

R (a) Remove asymmetry brake from aircraft.

(10) Remove screws and washers securing transmitter to brake assembly, and remove transmitter.

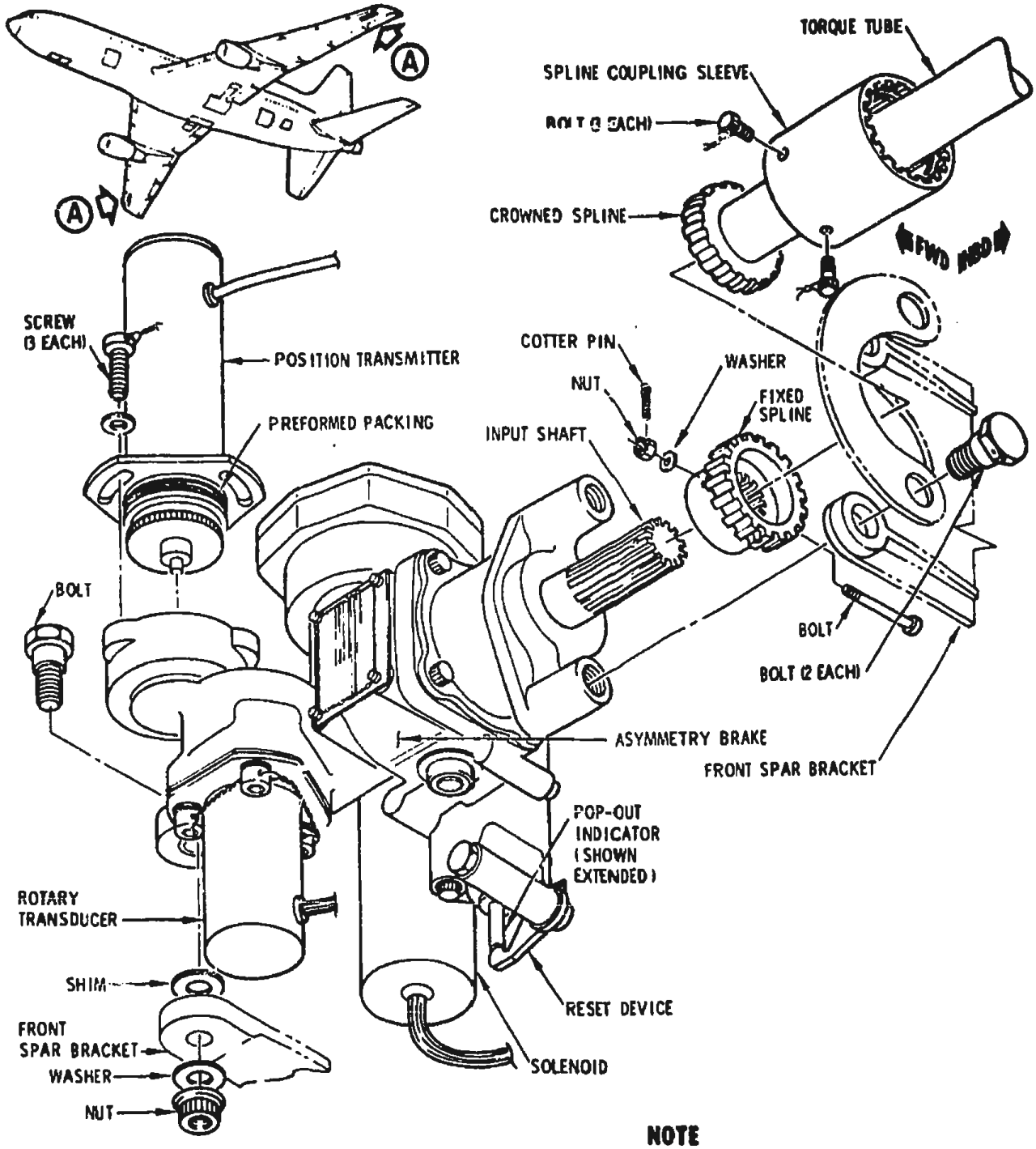
B. Installation (Ref. Fig. 401)

WARNING: VERIFY THAT HYDRAULIC SYSTEMS A AND C ARE SHUT OFF AND THAT HYDRAULIC PANELS ARE TAGGED.

(1) Verify that circuit breakers opened in Step 3A(4) are open and tagged.

(2) Apply grease to transmitter gear teeth.

(3) Lubricate and install preformed O-ring packing on transmitter housing (Ref. Fig. 401).



NOTE
RIGHT WING SLAT ASYMMETRY BRAKE SHOWN - LEFT WING SLAT ASYMMETRY BRAKE OPPOSITE.

HA 0817
M1-0003-27-308

R Slat Position Transmitter - Removal and Installation
R Figure 401

(4) Rotate transmitter gear until mechanical detent position is felt. (This is transmitter null position.)

(5) With mounting holes in asymmetry brake centered on slotted mounting holes of transmitter, and ensuring that transmitter gear does not rotate when meshed with brake assembly gear, position transmitter on brake assembly.

(6) Install mounting screws and washers to secure transmitter to the brake assembly. Lock-wire screws.

NOTE: If tri-wing screws are used, replace with socket-head cap screws, or equivalent.

(7) Butter-lubricate all splined surfaces with grease.

(8) Position brake on aircraft and loosely install two bolts securing inboard side of brake to front spar bracket.

(a) Do not tighten bolts.

(9) Install shim removed in Step A(8) between brake assembly and spar bracket.

(a) Install bolt, washer and nut.

(b) Tighten three bolts securing brake assembly to spar brackets.

(10) Install three electrical connectors from brake assembly to the structure-mounted receptacles.

(11) Remove tags and close circuit breakers opened in Step A(4).

R (12) Turn on electrical power (Ref. 24-41-00).

R (13) On right assymmetry brake,
R adjust slat transmitter to zero by rotaing input shaft
R of asymmetry brake. Determine zero setting in
R accordance with Maintenance Manual 31-31-01 Adjustment
R and Test, DFDR signal code 96-15. If DFDR test
R equipment is not available, use FE/SO Slat Monitor
R panel slat position indicator to determine zero.

R (13) On left asymmetry brake,
R adjust slat transmitter to zero by rotating input shaft
R of asymmetry brake. Determine zero setting with FE/SO
R Slat Monitor panel slat position indicator.

(14) Align mounting holes and engage spline coupling sleeve and fixed spline on the brake input shaft.

(a) Install three bolts and torque 15 to 20 lb in. Lock-wire bolts.

(15) Remove tags from hydraulic control panels.

D. Adjustment and Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS SET AT ZERO DEGREES.

ALL LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EUQIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic systems A and C (Ref. 29-11-00).

NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes and give invalid results. To perform a valid test of the flap and slat actuation system, pressurize the B and C hydraulic system using ATM pumps and the A hydraulic system using the PTU. Alternately, two ground sources each capable of 25 gpm at 3000 psi may be used to pressurize the A and C hydraulic systems.

(2) Operate the flap handle to cycle the slats.

(a) Verify that slat position indicator pointers follow slat movement.

(3) Verify that SLAT ASYM DET FAULT light on FE/SO annunciator panel does NOT come on (Ref. 27-82-00).

(4) Turn off hydraulic power if no longer required (Ref. 29-11-00).

(5) Turn off electrical power if no longer required (Ref. 24-41-00).

(6) Close access panel.

SLAT POSITION INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

R 24-41-00 External Power/Ground Service System - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

2. Removal/Installation

R A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker POSN IND LE SLAT (K17).

(2) On slat monitor panel, loosen instrument clamp screw on
R face of panel (Ref. Fig. 401).

(3) Withdraw slat position indicator from panel.

NOTE: If slat position indicator is difficult to remove from panel, release the four slat monitor panel screws (1/4 turn) and pull out slat monitor panel.

(4) Disconnect electrical connector from slat position indicator. Remove indicator.

R B. Installation

R (1) Install electrical connector on slat position indicator
R (Ref. Fig. 401).

(2) Position indicator in the instrument support clamp.

(3) Tighten instrument clamp screw on front of panel.

(4) Remove tag and close circuit breaker opened in Step A(1).

(5) Check slat position indicator as follows:

(a) Turn on electrical power (Ref. 24-41-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING
R ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWNLOCK SAFETY PINS AND
R DOOR SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL
R SURFACES AND MAIN GEAR DOORS ARE CLEAR
R OF PERSONNEL AND GROUND EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN
R ACCEPT HYDRAULIC PRESSURE.

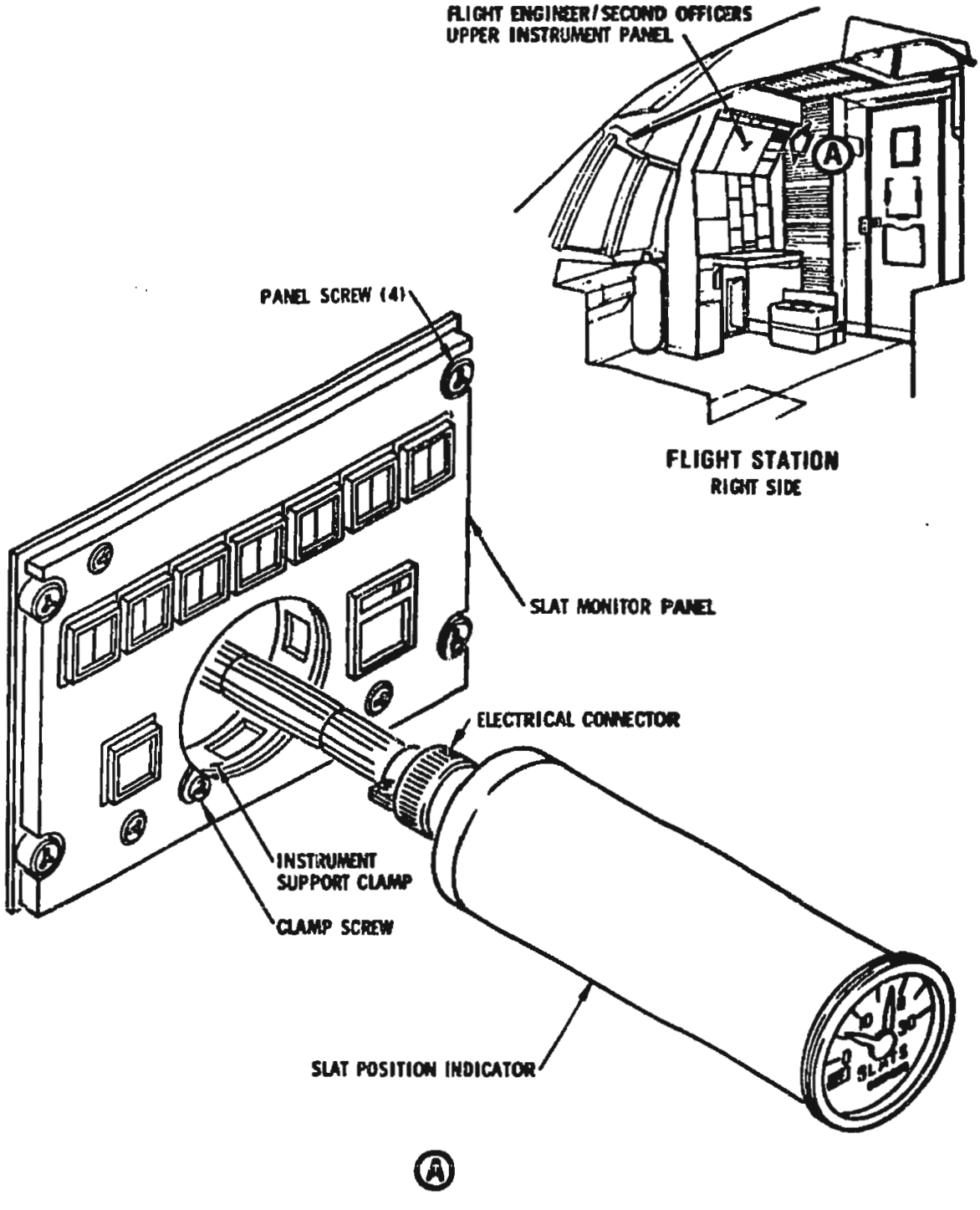
R (b) Turn on hydraulic system A and C (Ref. 29-11-00).

R NOTE: Operating flaps and slats with electric
R pumps can cause "jerky" operation, trip the
R overspeed governor in either or both brakes
R and give invalid results. To perform a
R valid test of the flap and slat actuation
R system, pressurize the B and C hydraulic
R system using ATM pumps and the A hydraulic
R system using the PTU. Alternately, two
R ground sources each capable of 25 gpm at
R 3000 psi may be used to pressurize the A
R and C hydraulic systems.

R (c) Position flap handle from 0-degree to 4-degree
R detent and back to 0-degree detent to cycle slats.
R Verify that pointers on slat position indicator
R follow slat movement and that pointer 1 and 2 move
R in unison without spreading.

R (d) Shut off hydraulic power (29-11-00).

R (e) Shut off electrical power if no longer required
R (24-41-00).



M1-0100-27-987

R R Slat Position Indicator - Removal and Installation
Figure 401

R R 001B EFFECTIVITY: ALL

SLAT PROXIMITY SWITCH SENSOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

R WARNING: VERIFY FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

R PITCH TRIM WHEEL IS AT ZERO DEGREES.

R LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

R AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (1) Turn on hydraulic system A and C (Ref. 29-11-00).

R (2) Position flap handle to 4 degree detent and extend slats.

R NOTE: Operating flaps and slats with electric pumps can cause "jerky" operation, trip the overspeed governor in either or both brakes. Alternately, two ground sources each capable of 25 gpm at 300 psi may be used to pressurize the A and C hydraulic systems.

R WARNING: ENSURE HYDRAULIC SYSTEMS A AND C IS TURNED OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(3) Turn off hydraulic systems A and C (Ref. 29-11-00) and install warning tags on FE/SO Hydraulic System Panel, zone 215, and Hydraulic Service Panel, zone 147.

(4) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker PROXIMITY SW PWR NO 1 (L10).

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker PROXIMITY SWITCH 2 and 3 (H3, H4).

(5) Remove applicable leading edge lower access panel (Ref. 6-40-00).

NOTE: Each slat proximity sensor is mounted on the inboard rib of the inboard track. The applicable access panels and approximate wing stations are as follows:

No. 1 slat: 511AB/611AB; IWS 162

No. 2 slat: 511DB/611DB; IWS 258E

No. 3 slat: 511GB/611GB; IWS 368

No. 4 slat: 521AB/621AB; IWS 540

No. 5 slat: 521GB/621GB; OWS 47

No. 6 slat: 521LB/621LB; OWS 214

No. 7 slat 521QB/621QB; OWS 372

(6) Disconnect three sensor wires: two from terminal strip and one ground wire.

(7) Remove sensor as follows (Ref. Fig. 401):

(a) On slats No. 1, 2, and 3, remove two screws holding sensor to mounting bracket; remove sensor.

(b) On slats No. 4, 5, 6, and 7, remove two screws holding sensor mounting bracket to track bracket; remove sensor.

B. Installation

(1) Verify slats are fully extended.

(2) Verify hydraulic systems A and C is turned off (Ref. 29-11-00).

(3) Install sensor as follows:

(a) On inboard slats No. 1, 2, and 3, install sensor attaching screws; leave screws loose. With slats fully extended, adjust sensor mounting bracket so that sensor housing is completely within target area. Tighten screws. (Sensor is adjusted fore and aft by slotted holes in sensor mounting bracket, and vertically by adding two washers between rib mounting bracket and sensor mounting bracket.) Slotted holes in sensor mounting bracket allow inboard and outboard movement of sensor.
R Adjust air gap between sensor and target to 0.105
R ± 0.035 by loosening bolts attaching sensor
R mounting bracket to rib mounting bracket.
R Additional adjustment is possible by installing a
R maximum of two shims (P/N 728807-101) between
R sensor and sensor mounting bracket (Ref. Fig.
R 401).

(b) On outboard slats No. 4, 5, 6, and 7, install sensor on mounting bracket with two screws. Then install sensor mounting bracket on rib mounting bracket; leave screws loose. With slats fully extended, position sensor mounting bracket in slotted holes so sensor housing is completely contained within target area. Tighten screws.
R Adjust air gap between sensor and target to 0.085
R ± 0.045 with P/N 728807-101 and/or -103 shims
R installed between mounting bracket and rib
R mounting bracket as required (Ref. Fig. 401).

(4) Connect sensor wires: yellow to ground, blue to terminal 1, red to terminal 2.

(5) Close access panel.

(6) Remove tags and close circuit breakers opened in Step 2A(4).

(7) Turn on electrical power (Ref. 24-41-00).

WARNING: VERIFY FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic system A or C (Ref. 29-11-00).

(9) On FE/SO SLAT MONITOR panel, latch the ON switchlight. All fourteen slat extend legends and the ON legend must come on.

(10) Position flap handle to 0 degree. Verify all slat extend legends go off when slats move from full extend position.

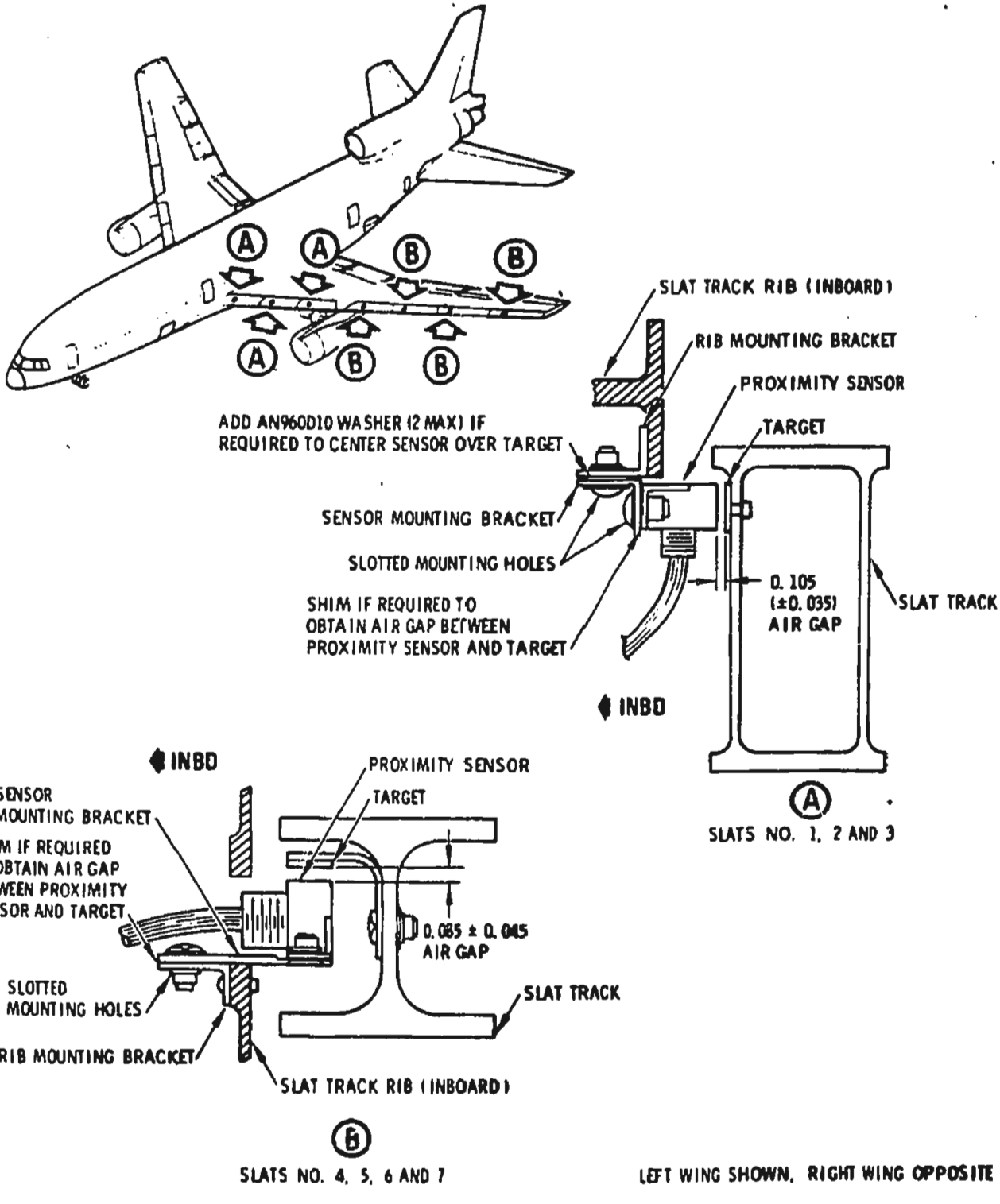
(11) Position flap handle to 4 degree detent position. Verify all slat extend legends come on when slats fully extend.

(12) Unlatch slat ON switchlight; ON legend must go off.

(13) Position flap handle to 0 degree.

(14) Shut off hydraulic power (Ref. 29-11-00).

(15) Turn off electrical power (Ref. 24-41-00).



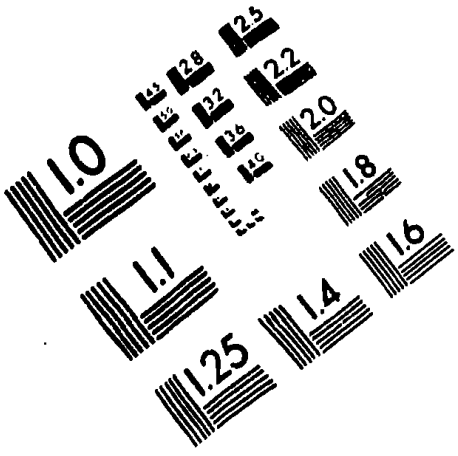
Slat Proximity Switch Sensor - Removal and Installation
Figure 401

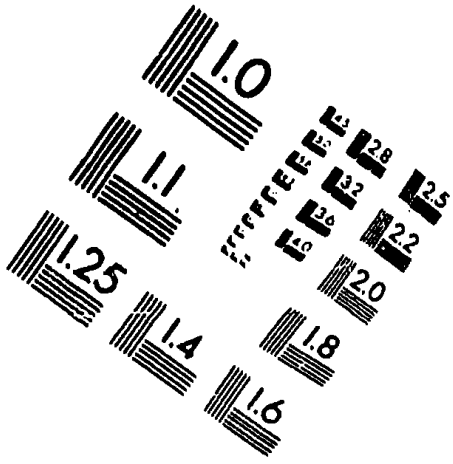
R
R
001B

EFFECTIVITY: ALL

TOP

Film Identification



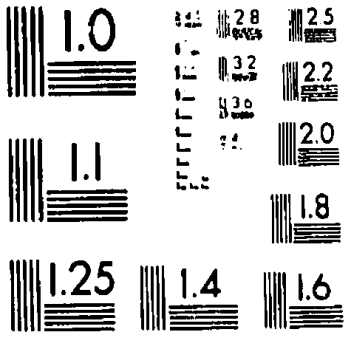


Century

1303 Geneva Avenue
St. Paul, MN 55119

PRECISION℠ RESOLUTION TARGETS

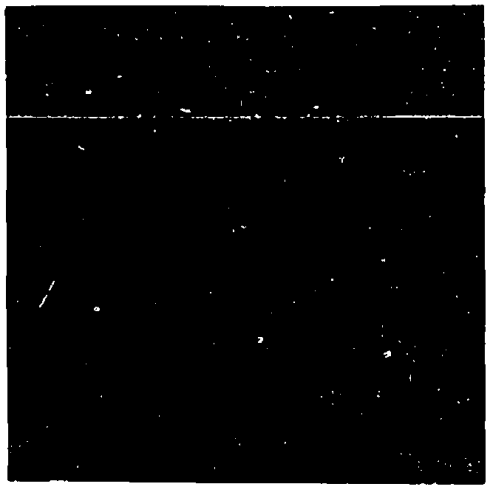
LEFT

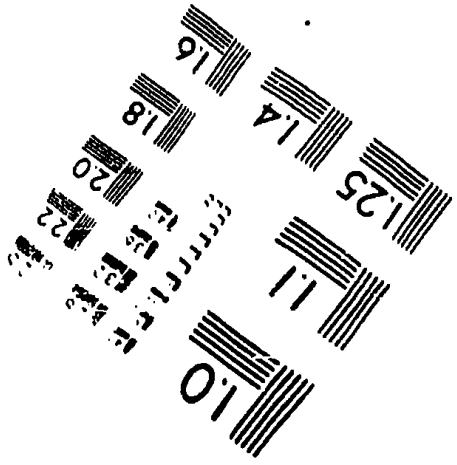


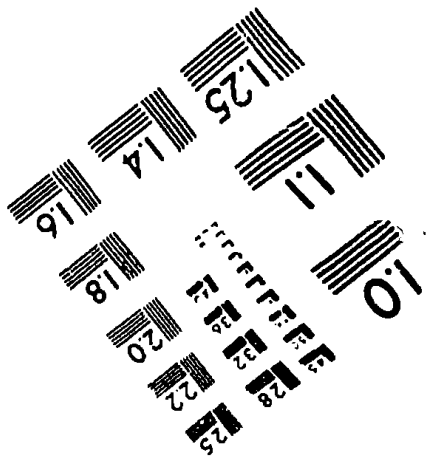
RIGHT

150 MM

6 ″







PM-3 8½″x11″ PHOTOGRAPHIC GENERAL TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT